Diffusion at the Cutting Edge

Power Pitch Theatre, Exhibition Hall

Monday, May 9, 2016: 11:45 - 12:45

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Computer #1

DWI^2: exploring the MRI-phase for imaging diffusion

Ralph Sinkus[1], Simon Auguste Lambert[1], Lucas Hadjilucas[1], Shaihan Malik[2], Anirban Biswas[1], Francesco Padormo[2], Jack Lee[1], and Joseph V Hajnal[2]

[1]Imaging Sciences & Biomedical Engineering Division Kings College, King's College London, London, United Kingdom, [2]Centre for the Developing Brain & Department Biomedical Engineering, King's College London, London, United Kingdom

Classical DWI methods extract information about microstructural tissue complexity from the signal decrease of the MR-magnitude as a function of b-value. Utilization of linear gradients for motion encoding prevents theoretically the use of the MR-phase. Rather, the diffusion information is encoded in the MR-magnitude via global spin dephasing due to Brownian motion with zero net phase shift. This dogma is overturned when considering quadratic gradient fields in space. We demonstrate in theory, experiment, and simulation that the diffusion process leads to a net phase shift with minimal loss in signal magnitude when imaging at the minimum of the quadratic gradient.

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magna cum laude

Computer #10

Improved tractography by modelling sub-voxel fibre patterns using asymmetric fibre orientation distributions

Matteo Bastiani[1], Michiel Cottaar[1], Krikor Dikranian[2], Aurobrata Ghosh[3], Hui Zhang[3], Daniel C. Alexander[3], Timothy Behrens[1], Saad Jbabdi[1], and Stamatios N. Sotiropoulos[1]

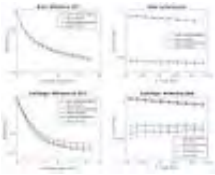
[1]FMRIB Centre, University of Oxford, Oxford, United Kingdom, [2]Department of Anatomy & Neurobiology, Washington University, St. Louis, MO, United States, [3]Department of Computer Science & Centre for Medical Image Computing, University College London, London, United Kingdom

Fiber bundles can cross or kiss, bend or fan within a single diffusion MRI (dMRI) voxel. Given the limited dMRI resolution and the inherent central symmetry in the measurements, these sub-voxel patterns cannot be distinguished by only using the voxel-wise signal. These asymmetric fibre patterns can be distinguished once information from neighbouring voxels is pooled together. We propose a direct estimation of asymmetric

fiber orientation distributions (aFODs) based on *neighbourhood-wise* constrained spherical deconvolution that is capable of inferring sub-voxel patterns. We also propose a tractography algorithm based on the estimated aFODs and we assess performance using real histological fibre patterns.

11

Computer #11



Investigation of the influence of the extracellular matrix on water diffusion in brain and cartilage

Jakob Georgi[1], Riccardo Metere[1], Markus Morawski[2], Carsten Jäger[2], and Harald E. Möller[1]

[1]Max-Planck-Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [2]Paul-Flechsig-Institute for Brain Research, Leipzig, Germany

Water diffusivity in biological tissues can be related to the underlying microstructure that modulates the restricted or hindered diffusion, and can be studied with NMR experiments. The extracellular matrix, whose composition depends on the tissue type, may have an influence on diffusion. In this work we study the influence of the extracellular matrix on diffusion, by measuring brain and cartilage samples before and after the enzymatic removal of the extracellular matrix components. The activation energy for the self-diffusion of water seems to be not significantly affected by the treatment for brain tissues.

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Computer #12

Measurement of the Effect of Tissue Fixation on Tumour Microstructure using VERDICT Diffusion-MRI

Ben Jordan[1], Tom Roberts[1], Angela D'Esposito[1], John Connell[1], Andrada Ianus[2], Eleftheria Panagiotaki[2], Daniel Alexander[2], Mark Lythgoe[1], and Simon Walker-Samuel[1]

[1]Centre for Advanced Biomedical Imaging, University College London, London, United Kingdom, [2]Centre for Medical Image Computing, University College London, London, United Kingdom

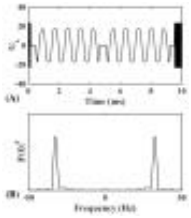
It has previously been shown that compartmental models of tissue diffusion such as VERDICT can enable access to useful measures of in-vivo tumour microstructure such as cell radius. However, comparing the in-vivo values with those measured from histology showed that a discrepancy exists between the two; histological values were consistently smaller. In this study, we assess the ability of VERDICT MRI to detect this change in cell radius by acquiring data (9.4T MRI) both in-vivo and post-fixation. A significant decrease in cell radius was detected post-fixation, which was supported by a decrease in the intra-cellular

volume fraction.

13

summa cum laude

Computer #13



Validation of Surface-to-Volume Ratio derived from Oscillating Gradient Spin Echo on a clinical scanner using anisotropic fiber phantoms

Gregory Lemberskiy[1], Steven H. Baete[1], Martijn A. Cloos[1], Dmitry S. Novikov[1], and Els Fieremans[1]

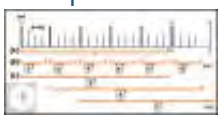
[1]Radiology, NYU School of Medicine, New York, NY, United States

This work represents the first measurement of S/V on a clinical scanner using OGSE on a well-characterized anisotropic fiber phantom. The S/V measurement is validated externally via non-diffusion metrics (Spin Echo and MR Fingerprinting). Lastly, a comparison of $$$D(\omega)$$$ and $$$D(t)$$$ shows that the effective diffusion time is $$$t_{\rm eff}^{\rm Mitra} = 9/64f = 9/16\cdot t_{\rm eff}$$$ rather than the commonly used $$$t_{\rm eff} = 1/4f$$$.

14

magna cum laude

Computer #14



Demonstration of a Sliding-Window Diffusion Tensor Technique for Temporal Study of Post-Exercise Skeletal Muscle Dynamics

Conrad P Rockel[1,2] and Michael D Noseworthy[1,2,3]

[1]School of Biomedical Engineering, McMaster University, Hamilton, ON, Canada, [2]Imaging Research Centre, St Josephs Healthcare, Hamilton, ON, Canada, [3]Electrical and Computer Engineering, McMaster University, Hamilton, ON, Canada

A novel sliding-window DTI analysis strategy, aimed at achieving both temporal resolution and valid spatial representation, was tested on one human subject pre- and post-exercise (plantar flexion) across 4 sets of different intensity. Temporal diffusion measures comprised of 3- and 15-directions (ADC and MD/FA, respectively) were assessed, as well as signal intensity of accompanying T2-weighted images (S0). Peroneus longus demonstrated increase in MD, ADC and S0, the peak and duration of which reflected exercise intensity. FA appeared noisy, although demonstrated large decreases following higher intensity exercise. While further work is needed, this method shows promise in measuring skeletal muscle dynamics.

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Computer #15

Denoising Diffusion-Weighted Images Using x-q Space Non-Local Means

Geng Chen[1,2], Yafeng Wu[1], Dinggang Shen[2], and Pew-Thian Yap[2]

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People's Republic of, [2]Department of Radiology and BRIC, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States

In this abstract, we show that improved denoising performance can be attained by extending the non-local means (NLM) algorithm beyond the *x*-space (i.e., the spatial space) to include the *q*-space (i.e., the wave-vector space). The advantage afforded by this extension is twofold: (1) Non-local information can now be harnessed not only across space, but also across measurements in *q*-space; (2) In white matter regions with high curvature, *q*-space neighborhood matching corrects for such non-linearity so that information from structures oriented in different directions can be used more effectively for denoising without introducing artifacts.

2

Computer #2

High resolution diffusion tensor reconstruction from simultaneous multi-slice acquisitions in a clinically feasible scan time

Gwendolyn Van Steenkiste[1], Ben Jeurissen[1], Steven Baete[2,3], Arnold J den Dekker[1,4], Dirk H.J. Poot[5,6], Fernando Boada[2,3], and Jan Sijbers[1]

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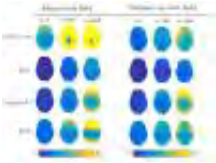
Achieving a high spatial resolution with DTI is challenging due to the inherent trade-off between resolution, acquisition time and signal-to-noise ratio (SNR). We propose a strategy to improve this trade-off by combining super-resolution DTI (SR-DTI) and simultaneous multi-slice (SMS) acquisition. With SMS-SR-DTI, high resolution DTI parameters can be recovered from thick slice images which have a high SNR. By acquiring the images with SMS, the overall acquisition time remains clinically feasible. As such, high resolution in vivo DTI becomes feasible in a clinical setting. This opens up exciting possibilities for diffusion MRI research.

3

Computer #3

Quantitative evaluation of eddy-current and motion correction techniques for diffusion-weighted MRI

Mark S Graham[1], Ivana Drobnjak[1], and Hui Zhang[1]



[1]*Centre for Medical Image Computing & Department of Computer Science, UCL, London, United Kingdom*

It is necessary to perform correction of eddy-current and motion artefacts before analysing DW-MR data, but none of the commonly used correction techniques have been evaluated quantitatively using direct measures of correspondence. Here we apply a recently proposed simulation framework to evaluate four correction techniques. We found the three techniques that register to a b=0 image (Eddy_correct, ACID, ExploreDTI) perform worse than a technique that registers to predicted DWIs (eddy). Furthermore, we found that one of the most commonly used methods for registration to b=0, eddy_correct, performs significantly worse than the other methods considered.

4

Computer #4

A Mathematical Model and an Efficient Simulation Framework for Diffusion Cardiac Imaging: Application to Quantification of Cardiac Deformation on the Diffusion Signal

Imen Mekkaoui[1], Kévin Moulin[2,3], Jérôme Pousin[1], and Magalie Viallon[2,4]

[1]*ICJ, INSA-Lyon, Villeurbanne, France,* [2]*Creatis, INSA-Lyon, Lyon, France,* [3]*Siemens Healthcare, Saint-Denis, France,* [4]*Department of Radiology, Université J. Monnet, Saint Etienne, France*

The diffusion process in the myocardium is difficult to investigate because of the unqualified sensitivity of diffusion measurements to cardiac motion. We introduced a mathematical formalism to quantify the effect of tissue motion on the diffusion NMR signal. The presented model is based on the Bloch-Torrey equations and takes into account the cardiac deformation according to the laws of continuum mechanics. Approximating this model by using a finite element method, numerical simulations can predict the sensitivity of the signal to cardiac motion under the influence of different preparation schemes. Our model identified the existence of two time points of the cardiac cycle, called "sweet spots", on which the diffusion is unaffected by the cardiac deformation. This study also demonstrates that the sweet spots depend on the type of diffusion encoding schem.

5

Computer #5

Diffusion Kurtosis at varying diffusion times in the normal and injured mouse brains

Dan Wu[1], Frances J Northington[2], and Jiangyang Zhang[1,3]

[1]Radiology, Johns Hopkins University School of Medicine, BALTIMORE, MD, United States, [2]Pediatrics, Johns Hopkins University School of Medicine, BALTIMORE, MD, United States, [3]Radiology, New York University School of Medicine, New Yourk, NY, United States

To investigate the diffusion time dependence of diffusion kurtosis, we measured kurtosis at varying diffusion times using pulsed and oscillating gradients. The results showed reduced kurtosis as diffusion time decreased from 25 ms to 2.5 ms in the normal adult mouse brains, and the differences were higher in the gray matter than the white matter regions. Results from neonatal mice with severe hypoxic-ischemic injury showed that both kurtosis measurements at short and long diffusion times elevated in the edema region, and the changes were heterogeneous in the hippocampus, which may be correlated with long-term outcome.

6

Computer #6

Can the Stretched Exponential Model of Gas Diffusion Provide Clinically -Relevant Parenchyma Measurements of Lung Disease?

Alexei Ouriadov[1], Eric Lessard[1], David G McCormack[2], and Grace Parraga[1]

[1]Robarts Research Institute, The University of Western Ontario, London, ON, Canada, [2]Department of Medicine, The University of Western Ontario, London, ON, Canada

We hypothesized that using inhaled noble gas MRI diffusion-weighted imaging, the diffusion scale estimated using the stretched exponential model would be strongly related to MRI estimates of the mean linear intercept of the lung parenchyma. In this proof-of-concept evaluation, we evaluated 34 never- and ex-smokers and compared parenchyma morphological estimates acquired using two different MRI approaches ad as well with CT and pulmonary function test measurements of acinar duct structure and function. This is important because in obstructive lung disease, the non-invasive measurement of parenchyma tissue destruction or maldevelopment may serve as a therapeutic target.

7

Computer #7

Overestimation of CSF fraction in NODDI: possible correction techniques and the effect on neurite density and orientation dispersion measures

Samira Bouyagoub[1], Nicholas G. Dowell[1], Samuel A. Hurley[2], Tobias C. Wood[3], and Mara Cercignani[1]

[1]Clinical Imaging Sciences Centre, Brighton and Sussex Medical School,

Brighton, United Kingdom, [2]FMRIB Centre, University of Oxford, Oxford, United Kingdom, [3]Neuroimaging, IoPPN, King's College London, London, United Kingdom

NODDI is a diffusion MRI technique based on combining a 3 compartment tissue model with a (HARDI) protocol. NODDI overestimates CSF volume fractions (fiso), particularly in white matter regions. This is possibly due to the single T2 assumption for all compartments. High fiso could lead to inaccurate measure of neurite density (ficvf) and orientation dispersion (odi). We propose a method to correct these errors by scaling fiso with voxel-based T2 maps from DESPOT. We acquired NODDI data for 5 healthy subjects, and we run original NODDI analysis and another NODDI analysis using rescaled fiso. Results showed rescaling fiso generated low fiso measures consistent with those reported in literature. It also generated more physiologically acceptable measures of ficvf, whereas odi was not sensitive to the change.

8

Computer #8

Quantitative Assessment of Microstructure Properties of Human Corpus Callosum and Distinct Connectivity to Projected Cortices using Parametric T1 Imaging and Diffusion Tractography

Byeong-Yeul Lee[1], Xiao-Hong Zhu[1], and Wei Chen[1]

[1]Center for Magnetic Resonance Research, Radiology, University of Minnesota, Minneapolis, MN, United States

Imaging of callosal microstructures is of importance to understand its functional and anatomical connectivity to the projected cortical areas across two hemispheres. In this work, we tested our hypothesis that the parametric T_1 measure could be sensitive to the corpus callosum (CC) microstructure and the fiber size within CC, and it may reflect the underlying functionality. In comparison with histology reports, our T_1 maps indicate high inhomogeneity in CC and a positive trend between the T_1 value and CC fiber size. In addition, diffusion tractograpy analysis shows that regional differentiation of CC T_1 value or fiber size is indicative of unique connection to the cortical areas with distinct brain function. We found that the large callosal fibers likely connect to sensory and visual cortices; in contrast, small callosal fibers connect higher functional brain regions. The overall results show the new utility of parametric T_1 imaging for quantitatively assessment of the fiber microstructure of human corpus callosum and its connections to functionally relevant cortices. This imaging approach could provide a robust and useful tool for detection of fiber abnormality in the human white matter and dysfunction.

9

magna cum laude

Computer #9

Fibre directionality and information flow through the white matter: Preliminary results on the fusion of diffusion MRI and EEG

Samuel Deslauriers-Gauthier[1], Jean-Marc Lina[2], Russell Butler[3], Kevin Whittingstall[3], Pierre-Michel Bernier[4], and Maxime Descoteaux[1]

[1]Computer Science department, Université de Sherbrooke, Sherbrooke, QC, Canada, [2]École de Technologie Supérieure, Montréal, QC, Canada, [3]Department of Diagnostic Radiology, Université de Sherbrooke, Sherbrooke, QC, Canada, [4]Department of Kinanthropology, Université de Sherbrooke, Sherbrooke, QC, Canada

Diffusion MRI can recover white matter fibre bundles but it is blind to their directionality. We propose to identify the directionality of white matter fibre bundles by combining diffusion MRI and EEG data. Based on a realistic model of the brain and simulated EEG data, our preliminary results show that our proposed method is able to differentiate between afferent and efferent white matter connections.

Electronic Power Pitch Poster

Novel Acquisitions & Reconstruction Strategies

Power Pitch Theatre, Exhibition Hall

Monday, May 9, 2016: 15:15 - 16:15

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Computer #10

The role of brain viscoelasticity in chronically shunted hydrocephalus using Magnetic Resonance Elastography

Kristy Tan[1], Adam L. Sandler[2], Avital Meiri[1], Rick Abbott[2], James T. Goodrich[2], Eric Barnhill[3], and Mark E. Wagshul[1]

[1]Gruss MRRC, Albert Einstein College of Medicine, Bronx, NY, United States, [2]Department of Neurological Surgery, Albert Einstein College of Medicine/Children's Hospital at Montefiore, Bronx NY, Bronx, NY, United States, [3]Clinical Research Imaging Centre, University of Edinburgh, Edinburgh, United Kingdom

Hydrocephalus patients with functioning shunts are often faced with severe headache disorders. This is believed to be due to a change in brain viscoelasticity. MRE uses external mechanical vibrations to induce waves and estimates viscoelasticity from the wave propagation. This study found a significant decrease of brain viscoelasticity in patients (N=14) compared to controls (N=12) (G* white matter, controls: 1407.82

(SD=111.3) Pa vs patients: 1099.33 (SD=262.86) Pa, p =0.0001). Additionally, an inverse correlation between ventricular volume and viscoelasticity in corresponding lobes was found indicating that brain viscoelasticity may play a role in hydrocephalus patient's symptoms such as headaches.

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Computer #11

Prospective Motion Correction With NMR Markers Using Only Native Sequence Elements

Alexander Aranovitch[1], Maximilian Haeberlin[1], Simon Gross[1], Thomas Schmid[1], and Klaas Paul Pruessmann[1]

[1]Institute for Biomedical Engineering, ETH Zurich and University of Zurich, Zurich, Switzerland

A field-detection based method for prospective motion correction is proposed which uses the sequence itself for localizing NMR field probes. No additional gradients or increase of the sequence duration are required to apply this method to various MR sequences, such as clinically relevant spin-warp sequences. The proposed method collects high-frequency information present due to gradient switching from multiple short, temporally separated snippets within one TR. A precision on the order of 10µm and 0.01° (RMS) for translational and rotational degrees of freedom is obtained. The method is demonstrated in-vivo with high-resolution T2*-weighted gradient echo scans.

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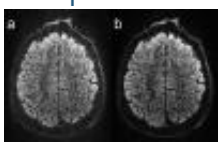
Computer #12



Whole-brain quantitative diffusion MRI at 660 µm resolution in 25 minutes using gSlider-SMS and SNR-enhancing joint reconstruction

Justin P Haldar[1], Qiuyun Fan[2], and Kawin Setsompop[2]

[1]Electrical Engineering, University of Southern California, Los Angeles, CA, United States, [2]A. A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Charlestown, MA, United States

We propose a novel approach to data acquisition and image reconstruction that achieves high-quality *in vivo* whole-brain human diffusion imaging at (660 µm)^3 resolution in 25 minutes. The approach uses a powerful acquisition strategy (generalized SLIce Dithered Enhanced Resolution Simultaneous MultiSlice, or gSlider-SMS) that enables high-resolution whole-brain imaging in 25 minutes (64 diffusion weightings + 7 *b*=0 images), but the resulting images suffer from low SNR without averaging. To address the SNR problem, we utilize a regularized reconstruction/denoising approach that leverages the shared spatial structure of different diffusion images. *In vivo* results

demonstrate the effectiveness of this approach.

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Computer #13

Joint K-space Trajectory and Parallel Imaging Optimization for Auto-calibrated Image Reconstruction

Stephen Cauley[1,2], Kawin Setsompop[1,2], Berkin Bilgic[1], Himanshu Bhat[3], Borjan Gagoski[2,4], Thomas Witzel[1,2], and Lawrence L. Wald[1,2,5]

[1]MGH/HST, Athinoula A. Martinos Center for Biomedical Imaging, Charlestown, MA, United States, [2]Harvard Medical School, Boston, MA, United States, [3]Siemens Medical Solutions Inc, Malvern, PA, United States, [4]Fetal-Neonatal Neuroimaging & Developmental Science Center, Boston Children's Hospital, Boston, MA, United States, [5]Harvard-MIT Division of Health Sciences and Technology, MIT, Cambridge, MA, United States

Fast MRI acquisitions often rely on efficient traversal of k-space, e.g. Spiral, EPI, and Wave-CAIPI. Limitations in hardware and other physical effects cause these trajectories to deviate from the theoretical path, and additional measurements are typically used to approximate discrepancies. We propose a joint optimization to directly estimate trajectory discrepancies simultaneously with the underlying image, without need for additional characterization measurements. Model reduction schemes are introduced to make this optimization computationally efficient and ensure final image quality. We demonstrate our approach for a clinically relevant Wave-CAIPI acquisition, where we accurately optimize across >6million unknowns in 30s on standard vendor hardware.

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Computer #14

Looping star: A novel, self-refocusing zero TE imaging strategy

Ana Beatriz Solana[1], Anne Menini[1], and Florian Wiesinger[1]

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Zero TE is an extremely efficient 3D pulse sequence which also has the advantages of low geometrical distortion, reduced acoustic noise and the capacity of imaging short T2 structure. However, its native contrast is proton density. Here we present a novel method that allows gradient refocusing at echo times suitable for fMRI or susceptibility weighted imaging. As a proof of concept, this new imaging strategy is tested in phantom experiments.

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Computer #15

Real-time SENSE reconstruction using pre-scan and E-maps sensitivities

Muhammad Faisal Siddiqui[1], Abubakr Shafique[2], Yousif Rauf Javed[2],

Talha Ahmad Khan[2], Hamza Naeem Mughal[2], Ahmed Wasif Reza[1], Hammad Omer[2], and Jeevan Kanesan[1]

[1]*Electrical Engineering, University of Malaya, Kuala Lumpur, Malaysia,* [2]*Electrical Engineering, COMSATS Institute of Information Technology, Islamabad, Pakistan*

FPGA (Field Programmable Gate Array) based application specific hardware, for real-time Sensitivity Encoding (SENSE) reconstruction, embedded on the receiver coil system may provide reconstruction without transferring the data to the MRI server. This may dramatically decrease the transmission cost of the system and the image reconstruction time. This paper proposes an FPGA implementation of SENSE algorithm using two different sensitivity maps estimation methods (pre-scan and E-maps). The results show that the proposed system consumes only 145.64 µs for SENSE reconstruction (acceleration factor=2), while maintaining the quality of the reconstructed images with good mean SNR (29+ dB) and significantly less artefact power ($<9\times10^{-4}$) values.

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Computer #16

Do try this at home: the role of CAIPIRINHA and non-Cartesian techniques for increased throughput and aesthetic enhancement in baking (or vice versa)

Benedikt A Poser[1]

[1]*Faculty of Psychology and Neuroscience, Maastricht University, Maastricht, Netherlands*

Parallel imaging with controlled aliasing has revolutionised the way we do MRI, and this may directly translate to the way we bake. In this work CAIPIRINHA principles are successfully applied to the baking of cinnamon rolls. Furthermore, the question is considered of whether CAIPIRINHA may have been inspired by established baking practices in the first place.

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Computer #1

Phaseless Encoding

Franciszek Hennel[1] and Klaas P. Pruessmann[1]

[1]*Institute for Biomedical Engineering, University of Zurich and ETH Zurich, Zurich, Switzerland*

Classically encoded MRI signals are complex and therefore sensitive to uncontrolled phase variations. We propose an alternative spatial

encoding method which leads to real positive signals and allows phase fluctuations to be removed by a simple magnitude calculation before the Fourier transform. The phase immunity of the method is demonstrated by recovering an image from a scan with unknown random receiver phase.

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Computer #2

Rabi Modulated Continuous Wave Imaging

James C Korte[1], Bahman Tahayori[1], Peter M Farrell[1], Stephen M Moore[2,3], and Leigh A Johnston[1]

[1]Dept. Electrical and Electronic Engineering, University of Melbourne, Melbourne, Australia, [2]IBM Research, Melbourne, Australia, [3]Dept. Mechanical Engineering, University of Melbourne, Melbourne, Australia

The observable periodic magnetisation induced in a spin system excited by Rabi modulated Continuous Wave excitation is exploited in this work to construct a new imaging paradigm. Localised frequency information is encoded in the steady-state Rabi harmonics, reconstructed as radial projections of proton density and back-projected to form images. This form of imaging has the potential to image samples with ultra-short T_2 decay, which is beneficial for the diagnosis of muscular skeletal injury and disease.

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Computer #3

Gradient Free MRI with a rotating magnet and receiver fields

Somaie Salajeghe[1], Paul Babyn[2], Logi Vidarsson[3], and Gordon E. Sarty[1]

[1]Biomedical Engineering, University of Saskatchewan, Saskatoon, SK, Canada, [2]Medical Imaging, University of Saskatchewan, Saskatoon, SK, Canada, [3]LT Imaging, Toronto, ON, Canada

Portable MRI can be possible by eliminating gradient coils and B_0 homogeneity requirements. Relaxing the B_0 homogeneity requirements leads to non-uniform B_0 field. In-homogeneous B_0 fields have the potential to encode spatial information in one direction for use in novel image encoding schemes. We investigated the possibility of image reconstruction of the signal from a non-uniform rotating magnetic field and two rotating RF receivers. Our results indicate that this is a feasible approach.

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Computer #4

Cyclic Continuous Max-Flow: Phase Processing Using the Inherent Topology of Phase

John Stuart Haberl Baxter[1], Zahra Hosseini[1], Junmin Liu[2], Maria

Drangova[3], and Terry M Peters[1]

[1]Biomedical Engineering Graduate Program, Western University, London, ON, Canada, [2]Imaging Laboratories, Robarts Research Institute, London, ON, Canada, [3]Department of Medical Biophysics, Western University, London, ON, Canada

Tissue susceptibility differences manifest in MR phase images as high-frequency changes in an otherwise smooth phase background. Two paradigms currently exist for isolating these changes: one involves phase unwrapping followed by filtering; the other involves filtering the complex signal. Both rely on a linear topology, which can result in artifacts such as phase wraps and shadowing, as phase is inherently cyclic. This paper introduces the cyclic continuous max-flow (CCMF) method, which uses optimization over a cyclic topology to process phase information. More robust field maps are generated using this approach compared to the traditional paradigms.

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Computer #5

a-f BLAST: A Non-Iterative Radial k-t BLAST Reconstruction in Radon Space

Madison Kretzler[1], Jesse Hamilton[2], Mark Griswold[2,3], and Nicole Seiberlich[2,3]

[1]Electrical Engineering, Case Western Reserve University, Cleveland, OH, United States, [2]Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States, [3]Radiology, University Hospitals, Cleveland, OH, United States

This abstract presents a-f BLAST, a non-iterative approach to non-Cartesian k-t BLAST for radial trajectories, and demonstrates its use for accelerated cardiac imaging.

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Computer #6

Model-based Reconstruction for Real-Time Phase-Contrast Flow MRI - Improved Spatiotemporal Accuracy

Zhengguo Tan[1], Volkert Roeloffs[1], Dirk Voit[1], Arun Joseph[1], Markus Untenberger[1], Klaus-Dietmar Merboldt[1], and Jens Frahm[1]

[1]Biomedizinische NMR Forschungs GmbH, Max-Planck-Institute for Biophysical Chemistry, Goettingen, Germany

The proposed model-based reconstruction technique jointly computes a magnitude image, a phase-contrast map, and a set of coil sensitivities from every pair of flow-compensated and flow-encoded datasets

obtained by highly undersampled radial FLASH. Real-time acquisitions with 5 and 7 radial spokes per image resulted in 25.6 and 35.7 ms measuring time per phase-contrast map, respectively. It yields quantitatively accurate phase-contrast maps with improved spatial acuity, reduced phase noise, reduced partial volume effects, and reduced streaking artifacts.

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Computer #7

Acquisition of high resolution three-dimensional ocular images at 7 Tesla to generate patient-specific eye-models for clinical ray-tracing

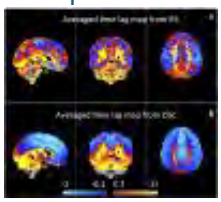
Jan-Willem Beenakker[1], Lucia Hervella[2], Juan Tabarnero[2], Dennis Shamonin[1], Andrew Webb[1], Gregorius Luyten[1], and Pablo Artal[2]

[1]Leiden University Medical Centre, Leiden, Netherlands, [2]University of Murcia, Murcia, Spain

Patient-specific three-dimensional eye models obtained using very high resolution scans on a human 7T MRI system have been shown to form a much more accurate input for ray tracing algorithms than the current state-of-the-art generalized eye models used for clinical ophthalmology. Using a cued-blink protocol, custom-built phased array coil and segmentation software, accuracy of less than one-half dioptre can be achieved using the MRI data. These patient-specific models should provide much improved input for therapeutic procedures such as intra-ocular lens replacement for post-cataract surgery.

98

Computer #8



Perfusion map derived from resting state fMRI

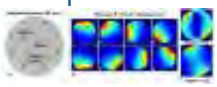
Yunjie Tong[1], Kimberly P Lindsey[1], Lia M Hocke[2], Gordana Vitaliano[1], Dionyssios Mintzopoulos[1], and Blaise B Frederick[1]

[1]McLean Hospital/Harvard Medical School, Belmont, MA, United States, [2]Hotchkiss Brain Institute, University of Calgary, Calgary, AB, Canada

Previously, we have demonstrated that we can extract systemic low frequency oscillation (sLFO) from resting state (RS) fMRI data and map its dynamic patterns as it moves through the brain. We have hypothesized that the dynamic patterns represent the cerebral blood flow. In this study, we tested this hypothesis by conducting both Dynamic Susceptibility Contrast scan (bolus tracking) and RS fMRI scan in health subjects. By comparing the flow patterns of the bolus with that of sLFO, we found that the flow of sLFO does represent the blood flow, however, mostly in the capillaries and veins.

99

Computer #9



Nonlinear RF spatial encoding with multiple transmit coils based on Bloch-Siegert shift

Yuqing Wan[1], Maolin Qiu[1], Gigi Galiana[1], and R. Todd Constable[1]

[1]Radiology and Biomedical Imaging, Yale University, New Haven, CT, United States

We developed a nonlinear encoding method with multiple RF coils based on the Bloch-Siegert shift. Simulated reconstructions showed that higher B1 fields and lower off-resonance frequency shift improves reconstruction quality. This approach is potentially promising as a replacement for conventional gradient encoding providing excellent spatial encoding with essentially silent imaging.

Electronic Power Pitch Poster

At the Cutting-Edge of Cancer Imaging

Power Pitch Theatre, Exhibition Hall

Monday, May 9, 2016: 17:30 - 18:30

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Computer #1

Immune co-stimulatory blockade permits human glioblastoma xenografting in immunocompetent mice: model validation with MRI and bioluminescence imaging

Samantha Lynn Semenkow[1], Shen Li[2], Eric Raabe[1,3], Jiadi Xu[2,4], Miroslaw Janowski[2,5], Byoung Chol Oh[6], Gerald Brandacher[6], Jeff W. Bulte[2,4], Charles Eberhart[1,3,7], and Piotr Walczak[2]

[1]Department of Pathology, Johns Hopkins Medical Institue, Baltimore, MD, United States, [2]Department of Radiology and Radiological Science, Johns Hopkins Medical Institue, Baltimore, MD, United States, [3]Department of Oncology, Johns Hopkins Medical Institue, Baltimore, MD, United States, [4]F. M. Kirby Center for Functional Brain Imaging Kennedy Krieger Institute, Johns Hopkins Medical Institue, Baltimore, MD, United States, [5]NeuroRepair Department, Mossakowski Medical Research Centre, Warsaw, Poland, [6]Department of Plastic and Reconstructive Surgery, Vascularized Composite Allotransplantation (VCA) Laboratory, Johns Hopkins Medical Institue, Baltimore, MD, United States, [7]Department of Opthalmology, Johns Hopkins Medical Institue, Baltimore, MD, United States

Immunodeficient mice are currently used for modeling human brain tumor xenografts; however, immunodeficiency is a serious limitation precluding studies based on immunotherapy or inducing tumors in a variety of transgenic animal models. We therefore investigated whether

disruption of co-stimulatory signaling using blocking antibodies induces tolerance to intracerebrally transplanted human glioblastoma xenografts in immunocompetent mice. With longitudinal MRI and bioluminescence we established that the growth rate of xenografts is comparable between immunodeficient and tolerance-induced immunocompetent mice. Quantitative MRI including T2/T1 relaxation time, MTR, diffusion parameters and perfusion were not significantly different, validating this new approach as a reliable brain tumor model.

183

Computer #2

In vivo 1H MRS and MRI longitudinal assessment of GBM mouse xenografts derived from freshly injected human cells

Marta Lai[1], Cristina Cudalbu[2], Marie-France Hamou[3,4], Mario Lepore[2], Lijing Xin[2], Roy Thomas Daniel[4], Andreas Felix Hottinger[5], Monika Hegi[3,4], and Rolf Gruetter[1,6,7]

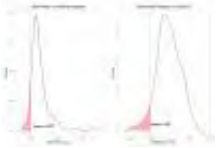
[1]Laboratory of Functional and Metabolic Imaging (LIFMET), Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, [2]Animal Imaging and Technology Core (AIT), Center for Biomedical Imaging (CIBM), Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, [3]Laboratory of Brain Tumor Biology and Genetics, Neuroscience Research Center, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [4]Service of Neurosurgery, Department of Clinical Neurosciences, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [5]Service of Neurology, Department of Clinical Neurosciences, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [6]Department of Radiology, University of Geneva, Geneva, Switzerland, [7]Department of Radiology, University of Lausanne, Lausanne, Switzerland

In the present study orthotopic xenograft mice models of glioblastoma (GBM) derived from freshly dissected human cells of three different patients were compared at the aim of assessing patient-to-patient variability related to tumor metabolism and structural development. Mice were followed longitudinally *in vivo* in a 14.1 Tesla scanner with MRI and ^{1}H MRS which allowed to precisely quantify a wide range of GBM biomarkers. Finally spectra examined at late stage revealed peculiarity linked to each patient-derived xenograft, while longitudinal evolution of GBM biomarkers showed a close similarity in their expression within the same group and in animal lifespan.

184

Computer #3

Multi-modal MRI Parametric Maps Combined with Receptor Information to Optimize Prediction of Pathologic Response to Neoadjuvant Chemotherapy in Breast Cancer



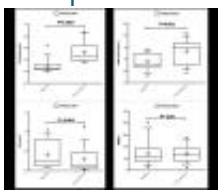
Hakmook Kang[1,2], Allison Hainline[1], Xia Li[3], Lori R. Arlinghaus[4], Vandana G. Abramson[5,6], A. Bapsi Chakravarthy[5,7], Brian Bingham[8], and Thomas E. Yankeelov[2,4,5,9]

[1]Biostatistics, Vanderbilt University, Nashville, TN, United States, [2]Center for Quantitative Science, Vanderbilt University, Nashville, TN, United States, [3]GE Global Research, Niskayuna, NY, United States, [4]Institute of Imaging Science, Vanderbilt University, Nashville, TN, United States, [5]Ingram Cancer Center, Vanderbilt University, Nashville, TN, United States, [6]Medical Oncology, Vanderbilt University, Nashville, TN, United States, [7]Radiation Oncology, Vanderbilt University, Nashville, TN, United States, [8]School of Medicine, Vanderbilt University, Nashville, TN, United States, [9]Radiology and Radiological Sciences, Vanderbilt University, Nashville, TN, United States

Pathologic complete response (pCR) following neoadjuvant chemotherapy is used as a short term surrogate marker of ultimate outcome in patients with breast cancer. Current imaging tools are suboptimal in predicting this response. Analyzing voxel-level heterogeneity in multi-modal MRI maps in conjunction with receptor status data, i.e., DCE- and DW-MRI, and ER/PR/HER2 status, allows us to improve the predictive power after the first cycle of neoadjuvant chemotherapy (NAC).

185

Computer #4



Early post-treatment changes of multi-parametric whole-body MRI quantitative parameters following Bortezomib induction in multiple myeloma; Preliminary results at 3.0 T

Arash Latifoltojar[1], Margaret Hall-Craggs[2], Alan Bainbridge[2], Magdalena Sokolska[2], Kwee Yong[1], Neil Rabin[2], Liam Watson[1], Michelle Siu[2], Matthew Benger[2], Nikolaos Dikaios[1], and Shonit Punwani[1]

[1]University College London, London, United Kingdom, [2]University College London Hospital, London, United Kingdom

Whole body magnetic resonance imaging is becoming the gold standard imaging in initial assessment of multiple myeloma. Recently, functional imaging is being investigated in treatment response monitoring in multiple myeloma. We investigated different functional MRI biomarkers' temporal changes at early post-treatment stage in multiple myeloma patients following Bortezomib induction.

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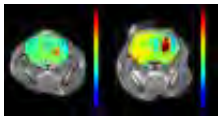
Computer #5

The origins of glucoCEST signal: effect inhibiting glucose transport in brain tumors

Xiang Xu[1,2], Jiadi Xu[1,2], Linda Knutsson[3], Yuguo Li[1,2], Huanling Liu[1,4],

summa cum laude



Guanshu Liu[1,2], Bachchu Lal[5,6], John Laterra[5,6], Dmitri Artemov[7,8], Michael T. McMahon[1,2], Peter C.M. van Zijl[1,2], and Kannie WY Chan[1,2]

[1]Radiology, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [2]FM Kirby Research Center, Kennedy Krieger Institute, Baltimore, MD, United States, [3]Department of Medical Radiation Physics, Lund University, Lund, Sweden, [4]Department of Ultrasound, Guangzhou Panyu Central Hospital, Panyu, China, People's Republic of, [5]Department of Neurology, Kennedy Krieger Institute, Baltimore, MD, United States, [6]Department of Neuroscience, Kennedy Krieger Institute, Baltimore, MD, United States, [7]Division of Cancer Imaging Research, Johns Hopkins University School of Medicine, Baltimore, MD, United States, [8]JHU In Vivo Cellular Molecular Imaging Center, Baltimore, MD, United States

Recently D-glucose has shown potential to be used as a biodegradable contrast agent for cancer detection. However the origins of the glucoCEST signal is not yet completely understood. To identify the contributions to glucoCEST contrast, we administrated a glucose transporter inhibitor in a group of mice with implanted glioma. By inhibiting glucose transport into the cells, the effects of cellular glucose uptake and metabolism are suppressed and the perfusion properties of the extravascular extracellular space are delineated. A greater increase in glucoCEST contrast was seen in tumors in the group of mice with glucose transporter inhibitor compared to a group of mice without. This greater uptake and retention of glucose in the inhibitor group provides evidence that the intracellular glucose contribution is minimal.

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Computer #6

CEST Metrics for Assessing Early Response to Stereotactic Radiosurgery in Human Brain Metastases

Kimberly L. Desmond[1,2], Hatef Mehrabian[1,2], Arjun Sahgal[1,3], Hany Soliman[1,3], and Greg J. Stanisz[1,2]

[1]Physical Sciences, Sunnybrook Research Institute, Toronto, ON, Canada, [2]Medical Biophysics, University of Toronto, Toronto, ON, Canada, [3]Radiation Oncology, Odette Cancer Centre, Toronto, ON, Canada

Chemical exchange saturation transfer (CEST) spectra were collected at three timepoints following stereotactic radiosurgery (SRS). The magnetization transfer ratio (MTR) and CEST peak properties were evaluated at the offset frequencies of the NOE, amide and amine pools in the lesion and in the surrounding tissue. Positive correlation was found between changes in NOE peak amplitude and amide MTR at 1 week post-therapy and tumour volume change at one month post-therapy, while negative correlation was found between amide peak

width and NOE peak amplitude at the pre-treatment timepoint with volume change at one month post-therapy (p<0.1).

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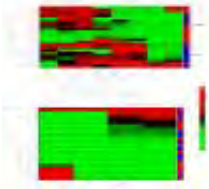
Computer #7



Predicting TP53 mutational status of breast cancers on clinical DCE MRI using directional-gradient based radiogenomic descriptors

Nathaniel Braman[1], Prateek Prasanna[1], Donna Plecha[2], Hannah Gilmore[2], Lyndsay Harris[2], Kristy Miskimen[1], Tao Wan[3], Vinay Varadan[1], and Anant Madabhushi[1]

[1]Case Western Reserve University, Cleveland, OH, United States, [2]University Hospitals, Cleveland, OH, United States, [3]Beihang University, Beijing, China, People's Republic of

In this work, we report preliminary success in the prediction of TP53 mutational status in breast cancer from DCE-MRI using a computer-extracted radiogenomic descriptor of multi-scale disorder, Co-occurrence of Local Anisotropic Gradient Orientations (CoLlAGe). A set of 8 distinguishing CoLlAGe features yielded accuracy of 78% in predicting TP53 mutational status and outperformed standard DCE-MRI pharmacokinetic parameters in an unsupervised hierarchical clustering. A non-invasive means of discerning TP53 mutational status may allow clinicians to more easily determine prognosis, assess treatment response, and inform treatment strategy.

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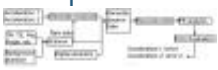
Computer #8



A Prototype Image Quality Assurance System for Accelerated Quantitative Breast DCE-MRI

Yuan Le[1], Aneela Afzal[2], Xiao Chen[3], Bruce Spottiswoode[4], Wei Huang[2], and Chen Lin[1]

[1]Radiology and Imaging Science, Indiana University School of Medicine, Indianapolis, IN, United States, [2]Advanced Imaging Research Center, Oregon Health and Science University, Portland, OR, United States, [3]Siemens Healthcare, Princeton, NJ, United States, [4]Siemens Healthcare, Chicago, IL, United States

The goal of this work is to build a prototype quality assurance (QA) system for the quantitative pharmacokinetic (PK) analysis of breast DCE-MRI acquired with accelerated imaging techniques. A 3D digital tumor model with two sub-regions was constructed by segmenting patient images. The dynamic contrast enhanced images were synthesized according to the Tofts and Shutter Speed models with the TWIST technique. The QA system shows how the TWIST technique impacts the estimated pharmacokinetic parameters, and therefore allows necessary

adjustments to be made to control the error.

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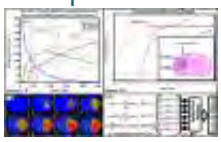
Computer #9



Model Evolution Concept in Dynamic Contrast Enhanced MRI for Prediction of Tumor Interstitial Fluid Pressure

Hassan Bagher-Ebadian[1,2], Azimeh NV Dehkordi[3], Rasha Alamgharibi[2], Tavarekere Nagaraja[1], David Nathanson[1], Hamid Soltanian-Zadeh[1], Stephen Brown[1], Hamed Moradi[4], Ali Arbab[5], and James R Ewing[1,2]

[1]Henry Ford Hospital, Detroit, MI, United States, [2]Oakland University, Rochester, MI, United States, [3]Shahid Beheshti University, Tehran, Iran, [4]Tarbiat Modares University, Tehran, Iran, [5]Georgia Regents University, Augusta, GA, United States

In this study, three physiologically nested models (NM) are derived from the standard Tofts model to describe possible physiological conditions of underlying tissue pathology. Then, using NM selection technique, Model Evolution (ME) concept is framed to quantify the evolutions of 3 different model volumes throughout the course of Dynamic Contrast Enhanced MRI experiment. We hypothesized that three evolutionary profiles in the course of DCE-MRI experiment generated from the ME concept, highly depend on the inward diffusion and outward convection of CA concentration and contain abundant information for describing the mechanical properties of solid tumors such as Interstitial Fluid Pressure (IFP).

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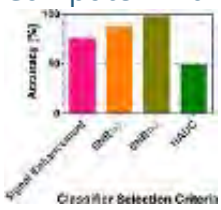
Computer #10



Automation of Pattern Recognition Analysis of Dynamic Contrast-Enhanced MRI Data to Assess the Tumor Microenvironment

SoHyun Han[1], Radka Stoyanova[2], Jason A. Koutcher[3], HyungJoon Cho[1], and Ellen Ackerstaff[3]

[1]Ulsan National Institute of Science and Technology, Ulsan, Korea, Republic of, [2]Miller School of Medicine, University of Miami, Miami, FL, United States, [3]Memorial Sloan Kettering Cancer Center, New York, NY, United States

Recently, a novel pattern recognition (PR) approach has been developed, identifying extent and spatial distribution of tumor microenvironments based on tumor vascularity. Here, our goal is to develop methods to minimize user intervention and errors from model-based approaches by introducing an automated algorithm for determining the number of classifiers. An SNR approach showed the highest accuracy at ~97% along five different tumor cell models with 104 slices total. The visualization of tumor heterogeneity (perfusion, hypoxia, necrosis) with automated analysis of DCE-MRI can reduce the need for manual expert

intervention, extensive pharmacokinetic modeling, and could provide critical information for treatment planning.

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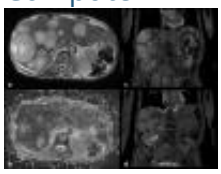
Computer #11



In vivo measurement of tumor T1 relaxation time using a whole body clinically feasible multiple flip angle method can predict response to chemotherapy

Harbir Singh Sidhu[1], Anna Barnes[2], Nikolaos Dikaios[1], Scott Rice[1], Alan Bainbridge[3], Robert Stein[4], Sandra Strauss[5], David Atkinson[1], Stuart Taylor[1], and Shonit Punwani[1]

[1]Centre for Medical Imaging, University College London, London, United Kingdom, [2]Institute of Nuclear Medicine, University College London Hospital, London, United Kingdom, [3]Medical Physics and Biomedical Engineering, University College London Hospital, London, United Kingdom, [4]Medical Oncology, University College London Hospital, London, United Kingdom, [5]Research Department of Oncology, University College London, London, United Kingdom

Tumor response assessment currently relies upon measurement of size change, which may not alter significantly early during treatment or at all with newer therapies. Patients may therefore incur significant side-effects (with associated healthcare cost) without benefit. Assessment of soft tissue tumor T1 relaxation times before and early during treatment can predict lesion response whilst being incorporated within a clinically feasible whole-body MRI scan duration. Tumors undergoing partial response at the end of treatment demonstrated significant reduction in T1 values early during therapy compared to non-responding lesions.

In the future, this could facilitate early response assessment and complement other imaging biomarkers.

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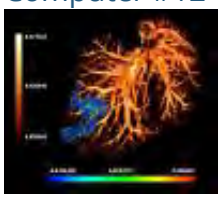
magna cum laude

Computer #12



Quantitative Susceptibility Mapping to Interrogate Colorectal Metastases in Mouse Liver during Normoxia and Hyperoxia

Eoin Finnerty[1], Rajiv Ramasawmy[2], James O'Callaghan[2], Mark F Lythgoe[2], Karin Shmueli[1], David L Thomas[3], and Simon Walker-Samuel[2]

[1]Medical Physics and Biomedical Engineering, University College London, London, United Kingdom, [2]University College London, London, United Kingdom, [3]Institute of Neurology, University College London, London, United Kingdom

This work examines the application of Quantitative Susceptibility Mapping (QSM) in a mouse model of colorectal liver metastases. It was

hypothesised that QSM could provide a novel method of interrogation of liver tumours based on differences in blood oxygenation. Results under hyperoxic and normoxic conditions were compared to assess the response of the liver tissue and tumours. A vascular disrupting agent was then administered to assess its effect on the QSM measurements. A significant difference was found between liver and tumour tissue, and regional differences in susceptibility were found within a tumour. These differences were less apparent after VDA administration.

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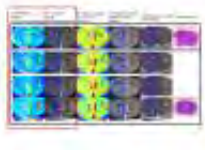
magna cum laude

Computer #13



Early Brain Tumor Detection by Active-Feedback MRI

Zhao Li[1], Chaohsiung Hsu[1], Ryan Quiroz[1], and Yung-Ya Lin[1]

[1]Department of Chemistry and Biochemistry, UCLA, Los Angeles, CA, United States

Early detection of high-grade malignancy, such as glioblastoma multiforme (GBM), using enhanced MRI techniques significantly increases not only the treatment options available, but also the patients' survival rate. For this purpose, a conceptually new approach, termed "Active-Feedback MRI", was developed. An active feedback electronic device was homebuilt to implement active-feedback pulse sequences to generate avalanching spin amplification and fixed-point spin dynamics, which enhances the local magnetic-field gradient variations due to irregular water contents and deoxyhemoglobin concentration in early GBM. Statistical results (N=22) for in vivo orthotopic xenografts GBM mouse models at various cancer stages validate the superior contrast and robustness of this approach (tumor time constant differs from that of the healthy brain tissue by +24%) towards early GBM detection than conventional T1-weighted (+2.6%) and T2-weighted images (-3.1%). This novel approach provides 4-8 times of improvements in early GBM tumor contrast, as measured by "tumor to normal tissue contrast", "contrast-to-noise ratio" (CNR) or "Visibility".

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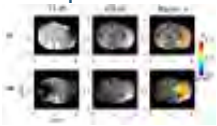
Computer #14



In Vivo Conductivity Imaging of Rat Tumor Model Using MRI

Jiaen Liu[1], Qi Shao[1], Yicun Wang[1], Gregor Adriany[2], John Bischof[3], Pierre-Francois Van de Moortele[2], and Bin He[1,4]

[1]Biomedical Engineering, Univeristy of Minnesota, Minneapolis, MN, United States, [2]Center for Magnetic Resonance Research, Univeristy of Minnesota, Minneapolis, MN, United States, [3]Mechanical Engineering, Univeristy of Minnesota, Minneapolis, MN, United States, [4]Institute for Engineering in Medicine, Univeristy of Minnesota, Minneapolis, MN, United States

Noninvasive in vivo imaging of the tissue conductivity has great potential in cancer diagnosis. Recently, electrical properties tomography (EPT) has been investigated with increasing effort to noninvasively image tissue conductivity in vivo using MRI. A preclinical method for imaging tumor conductivity can be valuable for understanding tumor development and associated conductivity change due to fundamental molecular and cellular reasons. In this study, tumor conductivity was studied based on a xenograft rat tumor model using a small animal EPT system. The result showed elevated conductivity in cancerous tissue compared to healthy tissue, suggesting the clinical value of EPT for tumor diagnosis.

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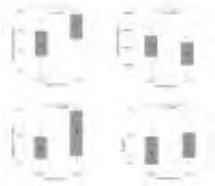
Computer #15



Evaluation of T2W MRI-derived Textural Entropy for Assessment of Prostate Cancer Aggressiveness

Gabriel Nketiah[1], Mattijs Elschot[1], Eugene Kim [1], Tone Frost Bathen [1], and Kirsten Margrete Selnæs[1]

[1]*Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trondheim, Norway*

The complexity of the prostatic tissue requires sensitive, accurate and reproducible assessment methods for aggressiveness of prostatic carcinomas, especially in differentiating between Gleason score 3+4 and 4+3 tumors. We evaluated the applicability of T2W MRI-derived textural entropy as a potential marker for assessing prostate cancer aggressiveness. Our study found textural entropy to correlate moderately positive and negative with Gleason score and apparent diffusion coefficient (ADC), respectively. T2W image textural entropy differentiated Gleason score 3+4 and 4+3 tumors with higher accuracy than other MRI-derived parameters (ADC, K^{trans} and V_e), indicating the potential of MRI texture analysis in prostate cancer assessment.

Electronic Power Pitch Poster

Neuroimaging: Novel Findings & Techniques

Power Pitch Theatre, Exhibition Hall

Tuesday, May 10, 2016: 11:00 - 12:00

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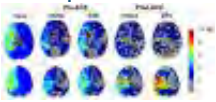
Computer #1



Simultaneous evaluation of hemodynamic and functional connectivity in patients with chronic steno-occlusive disease of the cerebrovascular system: A study using BOLD with acetazolamide

Junjie Wu[1], Seena Dehkharghani[1], Tyler Gleason[1], Fadi Nahab[2], and Deqiang Qiu[1]

summa cum laude

[1]*Department of Radiology and Imaging Sciences, Emory University, Atlanta, GA, United States,* [2]*Department of Neurology, Emory University, Atlanta, GA, United States*

In this paper we applied a *temporal-shift* analysis of the BOLD signal to delineate regions with abnormal perfusion in patients with chronic steno-occlusive disease of the cerebrovascular system. We proposed an improved method of analysis based on an iterative approach for the temporal shift analysis. We further explored the effects of acetazolamide, a vasodilator, on the assessment of hemodynamic compromise using temporal-shift analysis and functional connectivity.

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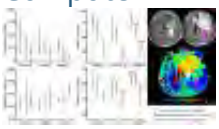
Computer #2



Electrical Conductivity Characteristics of Glioma: Noninvasive Assessment by MRI and Its Validity

Khin Khin Tha[1,2], Ulrich Katscher[3], Shigeru Yamaguchi[4], Shunsuke Terasaka[4], Toru Yamamoto[5], Kohsuke Kudo[2,6], and Hiroki Shirato[1,2]

[1]*Department of Radiobiology and Medical Engineering, Hokkaido University Graduate School of Medicine, Sapporo, Japan,* [2]*Global Institution for Quantum Medical Science and Engineering, Hokkaido University, Sapporo, Japan,* [3]*Research Laboratories, Hamburg, Germany,* [4]*Department of Neurosurgery, Hokkaido University Graduate School of Medicine, Sapporo, Japan,* [5]*Graduate School of Health Sciences, Sapporo, Japan,* [6]*Hokkaido University Hospital, Sapporo, Japan*

Electric Properties Tomography was performed in 24 glioma patients, and the electrical conductivity characteristics of glioma were determined noninvasively. Diagnostic performance of electrical conductivity in distinguishing glioma grades was also evaluated. Validity of noninvasive electrical conductivity measurement was proved by correlating with the conductivity values measured ex vivo by a dielectric probe.

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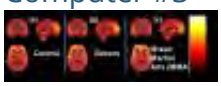
magna cum laude

Computer #3



Quantifying differences in the cerebral blood flow (CBF) between controls, professional boxers and Mixed Martial Arts (MMA) fighters using arterial spin labeling (ASL) MRI

Virendra R Mishra[1], Karthik Sreenivasan[1], Xiaowei Zhuang[1], Zhengshi Yang[1], Sarah Banks[1], Dietmar Cordes[1], and Charles Bernick[1]

[1]*Cleveland Clinic Lou Ruvo Center for Brain Health, Las Vegas, NV, United States*

The professional fighters brain health study (PFBHS) is a longitudinal

study of active professional fighters with age-matched healthy controls using multimodal MRI methods. Using ASL-MRI, we report for the first time that cerebral blood flow (CBF) is significantly lower in boxers and mixed-martial-arts fighters (MMA) than age-matched healthy controls. Most of the clusters were located in the fronto-temporal lobe, cerebellum and thalamus. No significant difference in perfusion between boxers and MMA suggests that type of combat sports have an indiscernible effect on CBF, further suggesting that perfusion may not account for different patterns of cognitive decline observed later in the life of these athletes.

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Computer #4

The Evolution of the Mammalian Connectome

Yossi Yovel[1], Omri Zomet[1], Arieli Bonzach[2], Assaf Marom[1], and Yaniv Assaf[1]

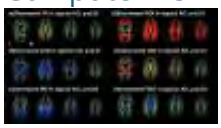
[1]Tel Aviv University, Tel Aviv, Israel, [2]Beit Dagan Veterinary institute, Beit Dagan, Israel

Despite its importance, little is known on the evolution of the mammalian brain. Previous work suggests that body size and behavioral function are intertwined in their influence on the evolution of the brain. Most previous studies focused on examining gray matter. Because the underlying white matter connectome facilitates the connections between gray matter areas, it must have simultaneously evolved to support gray matter evolution. In this work we used a wide comparative approach relying on diffusion MRI based fiber-tracking to reconstruct whole-brain structural connectomes and explore its evolution.

277

summa cum laude

Computer #5



Neurite Orientation Dispersion and Density Imaging (NODDI) in Young Onset Alzheimer's Disease and Its Syndromic Variants

Jiaying Zhang[1], Catherine F Slattery[2], Ross W Paterson[2], Alexander JM Foulkes[2], Laura Mancini[2], David L Thomas[2], Marc Modat[1], Nicolas Toussaint[2], David M Cash[2], John S Thornton[2], Daniel C Alexander[1], Sebastien Ourselin[1], Nick C Fox[2], Jonathan M Schott[2], and Hui Zhang[1]

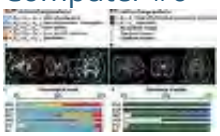
[1]Department of Computer Science and Centre for medical image computing, University College London, London, United Kingdom, [2]Department of Neurodegenerative disease, Institute of Neurology, University College London, London, United Kingdom

Alzheimer's disease (AD) is now increasingly considered as a disorder of brain networks. Therefore, it is important to quantify the integrity of white matter (WM) connections in AD populations. Previous DTI studies

have shown WM breakdown in patients with young onset AD (YOAD), but DTI parameters are not specific to any tissue property. Here we investigated WM changes using NODDI and DTI in YOAD patients using TBSS and explored whether unique patterns of WM changes exist in YOAD subtypes. We found NODDI was more sensitive than DTI and demonstrated different profiles of WM damage in YOAD syndromic subgroups.

278

Computer #6



Developmental processes on the neonatal brain revealed by white matter tract integrity metrics derived from diffusion kurtosis imaging

Xianjun Li[1,2], Jie Gao[1], Yumiao Zhang[1], Yanyan Li[1], Huan Li[1], Mingxi Wan[2], and Jian Yang[1,2]

[1]Radiology Department of the First Affiliated Hospital, Xi'an Jiaotong University, Xi'an, China, People's Republic of, [2]Department of Biomedical Engineering, the Key Laboratory of Biomedical Information Engineering of the Ministry of Education, School of Life Science and Technology, Xi'an Jiaotong University, Xi'an, China, People's Republic of

To distinguish axon-related and myelin-related developmental processes, we tried to find a strategy for assessing white matter developmental processes by using white matter tract integrity (WMTI) metrics derived from diffusion kurtosis imaging (DKI). The method was used on 41 neonates. The proposed strategy provided more processes than conventional diffusion tensor imaging (DTI) method. Five change patterns were found for WMTI metrics, while 2 patterns for DTI metrics. WMTI metrics derived from DKI could provide more detailed developmental processes on neonatal white matter.

279

summa cum laude

Computer #7

A serial microcompartment-specific T2* relaxation study of white matter lesions in multiple sclerosis at 7T

Xiaozhen Li[1,2], Peter van Gelderen[2], Pascal Sati[3], Jacco de Zwart[2], Daniel Reich[3], and Jeff Duyn[2]

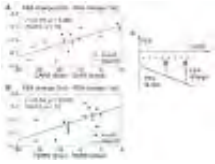
[1]Dept. NVS, Karolinska Institutet, Stockholm, Sweden, [2]Advanced MRI Section, LFMI, NINDS, National Institutes of Health, Bethesda, MD, United States, [3]Translational Neuroradiology Unit, NINDS, National Institutes of Health, Bethesda, MD, United States

Multiple sclerosis (MS) is a chronic demyelinating disease characterized by focal lesions. Recent studies suggest the possibility of obtaining cellular microcompartment-specific information from three-component fitting of the T_2^* relaxation decay curve, allowing determination of the

relative fractions of myelin water, axonal water and interstitial water. The microcompartment-specific T_2^* relaxation values of initially enhancing lesions were followed serially on 7T at approximately 3, 6, and 12 months. The changes over time that we observed in enhancing lesions are consistent with the presence of ongoing remyelination. This may lead to a better understanding of, and prognostic ability for, this complex disease.

280

Computer #8



Real-time fMRI Neurofeedback with Simultaneous EEG in Combat-related PTSD: Frontal EEG Asymmetry Variations as Measure of Treatment Response

Vadim Zotev[1], Raquel Phillips[1], Masaya Misaki[1], Chung Ki Wong[1], Brent Wurfel[1], Matthew Meyer[1,2], Frank Krueger[1,3], Matthew Feldner[1,4], and Jerzy Bodurka[1,5]

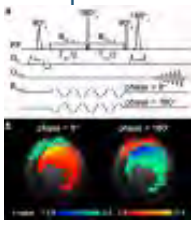
[1]Laureate Institute for Brain Research, Tulsa, OK, United States, [2]Laureate Psychiatric Clinic and Hospital, Tulsa, OK, United States, [3]Neuroscience Dept., George Mason University, Fairfax, VA, United States, [4]Dept. of Psychological Science, University of Arkansas, Fayetteville, AR, United States, [5]College of Engineering, University of Oklahoma, Tulsa, OK, United States

We have performed a study of emotion regulation training in veterans with combat-related PTSD using real-time fMRI neurofeedback (rtfMRI-nf) with simultaneous EEG. Fifteen PTSD patients learned to upregulate their left amygdala activity using rtfMRI-nf during a positive emotion induction task based on retrieval of happy autobiographical memories. Individual session-to-session variations in frontal EEG asymmetry (FEA) changes during the rtfMRI-nf task significantly correlated with variations in PTSD severity (CAPS) and co-morbid depression severity (HDRS). These results suggest that variations in task-specific FEA changes during rtfMRI-nf training provide a sensitive measure of individual response to treatment in PTSD patients.

281

magna cum laude

Computer #9



In-vivo detection of neuronal current using spin-lock oscillatory excitation at 7T

Yuhui Chai[1], Guoqiang Bi[2], Liping Wang[3], Fuqiang Xu[4], Xin Zhou[4], Bensheng Qiu[2], Hao Lei[4], Bing Wu[5], Yang Fan[5], and Jia-Hong Gao[1]

[1]Center for MRI Research, Peking University, Beijing, China, People's Republic of, [2]University of Science and Technology of China, Hefei, China, People's Republic of, [3]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China, People's Republic of, [4]Wuhan Institute of Physics and Mathematics, Chinese Academy of Sciences, Wuhan, China,

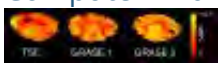
People's Republic of, [5]GE Healthcare, MR Research China, Beijing, China, People's Republic of

In-vivo detection of neuronal current remains a challenging and promising goal in fMRI. Previous work has demonstrated its feasibility in phantom and cell culture studies, but attempts in in-vivo studies remain few and far between. As neuronal current is usually comprised of a series of oscillatory waveforms rather than being a direct current, it is most likely to be detected using oscillatory current sensitive sequences. In this study, we explored the potential of using the spin-lock oscillatory excitation (SLOE) sequence to directly detect optogenetically evoked oscillatory neuronal current in vivo for the first time.

282

summa cum laude

Computer #10



Rapid Myelin Water Imaging in Human Cervical Spinal Cord

Emil Ljungberg[1], Irene Vavasour[2], Roger Tam[2,3], Youngjin Yoo[3], Alexander Rauscher[4], David Li[2], Anthony Traboulsee[5], Alex MacKay[1,2], and Shannon Kolind[5]

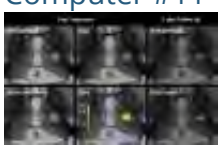
[1]Physics and Astronomy, University of British Columbia, Vancouver, BC, Canada, [2]Radiology, University of British Columbia, Vancouver, BC, Canada, [3]Electrical and Computer Engineering, University of British Columbia, Vancouver, BC, Canada, [4]Pediatrics, University of British Columbia, Vancouver, BC, Canada, [5]Medicine, University of British Columbia, Vancouver, BC, Canada

Myelin water imaging can quantify myelin in the cervical cord in vivo. However, the established 3D Turbo Spin Echo (TSE) approach has a lengthy scan time. We used a 3D Gradient Spin Echo (GRASE) sequence to speed up cervical cord myelin water acquisition by a factor of three. Average GRASE and TSE myelin water estimates were similar (GRASE: 23±1.5%; TSE: 24±3%) and significantly correlated (R^2=0.69, p<0.001). 3D-GRASE showed good reproducibility with an average myelin water coefficient of variation of 6%. Our findings demonstrate that cervical cord myelin water data can reliably be collected in clinical feasible scan times.

283

summa cum laude

Computer #11



Transcranial MRI-Guided High-Intensity Focused Ultrasound for Treatment of Essential Tremor: Initial Clinical Experience and Correlation of Clinical Outcome with Lesion Size, Localization, and Dose

Christian Federau[1], Maged Goubran[1], Jason Su[1], Jaimie Henderson[1], Veronika Santini[1], Casey Harrison Halpern[1], Brian Rutt[1], Kim Butts Pauly[1], and Pejman Ghanouni[1]

[1]*Stanford University, Stanford, CA, United States*

Transcranial MR-guided high-intensity focused ultrasound ablation of the ventral division of the ventral lateral posterior thalamic nucleus (VLpv) is a promising, minimally invasive treatment method for essential tremor. We report our initial clinical experience in 11 patients, and correlate clinical outcome with lesion size, location, and thermal dose during treatment. We found a correlation between clinical outcome at 1 year follow-up and lesion size (r = 0.73), as well as thermal dose in the VLpv (r = 0.65).

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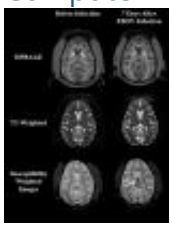
Computer #12



Neuroimaging of Acute Ebola Virus Disease in a Non-Human Primate Model

Margaret R. Lentz[1], Jeffery R. Solomon[2], Srikanth Yellayi[1], Richard Bennett[1], Dawn Traynor[1], David Thomasson[1], Anna Honko[1], Lisa Hensley[1], and Peter B. Jahrling[1,3]

[1]*Integrated Research Facility, NIAID, National Institutes of Health, Frederick, MD, United States,* [2]*Clinical Research Directorate/Clinical Monitoring Research Program, Frederick National Laboratory for Cancer Research, Leidos Biomedical Research, Inc., Frederick, MD, United States,* [3]*Emerging Viral Pathogens Section, NIAID, National Institutes of Health, Frederick, MD, United States*

The purpose of this study was to use MRI to assess alterations in the brain that occur in rhesus macaques infected with a variant of the Ebola virus (EBOV) isolated from the most recent outbreak. EBOV was found to induce signal alterations in susceptibility weighted imaging (SWI) along vasculature that correlate to venous congestion and perivascular hemorrhage. The use of SWI or other gradient echo based methods to examine vascular changes may be of interest when examining survivors of Ebola. Additionally, the identification of non-invasive imaging biomarkers of EBOV disease progression could help in development of medical countermeasures.

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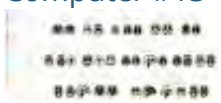
Computer #13



Structural variability in the human brain reflects functional architecture

Gwenaelle Douaud[1], Eugene Duff[1], Adrian Groves[1], Thomas Nichols[1,2], Saad Jbabdi[1], Christian Tamnes[3], Lars Westlye[3], Andreas Engvig[3], Kristine Walhovd[3], Anders Fjell[3], Heidi Johansen-Berg[1], and Steve Smith[1]

[1]*FMRIB Centre, University of Oxford, Oxford, United Kingdom,* [2]*University of Warwick, Coventry, United Kingdom,* [3]*University of Oslo, Oslo, Norway*

It is believed that the resting-state networks closely relate to the underlying anatomical connectivity and grey matter structure but cannot be understood in those terms alone. Here, we show that a purely data-driven approach used to co-model three complementary types of grey matter information on a large, healthy population covering most of the lifespan uncovers the entire repertoire of canonical functional networks. We further demonstrate that the modes of variation of grey matter volume across all participants forming these structural networks spatially co-vary with cortical area, except in primary sensory areas where they also partially co-vary with cortical thickness.

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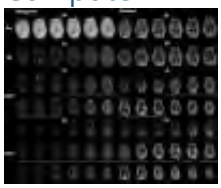
Computer #14



A constrained slice-dependent background suppression scheme for simultaneous multi-slice pseudo-continuous arterial spin labeling

Xingfeng Shao[1], Yi Wang[1], and Danny J.J. Wang[1]

[1]*Laboratory of FMRI Technology (LOFT), Department of Neurology, University of California Los Angeles, Los Angeles, CA, United States*

Compared to standard two-dimensional (2D) arterial spin labeling (ASL), simultaneous multi-slice (SMS) ASL imaging techniques can reduce T1 relaxation effect of the label; improve spatial coverage and resolution. However, existing 2D SMS ASL techniques are sub-optimal for the background suppression (BS) technique since multiple SMS excitations are required. In this study, we propose a novel constrained slice-dependent BS scheme for 2D multi-slice pseudo-continuous ASL (pCASL) with SMS-EPI acquisition, to suppress background signal across a wide range of T1s. In vivo experiment showed that the BS scheme can increase temporal SNR of perfusion images 1.5-2 folds.

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Computer #15

Brain Catalogue and its MRI of extinct species: the example of Thylacinus Cynocephalus

Mathieu David Santin[1,2], Marc Herbin[3], and Roberto Toro[4]

[1]*Centre de NeuroImagerie de Recherche - CENIR, Paris, France,* [2]*Inserm U 1127, CNRS UMR 7225, Sorbonne Universités, UPMC Univ Paris 06 UMR S 1127, Institut du Cerveau et de la Moelle épinière, ICM, Paris, France,* [3]*Muséum National d'Histoire Naturelle, Paris, France,* [4]*Institut Pasteur, Paris, France*

We present here an example of one of the application of the Brain Catalogue with an MRI of an extinct species: the Thylacine

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Electronic Power Pitch Poster

MSK: The Most Powerful Hour

Power Pitch Theatre, Exhibition Hall

Tuesday, May 10, 2016: 14:30 - 15:30

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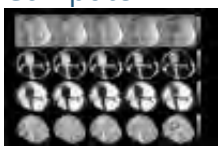
Computer #1



Bone Quantitative Susceptibility Mapping using tissue specific R2* and multi-peak fat spectrum to model ultra-short TE gradient echo signal

Alexey V. Dimov[1,2], Zhe Liu[1,2], Pascal Spincemaille[2], and Yi Wang[1,2]

[1]Department of Biomedical Engineering, Cornell University, Ithaca, NY, United States, [2]Radiology Department, Weill Cornell Medical College, New York, NY, United States

Bone quantitative susceptibility mapping (QSM) using standard IDEAL fat water/signal model often suffers from erroneous labeling of water component. We propose a new field estimation approach incorporating the negligible T2* decay of fat compared to bone water signal, and modeling fat with multiple spectral peaks. This tissue specific R2* multi-peak signal allows robust field mapping from radial ultra-short TE gradient echo data, enabling in vivo bone QSM with consistent high quality.

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Computer #2

Reproducibility and regional variations of an optimized gagCEST protocol for the in vivo evaluation of knee cartilage at 7 Tesla

Markus Matthias Schreiner[1,2], Stefan Zbyn[2], Benjamin Schmitt[3], Stephan Domayer[1], Reinhard Windhager[1], Siegfried Trattnig[2], and Vladimir Mlynarik[2]

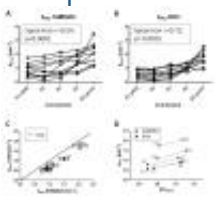
[1]Department of Orthopaedic Surgery, Medical University of Vienna, Vienna, Austria, [2]Department of Biomedical Imaging and Imag-Guided Therapy, High Field MR Centre, Medical University of Vienna, Vienna, Austria, [3]Siemens Healthcare Pty Ltd, Macquarie Park, Australia

Early onset osteoarthritis is associated with ultrastructural and compositional changes of cartilage, in particular with a loss of glycosaminoglycans (GAGs) and disorganization of the collagen matrix. Both changes remain elusive to morphological MRI. GagCEST is a promising tool for the evaluation of glycosaminoglycan content in articular cartilage. However, it is affected by many variables, thus rendering its application challenging. The implementation of a novel saturation scheme combined with optimized fixation seems to improve the robustness of the technique as indicated by increased

reproducibility. Our optimized protocol seems to be sensitive to regional differences in the GAG content.

365

Computer #3



Muscle functional oxidative capacity varies along the length of healthy tibialis anterior

Andreas Boss[1], Linda Heskamp[1], Mark Jacobus van Uden[1], Lauren Jean Bains[2,3], Vincent Breukels[1], and Arend Heerschap[1]

[1]Radiology and Nuclear Medicine, Radboud university medical center, Nijmegen, Netherlands, [2]Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, Netherlands, [3]Donders Centre for Cognitive Neuroimaging, Radboud University, Nijmegen, Netherlands

Traditional PCr recovery experiments are performed in a non-localized way, while skeletal muscle is not homogeneous. In this study we performed localized ^{31}P-MRS using a ladder-shaped ^{31}P-phased array receive coil optimized for the tibialis anterior and found a pronounced variation in the rate of PCr recovery after isometric exercise along the length of this muscle in healthy volunteers. In addition, we observed similar regional differences in the time-to-peak signal intensity of muscle functional MRI obtained after exercise in the same volunteers. The reasons for this strong functional gradient along the tibialis anterior remain, however, to be elucidated.

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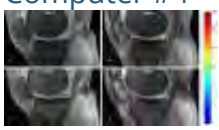
Computer #4



Assessment of meniscus with adiabatic $$$T_{1\rho}$$$ and $$$T_{2\rho}$$$ in asymptomatic subjects and patients with early osteoarthritis: Oulu knee osteoarthritis study

Abdul Wahed Kajabi[1,2,3], Victor Casula[2,3], Arttu Peuna[2,3,4], Simo Saarakkala[2,5], Eveliina Lammentausta[3,4], Ali Guermazi[6], and Miika T. Nieminen[2,3,4]

[1]Department of Biomedical Engineering, University of Oulu, Oulu, Finland, [2]Research Unit of Medical Imaging, Physics and Technology, University of Oulu and Oulu University Hospital, Oulu, Finland, [3]Medical Research Center, University of Oulu and Oulu University Hospital, Oulu, Finland, [4]Department of Diagnostic Radiology, Oulu University Hospital, Oulu, Finland, [5]Department of Medical Technology, Institute of Biomedicine, University of Oulu, Oulu, Finland, [6]Department of Radiology, Boston University School of Medicine, MA, MA, United States

Evaluation of meniscal degeneration in asymptomatic subjects and patients with early osteoarthritis (KL = 1,2) was performed using adiabatic $$$T_{1\rho}$$$ and $$$T_{2\rho}$$$ ($$$AdT_{1\rho}$$$

and $$$AdT_{2\rho}$$$, respectively) measurements in sagittal plane. Menisci of all subjects were also evaluated using semiquantitative MRI OA Knee Score (MOAKS). The results show that the length of $$$AdT_{1\rho}$$$ and $$$AdT_{2\rho}$$$ is directly related to clinical symptoms and the severity of meniscal degeneration. $$$AdT_{1\rho}$$$ and $$$AdT_{2\rho}$$$ may provide a non-invasive means of detecting and monitoring degenerative changes in the meniscus.

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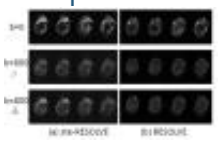
Computer #5



Diffusion Tensor Imaging of Human Achilles Tendon by Stimulated Echo RESOLVE (ste-RESOLVE)

Xiang He[1], Kenneth Wengler[2], Alex C Sacher[3], Marco Antonio Oriundo Verastegui[1], Alyssa Simeone[4], Mingqian Huang[1], Elaine Gould[1], and Mark Schweitzer[1]

[1]Department of Radiology, Stonybrook University School of Medicine, Stony Brook, NY, United States, [2]Department of Biomedical Engineering, Stonybrook University School of Medicine, Stony Brook, NY, United States, [3]SUNY Binghamton University, Binghamton, NY, United States, [4]New York Medical College, Valhalla, NY, United States

Diffusion tensor imaging (DTI) is sensitive to the injury-induced changes on the tendons microstructure. However, conventional spin-echo based DTI techniques often lead to poor tendon MR signal and difficulty on diffusion quantification, mainly due to the short tendon T2/T2* relaxation time constant. In this study, a novel method of combining stimulated-echo based DTI and readout-segmented multi-shot EPI (ste-RESOLVE) has been developed and evaluated. TE value can be as low as 20 ms for b value of 800 s/mm^2, enabling robust investigation of Achilles tendon microscopic tissue integrity on clinical MR scanners.

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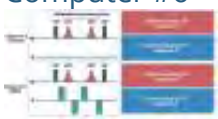
Computer #6



MR NeuroAngiography: Simultaneous Acquisition of Brachial Plexus MR Neurography and Subclavian MR Angiography Using phase-cycling Motion-Sensitized Driven-Equilibrium (pcMSDE)

Masami Yoneyama[1], Hajime Tanji[2], Tomoya Yamaki[2], Daisuke Takahashi[2], Makoto Obara[1], Tomoyuki Okuaki[3], and Marc Van Cauteren[3]

[1]Philips Electronics Japan, Tokyo, Japan, [2]Kita-Fukushima Medical Center, Fukushima, Japan, [3]Philips Healthcare Asia Pacific, Tokyo, Japan

Simultaneous acquisition of both MR angiography and MR neurography would be extremely helpful for diagnosing thoracic outlet syndrome. This study proposed a novel sequence, motion-sensitized driven-

equilibrium (MSDE) prepared phase-cycling gradient echo (pcMSDE), for achieving simultaneous depiction of both MR angiography and MR neurography. By using this sequence, MR neurography images were obtained by MSDE (with motion sensitized gradient (MSG)) scan. MR angiography images were obtained by subtraction between “b0” scan (without MSG) and MSDE (with MPG) images. Additionally, this sequence could simultaneously offer the anatomical proton-density images and “self-fusion” images (MR NeuroAngiography) by using MR neurography and MR angiography. This sequence has great potential to help the diagnosis for any type of TOS. Further clinical investigation is needed.

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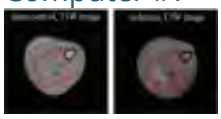
summa cum laude

Computer #7



Detection of Alterations in Intramyocellular Lipid and Creatine Diffusivities during Muscle Ischemia by Diffusion Weighted MRS

Anna M. WANG[1,2] and Ed X. Wu[1,2]

[1]Laboratory of Biomedical Imaging and Signal Processing, The University of Hong Kong, Hong Kong, China, People's Republic of, [2]Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, China, People's Republic of

We measured the apparent diffusion coefficients (ADCs), as well as the relative concentrations of both intramyocellular lipid (IMCL) and creatine in the rat muscle ischemia model. Comparing with the metabolite concentration changes, the IMCL and creatine ADCs had largely increased during muscle ischemia and the IMCL ADC increase was more drastic than creatine. The IMCL ADC, measured by diffusion weighted MRS, had shown the potential to probe the alterations in lipid droplet size and lipid metabolism in skeletal muscles.

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magna cum laude

Computer #8

Clinically Viable Diffusion-Weighted Imaging Near Metal using 2D-MSI PROPELLER DUO

Suryanarayanan Sivaram Kaushik[1], Ajeet Gaddipati[2], Brian Hargreaves[3], Dawei Gui[4], Robert Peters[2], Tugan Muftuler[5], and Kevin Koch[1]

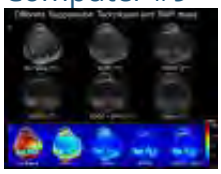
[1]Radiology, Medical College of Wisconsin, Milwaukee, WI, United States, [2]GE Healthcare, Waukesha, WI, United States, [3]Radiology, Stanford University, Stanford, CA, United States, [4]GE Healthcare, Waukesh, WI, United States, [5]Neurosurgery, Medical College of Wisconsin, Milwaukee, WI, United States

While FSE-based multi-spectral imaging (MSI) sequences help overcome the artifacts caused by metallic hardware, diffusion-weighted imaging remains a challenge. The non-CPMG artifacts caused by adding diffusion lobes to an FSE train can be mitigated by modulating the phase of the

refocusing pulses. Another solution involves splitting the contribution made by the spin and stimulated echoes (DUO acquisition). Here, we combine a 2D version of MSI with a PROPELLER-DUO sequence to obtain clinically-feasible, artifact-minimized, diffusion-weighted images in subjects that have cancerous lesions in close proximity to metallic hardware.

371

Computer #9



Evaluation of Different Fat Suppression Techniques for Clinical Knee MRI at 7.0 Tesla

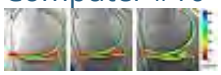
Michael Wyss[1], Andrei Manoliu[2], Georg Spinner[1], Magda Marcon[2], Roger Luechinger[1], Daniel Nanz[2], Klaas P. Pruessmann[1], and Gustav Andreisek[2]

[1]Institute for Biomedical Engineering, University of Zurich and ETH Zurich, Zurich, Switzerland, [2]Institute of Diagnostic and Interventional Radiology, University Hospital Zurich and University of Zurich, Zurich, Switzerland

Reliable fat suppression is challenging but mandatory for clinical 7.0T imaging. Purpose of this study was to evaluate different fat suppression techniques for clinical 7.0T knee MRI. Eight volunteers were imaged at 7.0T (Achieva, Philips) using a dedicated 28-channel TX-knee coil (QED) and axial PDw-TSE sequences without fat suppression, with SPIR, with SPAIR, with SSGR and with the combination of SSGR+SPIR.

372

Computer #10



3-D cones UTE-T2* maps show early cartilage degeneration 2 years after ACL reconstruction

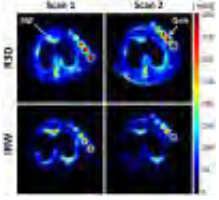
Ashley Anne Williams[1], Matthew R Titchenal[1], and Constance R Chu[1]

[1]Orthopaedic Surgery, Stanford University, Stanford, CA, United States

3-D cones UTE-T2* maps were examined in 22 subjects with reconstructed anterior cruciate ligaments (ACLR) and 16 uninjured controls for evidence of alterations to the subsurface cartilage matrix suggestive of cartilage at risk for early OA 2 years after surgery. Elevated UTE-T2* values in regions of deep tibiofemoral cartilage and in side-to-side UTE-T2* differences were detected. UTE-T2* values correlated to standard T2 values in tibial and posterolateral femoral regions. Together, these findings suggest that UTE-T2* mapping detects “pre-osteoarthritic” subsurface cartilage matrix changes that may occur following ACLR and thus can help to identify subjects at risk of developing OA.

373

Computer #11



Longitudinal sodium MRI of cartilage in patients with knee osteoarthritis: Baseline vs. 16 months follow-up

Guillaume Madelin[1], Ding Xia[1], Gregory Chang[1], Svetlana Krasnokutsky[2], Steven B Abramson[2], and Ravinder R Regatte[1]

[1]Department of Radiology, New York University Langone Medical Center, New York, NY, United States, [2]Department of Rheumatology, New York University Langone Medical Center, New York, NY, United States

In this longitudinal study, we measured the sodium concentration in knee cartilage in 12 patients with osteoarthritis (OA) with quantitative ^{23}Na MRI at 7 T. Sodium measurements were performed at baseline and 16 months follow-up (on average), with and without fluid suppression by inversion recovery (IR). We show that only fluid-suppressed measurements show a significant decrease of mean [Na^+] in different regions of cartilage over 16 months follow-up in OA patients. Quantitative ^{23}Na IR-MRI could therefore be a useful imaging biomarker to monitor cartilage degradation over time, and help assess the efficiency of potential disease modifying OA drugs.

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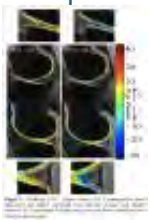
Computer #12



PCA-T1ρ Voxel-Based Relaxometry of the Articular Cartilage: a Comparison of Biochemical Pattern Changes in Knees with Osteoarthritis and ACL Injury

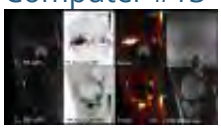
Valentina Pedoia[1], Colin Russell[1], Allison Randolph V[1], Keiko Amano[1], Xiaojuan Li[1], and Sharmila Majumdar[1]

[1]University of California, San Francisco, San Francisco, CA, United States

MR quantitative T1ρ mapping has been extensively used to probe articular biochemical changes. While several studies are still limited to analyzing average T1ρ values, there is growing interest in the analysis of local patterns of T1ρ maps. A novel algorithm for locally studying knee relaxation times using Voxel-Based Relaxometry (VBR) was recently proposed. In this study we propose to couple VBR and Principal Component Analysis in order to analyze local pattern changes in OA and ACL patients. Specific features, behind the expected average elevation of T1ρ values, are observed able to distinguish between OA, ACL and Controls subjects.

375

Computer #13



Correlation of Bone Pathology on MRI with 18F-fluoride PET Uptake in Subchondral Bone

Feliks Kogan[1], Audrey Fan[1], Emily McWalter[1], Edwin Oei[2], Andrew Quon[1], and Garry Gold[1]

[1]*Radiology, Stanford University, Stanford, CA, United States,* [2]*Radiology, Erasmus Medical Center, Rotterdam, Netherlands*

Osteoarthritis (OA) is a debilitating disease that affects 27 million Americans, causing pain, stiffness and loss of mobility. Simultaneous PET-MR imaging provides an opportunity to combine metabolic information regarding bone remodeling with high resolution images on MR. This work demonstrates that simultaneous 18F-fluoride PET/MR may provide additional metabolic information regarding bone pathology seen on conventional MR. This will allow for a better understanding of the role of bone degeneration in OA disease processes. Additionally, 18F-fluoride PET/MR may detect knee abnormalities unseen on MRI alone and is a promising tool for detection of early metabolic changes in OA.

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summa cum laude

Computer #14

Quantitative assessment of muscle metabolism and dynamics of oxygen consumption with vPIVOT

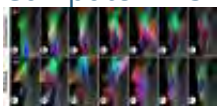
Erin Kristine Englund[1], Zachary Bart Rodgers[1], Michael C Langham[2], Emile R Mohler[3], Thomas F Floyd[4], and Felix W Wehrli[2]

[1]*Department of Bioengineering, University of Pennsylvania, Philadelphia, PA, United States,* [2]*Department of Radiology, University of Pennsylvania, Philadelphia, PA, United States,* [3]*Department of Medicine, University of Pennsylvania, Philadelphia, PA, United States,* [4]*Department of Anesthesiology, Stony Brook University, Stony Brook, NY, United States*

A method to simultaneously measure blood flow, perfusion, venous oxygen saturation, and muscle T_2* using a 3-slice interleaved PASL, multi-echo GRE sequence is presented. The method, termed Velocity and Perfusion, Intravascular Venous Oxygen saturation and T_2* (*v*PIVOT) was assessed in five subjects during a series of ischemia-reperfusion paradigms. Results indicate that *v*PIVOT faithfully measures all four parameters at 4-second temporal resolution. Dynamic measurement of these parameters was completed following a bout of dynamic plantar flexion contractions. *v*PIVOT allows for quantification of muscle oxygen consumption and evaluation of macro/microvascular flow dynamics, and may be useful for the development of biophysical models.

377

Computer #15



Synchronous Magnetic Resonance Imaging of Muscle Contraction induced by Electrical Stimulation

Xeni Deligianni[1,2], Michele Pansini[3], Meritxell Garcia[4], Anna Hirschmann[4], Arno Schmidt-Trucksäss[5], Oliver Bieri[1], and Francesco

Santini[1,2]

[1]Department of Radiology, Division of Radiological Physics, University of Basel Hospital, Basel, Switzerland, [2]Department of Biomedical Engineering, University of Basel, Basel, Switzerland, [3]Radiology, Kantonsspital Basel-Landschaft, Brudeholz, Switzerland, [4]Department of Radiology, University of Basel Hospital, Basel, Switzerland, [5]Department of Sports Medicine, University of Basel, Basel, Switzerland

Magnetic Resonance Imaging can be used to provide structural and functional muscle information either from oxygenation or contraction imaging. Contraction imaging can be based on real-time imaging or on voluntary movements. However, synchronization of the acquisition is challenging. Here, we present a new method for accurate, quantitative measurement of muscle contraction using a commercially available electrical muscle stimulator. This allows the direct assessment of the reaction time of muscle fibers, contraction speed, displacement, and strain providing complementary information to electromyography. MR images of the vastus lateralis muscle of five healthy volunteers were acquired at 3 Tesla field strength during electro-stimulation.

Electronic Power Pitch Poster

Top CV's

Power Pitch Theatre, Exhibition Hall

Tuesday, May 10, 2016: 17:00 - 18:00

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summa cum laude

Computer #1

Hybrid Interleaved Multi-contrast Imaging (HIMI) for Simultaneous Brain and Carotid Vessel Wall Imaging

Shuo Chen[1], Zechen Zhou[1], Rui Li[1], Xihai Zhao[1], Huijun Chen[1], Changwu Zhou[1,2], Bida Zhang[3], and Chun Yuan[1,4]

[1]Center for Biomedical Imaging Research, Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, China, People's Republic of, [2]Department of Radiology, Yangzhou First People's Hospital, Yangzhou, China, People's Republic of, [3]Healthcare Department, Philips Research China, Shanghai, China, People's Republic of, [4]Vascular Imaging Laboratory, Department of Radiology, University of Washington, Seattle, WA, United States

The aim of this study was to develop a Hybrid Interleaved Multicontrast Imaging (HIMI) sequence for simultaneous brain and carotid vessel wall imaging. The proposed HIMI sequence takes advantage of the long delay

time in conventional 3D FLAIR sequence to acquire multi-contrast carotid vessel wall images. Four healthy volunteers were recruited in this study. The results indicate that HIMI can generate a comparable FLAIR image with conventional FLAIR sequence and three more different contrast weighted (T1w, T2w, gray blood) carotid vessel wall images with the same scan time as a single conventional 3D FLAIR sequence.

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Computer #2

How Accurately and Precisely Are we Measuring Coronary Endothelial Function with Radial MRI?

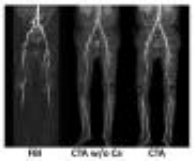
Jerome Yerly[1,2], Danilo Gubian[3], Jean-Francois Knebel[2,4], Thomas Robin[5], Giulia Ginami[1], and Matthias Stuber[1,2]

[1]CardioVascular Magnetic Resonance (CVMR) research center, Department of Radiology, University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [2]Center for Biomedical Imaging (CIBM), Lausanne, Switzerland, [3]University Hospital (CHUV), Lausanne, Switzerland, [4]Laboratory for Investigative Neurophysiology (The LINE), Departments of Radiology and Clinical Neurosciences, University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [5]Transport and Mobility Laboratory (TRANSP-OR), Swiss Federal Institute of Technology of Lausanne (EPFL), Lausanne, Switzerland

MRI with isometric handgrip exercise was recently proposed to non-invasively assess coronary endothelial function. However, the sensitivity of this technique has not yet been fully investigated. To address this need, we have designed a phantom that simulates a physiological range of coronary cross-sectional areas. Radial cine MR images with different spatial resolutions were acquired under moving conditions. Cross-sectional areas were automatically measured and compared to the known nominal values. Statistical analysis suggests that MRI is capable of distinguishing area changes in the order of 0.2-0.3mm^2, which correspond to a percentage coronary area change of 3-4% for a 3mm baseline diameter.

455

Computer #3



Evaluation of lower extremity arteries with severe wall calcification in peripheral arterial disease (PAD); comparison of Fresh blood imaging (FBI) with CT angiography with using a commercially available calcification removable tool

Katsumi NAKAMURA[1,2], Akiyoshi Yamamoto[1], Hiroki Matoba[1], Yuji Shintani[1], Daiji Uchiyama[1], Seigo Yoshida[1], and Mitsue Miyazaki[3]

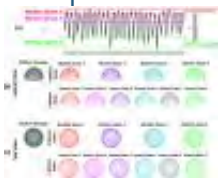
[1]Radiology, Tobata Kyoritsu Hospital, Kitakyushu, Japan, [2]Nexus Image Lab, Kitakyushu, Japan, [3]Toshiba Medical Research Institute USA, Inc., Vernon

Hills, IL, United States

We compared the diagnostic ability of FBI with that of CTA with using a calcification removal tool in the evaluation of the lower-extremity arteries with wall calcifications. In all segments, FBI provided diagnostic images regardless of the degree of wall calcification. On the contrary, CTA-MIP and CTA-MIP w/o Ca were strongly affected by calcification. The diagnostic ability of FBI was significantly superior to that of CTA-MIP and CTA-MIP w/o Ca in the moderate to severe calcified arterial segments. In conclusion, FBI is an accurate and noninvasive alternative to CTA for the assessment of aortoiliac and lower extremity arteries in patients with PAD.

456

Computer #4



A Novel Concept for Motion Suppression Applied to Free-Breathing 3D Whole-Heart Coronary MRA: Respiratory Motion-Resolved Reconstruction

Davide Piccini[1,2], Li Feng[3], Gabriele Bonanno[2], Simone Coppo[2], Jérôme Yerly[2,4], Ruth P. Lim[5], Juerg Schwitter[6], Daniel K. Sodickson[3], Ricardo Otazo[3], and Matthias Stuber[2,4]

[1]Advanced Clinical Imaging Technology, Siemens Healthcare, Lausanne, Switzerland, [2]Department of Radiology, University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [3]Center for Advanced Imaging Innovation and Research, New York University School of Medicine, New York City, NY, United States, [4]Center for Biomedical Imaging (CIBM), Lausanne, Switzerland, [5]Department of Radiology, Austin Health and The University of Melbourne, Melbourne, Australia, [6]Division of Cardiology and Cardiac MR Center, University Hospital of Lausanne (CHUV), Lausanne, Switzerland

We hypothesize that sparse reconstruction algorithms can be exploited to reconstruct respiratory motion-resolved 3D MRA images of the heart without the need for breath-holding, navigators, or self-navigated respiratory motion correction. Phantom, volunteer, and patient acquisitions were performed and image quality was compared to 1D self-navigation for vessel sharpness, length and diagnostic quality. Respiratory motion-resolved reconstruction effectively suppresses respiratory motion artifacts with superior results with respect to self-navigation. Instead of discarding data or enforcing motion models for motion correction, motion-resolved reconstruction makes constructive use of all respiratory phases to improve image quality, and may lead coronary MRA closer to clinical practice.

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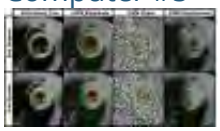
Computer #5



Preliminary Results: Cardiac Cine "Watermark" MRI provides both Anatomical Function via Magnitude Cine and 2D Myocardial Strain via Spatially Modulated Phase

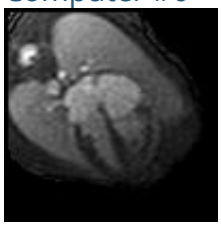
Ronald J Beyers[1], Davis M Vigneault[2], Dean Schwartz[3], Nouha Salibi[1,4], David A Bluemke[2], and Thomas Denney[1]

[1]MRI Research Center, Auburn University, Auburn University, AL, United States, [2]Radiology and Imaging Sciences, National Institutes of Health, Bethesda, MD, United States, [3]Anatomy, Physiology and Pharmacology, Auburn University, Auburn University, AL, United States, [4]MR R&D, Siemens Healthcare, Malvern, PA, United States

We developed a Cine Watermark (CWM) cine sequence that produces normal cine magnitude images, plus a grid pattern of tags added only in the phase for quantitative cine strain, while requiring no extra operator effort. Using spatial cosine modulation combined with *k*-space sum/differencing produced separate normal magnitude cine and unique phase-only grid-tags for strain calculation. *In vivo* rat and human scans demonstrated good magnitude cine and phase-only quantified displacement. Calculated by Farneback optical flow algorithm, the peak principle strain, averaged around the LV for rat = -16.5±2.4 % and human = -17.8±6.2 % (mean±StdDev).

458

Computer #6



Fetal cardiac cine imaging from motion-corrected super-resolution reconstruction of highly-accelerated real-time MRI

Joshua FP van Amerom[1], Maria Kuklisova Murgasova[1], Anthony N Price[1], Shaihan J Malik[1], Paul Aljabar[2], David A Lloyd[1], Kuberan Pushparajah[1,3], Maelene Lohezic[1], Matthew J Fox[2], Joanna M Allsop[2], Mary A Rutherford[1,2], Reza Razavi[1,3], and Joseph V Hajnal[1]

[1]Division of Imaging Sciences & Biomedical Engineering, King's College London, London, United Kingdom, [2]Centre for the Developing Brain, King's College London, London, United Kingdom, [3]Department of Congenital Heart Disease, Evelina London Children's Hospital, London, United Kingdom

Motion is a key limiting factor in fetal cardiac MRI as the small, rapidly beating heart is subject to various periodic and spontaneous motions. Highly accelerated real-time imaging with high temporal resolution was used to obtain serial 'snapshots' of the fetal heart and surrounding anatomy that could be motion-corrected and reassembled, combining several cardiac cycles into a single heartbeat. A super-resolution reconstruction was applied to increase the visibility of dynamic anatomical features in the densely sampled data. The resulting cine images provide a clear depiction of dynamic cardiac features.

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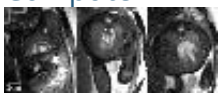
summa cum laude

Computer #7



A Golden-Angle Acquisition Coupled with k-t Sparse SENSE Reconstruction for Fetal Self Retro-Gated Cine Cardiac MRI: an In Vivo Feasibility Study

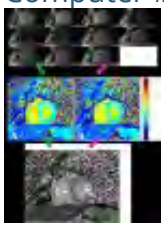
Jerome Chaptinel[1], Yvan Mivelaz[2], Jerome Yerly[1,3], Leonor Alamo[1], Milan Prsa[2], Yvan Vial[4], François Gudinchet[1], Gregoire Berchier[1], Jean-Baptiste Ledoux[1], and Matthias Stuber[1,3]

[1]Department of Radiology, University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [2]Department of Pediatrics, University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland, [3]Center for Biomedical Imaging (CIBM), Lausanne, Switzerland, [4]Department of Gynecology-Obstetrics, University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland

Fetal cardiac cine MRI is challenging due to the lack of an ECG trigger signal, fetal motion, and the need for both a high spatial and temporal resolution. To overcome these hurdles, we have developed and tested a new acquisition-reconstruction paradigm: data collection was performed with a continuous radial golden-angle acquisition and cine images were reconstructed with a k-t sparse SENSE algorithm. A cardiac gating signal was extracted from the images themselves and supported self retro-gated reconstructions in which motion-corrupted data were excluded. Fetal self retro-gated cardiac cine images with high temporal and spatial resolution were successfully obtained in pregnant patients.

460

Computer #8



Accurate T1 mapping in patients with Pulmonary Hypertension and age matched volunteers using synthetic image based registration

Laura Claire Saunders[1], Neil J Stewart[1], Charlotte Hammerton[1], David Capener[1], Valentina O Puntmann[2], David G Kiely[3], Martin J Graves[4], Andy Swift[1], and Jim M Wild[1]

[1]Academic Unit of Radiology, The University of Sheffield, Sheffield, United Kingdom, [2]Department of Cardiovascular Imaging, Kings College London, London, United Kingdom, [3]The University of Sheffield, Sheffield, United Kingdom, [4]University of Cambridge School of Clinical Medicine, University of Cambridge, Cambridge, United Kingdom

Patients with suspected pulmonary hypertension (n=94) and healthy volunteers (n=26) underwent T1 mapping of the right ventricle with a Modified Look Locker inversion recovery (MOLLI) sequence at 1.5T. MOLLI images were registered using pairwise registration to synthetic images produced using a simplified inversion recovery model to correct

cardiac or respiratory motion. 89% of patients and 100% of healthy volunteers were successfully registered, with mean T1s of 1.00±0.10s and 0.97±0.06s (septal), 1.05±0.11s and 0.97±0.06s (right ventricular insertion point) and 1.02±0.11s and 1.04±0.13s (right ventricular free wall) respectively.

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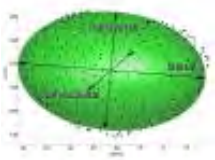
Computer #9



Towards a quantitative MRI-based measure of disease burden in patients with atrial fibrillation

Maurce Pradella[1], Sven Knecht[2], Michael Kühne[2], Aline Mühl[2], Tobias Reichlin[2], Gian Voellmin[2], David Conen[2], Jens Bremerich[1], Stefan Osswald[2], Christian Sticherling[2], and Bram Stieltjes[1]

[1]Department of Radiology, University of Basel Hospital, Basel, Switzerland, [2]Department of Cardiology, University of Basel Hospital, Basel, Switzerland

Atrial fibrillation (AF) is a common disease and associated with myocardial infarction, stroke and dementia. We propose a new approach based on the sphericity of fitted ellipsoids in left atriums of patients with AF. Our results show a strong correlation between sphericity of these ellipsoids and burden of disease and may serve as an objective surrogate parameter in the future.

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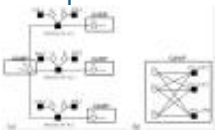
summa cum laude

Computer #10



Joint Processing of Highly Accelerated Multi-Directional PC-MRI Data Using ReVEAL

Adam Rich[1], Lee C. Potter[1], Ning Jin[2], Juliana Serafim da Silveira[3], Orlando P. Simonetti[3], and Rizwan Ahmad[3]

[1]Electrical and Computer Engineering, The Ohio State University, Columbus, OH, United States, [2]Siemens Medical Solutions, The Ohio State University, Columbus, OH, United States, [3]Dorthy M. Davis Heart and Lung Research Institute, The Ohio State University, Columbus, OH, United States

Phase-contrast magnetic resonance is a powerful tool for study of cardiac flow, but clinical application is limited to planar imaging of one velocity component. This abstract demonstrates three-directional flow imaging using a single breath-hold acquisition. Imaging is accomplished by jointly processing all encodings and frames; Bayesian reconstruction leverages image structure via both wavelet compression and statistical relations among velocity encoded images. Digital phantom results show accurate estimation of stroke volume and peak velocity, with significant reductions in bias and variance, as well as over 30% increase in Pearson correlation coefficient, compared to L1-SENSE. In vivo results demonstrate repeatable flow estimation.

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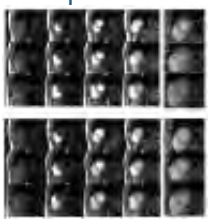
Computer #11



A new hybrid approach for quantitative multi-slice myocardial DCE perfusion

Edward DiBella[1], Devavrat Likhite[1], Ganesh Adluru[1], Chris Welsh[1], and Brent Wilson[1]

[1]*University of Utah, Salt Lake City, UT, United States*

Here we propose a unique perfusion acquisition that uses one saturation pulse per heartbeat. This combined with simultaneous multi-slice (SMS) methods allows for acquiring the same set of slices continuously through the cardiac cycle. This has a number of advantages including the ability to retrospectively reconstruct an accurate arterial input function (AIF) and optimized systolic/diastolic frames, or other portions of the cardiac cycle. The approach proposed here acquires both k-space rays that reflect the influence of the saturation pulse and other rays that reflect the steady-state GRE contrast, and thus is termed the "hybrid" method. Preliminary quantitative results including comparisons to more standard methods in two subjects show the promise of this SMS approach.

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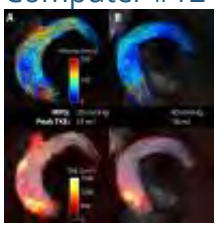
Computer #12



Added Value of Phase-Contrast MRI based Turbulent Kinetic Energy Quantification for the Assessment of Aortic Stenosis Severity

Alexander Gotschy[1,2], Christian Binter[1], Simon H Sündermann[3], Michelle Frank[2], Felix C Tanner[2], Robert Manka[2], and Sebastian Kozerke[1]

[1]*Institute for Biomedical Engineering, University and ETH Zurich, Zurich, Switzerland,* [2]*Department of Cardiology, University Hospital Zurich, Zurich, Switzerland,* [3]*Division of Cardiovascular Surgery, University Hospital Zurich, Zurich, Switzerland*

Aortic stenosis (AS) is the most prevalent valvular heart disease. Risk stratification and the decision for valve replacement are mostly based on echocardiography and symptomaticity. This work investigates the additional value of quantifying Turbulent Kinetic Energy (TKE) for the assessment of AS severity beyond echocardiographic measures. TKE was confirmed to be significantly elevated in patients with AS compared to controls. While TKE showed only weak correlation with the echocardiographic Mean Pressure Gradient, TKE allowed to discriminate the impact of bicuspid aortic valves and aortic dilatation on energy loss in AS patients; effects which are not assessable by standard echocardiographic measures.

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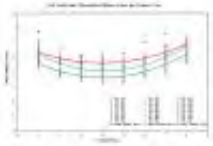
summa cum laude

Computer #13



In-Vivo Quantification of Myocardial Stiffness in Heart Failure with Preserved Ejection Fraction Using Magnetic Resonance Elastography: Assessment in a Porcine Model

Ria Mazumder[1,2], Samuel Schroeder[2,3], Xiaokui Mo[4], Bradley D Clymer[5], Richard D White[2,6], and Arunark Kolipaka[2,6]

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Left ventricular (LV) myocardial stiffness (MS) is elevated in heart failure with preserved ejection fraction (HFpEF) and hence has the potential to be used as a diagnostic tool. Current clinical techniques to estimate LV MS are invasive in nature and provides global stiffness measurements. Therefore, in this study, we implement cardiac magnetic resonance to investigate temporal alteration in LV MS over a two month period of disease progression in a porcine model induced with HFpEF. The alteration in LV MS is compared against change in mean LV pressure, LV thickness, circumferential strain and MRI relaxometry parameters.

466

Computer #14

Free breathing self-gated PC-MRI with Pseudo Random sampled kt-Sparse-Sense

Volker Herold[1], Patrick Winter[1], Philipp Mörchel[2], Fabian Gutjahr[1], and Peter Michael Jakob[1]

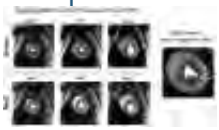
[1]Department of Experimental Physics 5, University of Wuerzburg, Wuerzburg, Germany, [2]Research Center for Magnetic Resonance Bavaria e.V., Wuerzburg, Germany

Phase-Contrast (PC) cine MRI is an established method for the assessment of blood flow and tissue motion patterns in cardiovascular MRI. In this paper we presented a highly accelerated self-gated PC-MRI-sequence based on free breathing random sampled data acquisition. Data acquired during respiratory motion as well as any other source of undesirable motion can be excluded from the post-processing. Moreover ECG-signal acquisition which is prone to distortions especially at higher field strength can be avoided. The high flexibility of data

processing would also allow the correction of unstable heart rate during the measurement.

467

Computer #15



End-systolic Myocardial Perfusion MRI Using a Hybrid 2D/3D Steady-State Acquisition Scheme: Towards Reliable Detection of Subendocardial Ischemia in Coronary Microvascular Dysfunction

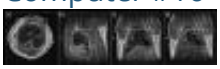
Behzad Sharif[1], Rohan Dharmakumar[1], Daniel Berman[2], Debiao Li[1], and Noel Bairey Merz[2]

[1]Biomedical Imaging Research Institute, Dept of Biomedical Sciences, Cedars-Sinai Medical Center, Los Angeles, CA, United States, [2]Heart Institute, Cedars-Sinai Medical Center, Los Angeles, CA, United States

A significant portion of patients with ischemic heart disease suffer from coronary microvascular dysfunction. Despite intense interest and several recent advancements, reliable diagnosis of coronary microvascular dysfunction on the basis of stress first-pass perfusion (FPP) cardiac MRI is an ongoing challenge. We hypothesized that high-resolution systolic FPP imaging can detect diffuse vasodilator-induced subendocardial defects and transmural perfusion gradients consistent with microvascular dysfunction in a swine model of diet-induced diabetes with no obstructive disease. To this end, we developed, optimized, and tested a new high-resolution FPP method with hybrid 2D/3D excitation capable of imaging all myocardial slices at the end-systolic phase.

468

Computer #16



Dual-modal cardiovascular in vivo assessment in rats using a highly integrated MPI-MRI hybrid system – initial result

Jochen Franke[1,2], Nicoleta Baxan[3], Ulrich Heinen[1], Alexander Weber[1,4], Heinrich Lehr[1], Martin Ilg[1], Wolfgang Ruhm[1], Michael Heidenreich[1], and Volkmar Schulz[2]

[1]Preclinical Imaging Devision, Bruker BioSpin MRI GmbH, Ettlingen, Germany, [2]Physics of Molecular Imaging Systems, University RWTH Aachen, Aachen, Germany, [3]Biomedical Imaging Centre, Imperial College London, London, United Kingdom, [4]Institute of Medical Engineering, University of Lübeck, Lübeck, Germany

Using a highly integrated Magnetic Particle Imaging – Magnetic Resonance Imaging hybrid system, a dual-modal cardiovascular in vivo assessment in rodents under the usage of a non-toxic Resovist dosage was performed successfully. The subject was imaged sequentially in both modality modes, whereas neither subject repositioning nor

anesthesia interruption were required. Complementary datasets were acquired within a single seamless multi-modal study using ParaVison6 (Bruker BioSpin, Germany) allowing direct MRI-based MPI Field-of-View planning. After reconstructing time-resolved (TR=21.45 ms) 3D MPI images of the bolus-passage they were successfully fused with a high-resolution static 3D MRI dataset and visualized as combined 4D/3D hybrid dataset.

Electronic Power Pitch Poster

MR Engineering, Safety & Interventional

Power Pitch Theatre, Exhibition Hall

Wednesday, May 11, 2016: 11:00 - 12:00

541

Computer #1

Porcine Imaging in a 10.5T Whole-Body Human MRI

Lance DelaBarre[1], Russell L. Lagore[1], Yigitcan Eryaman[1], Gregor Adriany[1], and J. Thomas Vaughan[1]

[1]*Center for Magnetic Resonance Research - University of Minnesota, Minneapolis, MN, United States*

Recently, our 10.5T whole-body MRI magnet achieved field strength and its installation was completed. While waiting for IRB and IDE approval, a human-sized porcine model serves as a surrogate for later human studies, thus allowing development of techniques in vivo. Using an 8-channel head coil on a porcine head, the first in vivo images from the 10.5T whole-body MRI were acquired.

542

magna cum laude

Computer #2

The first demonstration of simultaneous transmit and receive MRI in vivo

Sung-Min Sohn[1], J. Thomas Vaughan[1], Michael Garwood[1], and Djaudat Idiyatullin[1]

[1]*Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, United States*

This is the first demonstration of in vivo human MR imaging with simultaneous transmit and receive using continuous mode SWIFT at 4T. Due to a large RF power difference between Tx and Rx working at the same frequency, the difficulties to obtain the high and stable Tx/Rx isolation, and the sensitivity of the Tx/Rx isolation to the loading conditions, in vivo images using the simultaneous RF pulse transmission

and signal acquisition have not been reported. This work proposed the simultaneous Tx/Rx system with highly minimized effects from variation of coil loading, which allowed us to acquire the first in vivo images with continuous SWIFT at 4T.

543

summa cum laude

Computer #3

Anatomically adaptive local coils for MR Imaging - Evaluation of stretchable antennas at 1.5T

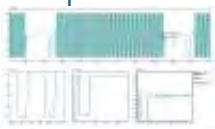
Bernhard Gruber[1] and Stephan Zink[2]

[1]Medical Engineering - School of Applied Health and Social Sciences, University of Applied Sciences Upper Austria, Linz, Austria, [2]R&D HW LC, Siemens Healthcare GmbH, Erlangen, Germany

This abstract is a first investigation on antenna materials and designs for anatomically adaptive local coils for MR Imaging. To overcome the SNR losses by poorly loaded and non-fitting RF coils, we proposed a stretchable antenna design. Each loop has the ability to reversible stretch up to 100% of its original size, to be anatomically adaptive to different shapes and sizes in three dimensions. Through bench measurements and MR Imaging at 1.5T we investigated different stretchable antenna materials, that fit the defined requirements. The results of stretchable loops showed an in average SNR loss of under 10% in comparison to standard loops, but we suppose that the improved filling factor will lead to much higher SNR of the adaptive loops. Further research may consider different improvements.

544

Computer #4



Gradient response harvesting for continuous system characterization during MR sequences

Bertram J. Wilm[1], Benjamin E. Dietrich[1], Jonas Reber[1], S. Johanna Vannesjo[1], and Klaas P. Pruessmann[1]

[1]Institute for Biomedical Engineering, University of Zurich and ETH Zurich, Zurich, Switzerland

Gradient impulse response functions were recently proposed to characterize MR gradient systems with high accuracy. However, changes of the impulse response, e.g. due to thermal drifts, can limit its accuracy and hence applicability. To overcome this problem, we present a novel method where the gradient response is continuously characterized during MR sequences from repeatedly performed field probe measurements. The benefit of this method is demonstrated by obtaining the continuous gradient output of MR sequences and first imaging results are presented.

545

Computer #5

A Wireless MRI system using mm-Wave Transmission

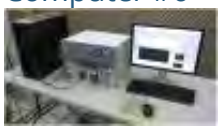
Kamal Aggarwal[1], Kiran Raj Joshi[1], Yashar Rajavi[1,2], Mazhareddin Taghivand[1,2], Ada S. Y. Poon[1], John M. Pauly[1], and Greig Scott[1]

[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Qualcomm Atheros, San Jose, CA, United States

High path loss and availability of wide bandwidth make mm-waves an ideal candidate for short range, high data rate transmission for wireless MRI applications. The proposed system uses a custom designed integrated chip (IC) radio that uses mm-waves (60 GHz) as the radio frequency carrier. We report link tests up-to 500 Mb/s for distances up-to 50cm in the MRI bore. The addition of time division multiplexing (TDM) circuitry allows multiple wireless links to be created simultaneously with minimal inter-channel interference. This leads to a highly scalable, low-power solution for wireless MRI.

546

Computer #6



A Broadband Spectrometer for Simultaneous Multinuclear Magnetic Resonance Imaging and Spectroscopy

Stephen Ogier[1], John C Bosshard[1], and Steven M Wright[1]

[1]Electrical and Computer Engineering, Texas A&M University, College Station, TX, United States

In this abstract we report progress and results towards developing a fully broadband spectrometer for multi-coil multi-nuclear MRI/MRS. This may be of interest for hyperpolarized MRI and MRS studies due to the very limited lifetime of the magnetization, as well as for quantitative MRI. A prototype spectrometer has been developed and tested by simultaneous 1H/2H imaging on a 1.0T magnet and simultaneous 1H/23Na/2H spectroscopy on a 4.7T magnet. The system is capable of acquiring data from four channel array coils for these and other nuclei.

547

Computer #7

MR Probe Design with On-Coil Digital Receiver

David Otto Brunner[1], Benjamin Sporrer[2], Christian Vogt[3], Jonas Reber[1], Josip Marjanovic[1], Luca Bettini[2], Lianbo Wu[2], Thomas Burger[2], Gerhard Troester[3], Qiuting Huang[2], and Klaas P Pruessmann[1]

[1]Institute for Biomedical Engineering, University and ETH Zurich, Zurich, Switzerland, [2]Integrated Systems Laboratory, ETH Zurich, Zurich, Switzerland, [3]Electronics Laboratory and Wearable Computing Group, ETH

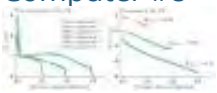
Zurich, Zurich, Switzerland

RF receivers placed directly on coil in conjunction with fibre-optical data transmission can provide various advantages for the design of array coils in terms of avoidance of dangerous sheath currents, common-mode noise and unwanted coil to coil interactions, as well as reduction of cable weight and routing problems. This helps to further increase channel counts but also usability or even wear-ability of RF receive arrays. Here we present first results from coil designs employing fully integrated (in 130 nm CMOS technology) digital receivers with a form factor and power requirements to be placed directly on the coil footpoint.

548

summa cum laude

Computer #8



Ultra-fast MRI based transfer function determination for the assessment of implant safety.

Janot Tokaya[1], A.J.E. Raaijmakers[1], J.F. Bakker[2], P.R. Luijten[1], and C.A.T. van den Berg[1]

[1]Imaging Division, UMC Utrecht, Utrecht, Netherlands, [2]Medtronic, Eindhoven, Netherlands

Tissue heating induced by sharply peaked scattered electric fields at the tip of elongated implants is a severe safety hazard refraining patients with active implants from undergoing MRI examinations. Transfer functions (TFs) are widely used in modern safety standards to assess implant safety. Currently, dedicated setups are required to determine TFs in challenging and time consuming experiments. We introduce a new experimental technique based on the principle of reciprocity and exploiting the ability to map induced currents with MRI. The proposed method can accurately determine TFs with high spatial resolution in a single, quick and relatively simple measurement. It furthermore has the potential to be applied in heterogeneous media allowing safety assessment in more realistic scenarios where the conventional methods become inapplicable.

549

summa cum laude

Computer #9

Improving Peak Local SAR Prediction in Parallel Transmit Using In-situ S-matrix Measurements

Matthew Restivo[1], Alexander Raaijmakers[1], Cornelis A.T. van den Berg[1], Pedro Crespo-Valero[2], Peter Luijten[1], and Hans Hoogduin[1]

[1]Center for Imaging Sciences, University Medical Center Utrecht, Utrecht, Netherlands, [2]Zurich Med Tech, Zurich, Switzerland

We propose a technique where we measure the real S-matrix of the array/subject setup in-situ and then closely match it in simulation using circuit co-simulation with a modified cost function. We show that by accurately simulating coupling, the B1+ and thus the SAR can be better predicted using FDTD simulations. Better pTx SAR predictions will ensure RF safety while reducing the overly conservative pTx SAR predictions that are used currently.

550

Computer #10

Percentage of change in the calculated SAR values in human head during 3T MRI of patients with deep brain stimulation implants: A computational study of realistic vs. simplified lead trajectories

Laleh Golestanirad[1], Maria Ida Iacono[2], Leonardo M Angelone[2], and Giorgio Bonmassar[1]

[1]Radiology, Massachusetts General Hospital, Charlestown, MA, United States, [2]Division of Biomedical Physics, Office of Science and Engineering Laboratories, Center for Devices and Radiological Health, US Food and Drug Administration, Silver Spring, MD, United States

Each year approximately 300,000 patients with medical implants including deep brain stimulation (DBS) devices are denied magnetic resonance imaging (MRI) examination due to safety concerns. One of the major contraindications of MRI for DBS patient population is due to the potential for permanent injuries from excessive tissue heating. One open question when evaluating RF-induced heating with DBS is the effect of the lead path and the need for patient-specific information. Using finite element method, we report results of calculated SAR maps for patient-specific lead paths based on CT images, and compare them to simplified path trajectories.

551

magna cum laude

Computer #11

Accurate MR Thermometry by Hyperpolarized 129Xe

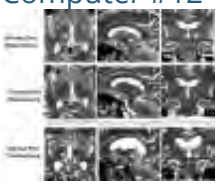
Le Zhang[1,2], Alex Burant[2,3], Andrew McCallister[2,3], Karl Koshlap[4], Simone Degan[5], Michael Antonacci[2,3], and Rosa Tamara Branca[2,3]

[1]Department of Applied Physical Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [2]Biomedical Research Imaging Center, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [3]Department of Physics and Astronomy, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [4]Eshelman School of Pharmacy, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [5]Center for Molecular and Biomolecular Imaging, Duke University, Durham, NC, United States

A new thermometry method based on the temperature dependence of lipid-dissolved ^{129}Xe was proposed, while its accuracy was assessed by direct comparison with Proton Resonance Frequency (PRF) based MR thermometry methods. The temperature dependences of chemical shifts of lipid-dissolved ^{129}Xe, water and methylene spins were first measured *in vitro* with high accuracy on various fat-rich tissues. The results were then used to obtain relative temperature maps *in vivo* in mice acclimated at different temperatures. Lipid-dissolved ^{129}Xe based MR thermometry demonstrated superior accuracy in both *in vivo* and *in vitro* results when compared to PRF based MR thermometry in fatty tissues.

552

Computer #12



MR Guided Focused Ultrasound Thalamotomy for Essential Tremor - Maryland Experience

Rao P Gullapalli[1], Jiachen Zhuo[1], Dheeraj Gandhi[1], Charlene Aldrich[2], Erma Owens[1], John Hebel[1], Paul Fishman[3], Howard Eisenberg[2], and Elias Melhem[1]

[1]Diagnostic Radiology & Nuclear Medicine, University of Maryland School of Medicine, Baltimore, MD, United States, [2]Neurosurgery, University of Maryland School of Medicine, Baltimore, MD, United States, [3]Neurology, University of Maryland School of Medicine, Baltimore, MD, United States

In the context of the remarkable reduction in tremors and improvement in quality of life at one year following MRgFUS thalamotomy procedure to treat Essential Tremors in a recently concluded multi-center trial, we examined pre- and post-imaging data including an assessment of the accuracy of MRgFUS targeting of the VIM nuclei and lesion evolution over 12 months. Lesions generated by this procedure were accurately placed, and matched well with the known location of VIM nucleus based on anatomical atlases. The lesions appear to regress in size over a 12 month period but the therapeutic effect is maintained.

553

Computer #13

Magnetic Resonance-Guided Focused Ultrasound Treatment of Extra-Abdominal Desmoid Tumors: A Retrospective Multicenter Study

Pejman Ghanouni[1], Andrew Dobrotwir[2], Alberto Bazzocchi[3], Matthew Bucknor[4], Rachelle Bitton[1], Jarrett Rosenberg[1], Kristen Telischak[5], Maurizio Busacca[3], Stefano Ferrari[6], Ugo Albisinni[3], Shannon Walters[1], Kristen Ganjoo[7], Alessandro Napoli[8], Kim Butts Pauly[1], and Raffi Avedian[9]

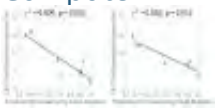
[1]Radiology, Stanford University, Stanford, CA, United States, [2]Radiology, The Royal Women's Hospital, Parkview, Australia, [3]Diagnostic and Interventional

Radiology, The Rizzoli Orthopaedic Institute, Bologna, Italy, [4]Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, CA, United States, [5]Anesthesiology, Perioperative and Pain Medicine, Stanford University, Stanford, CA, United States, [6]Oncology, The Rizzoli Orthopaedic Institute, Bologna, Italy, [7]Medicine, Stanford University, Stanford, CA, United States, [8]Radiology, Sapienza University, Rome, Italy, [9]Orthopaedic Surgery, Stanford University, Stanford, CA, United States

Desmoid tumors are benign, but can result in pain and dysfunction. Surgery, radiation and chemotherapy are only only partially effective and can cause significant morbidity. MR guided focused ultrasound (MRgFUS) was used to treat patients with desmoid tumors, sometimes in lieu of surgery, radiation or chemotherapy. This retrospective multicenter feasibility study of 15 patients demonstrates that MRgFUS is safe and that this technique may be used to control the growth of symptomatic desmoid tumors.

554

Computer #14



White-Matter-Nulled MP-RAGE Predicts Clinical Outcome of Focused Ultrasound Thalamic Ablation for Essential Tremor

Jason Su[1], Christian Federau[2], Thomas Tourdias[3], Manojkumar Saranathan[4], Casey Halpern[5], Jaimie Henderson[5], Veronica Santini[6], Kim Butts-Pauly[2], Pejman Ghanouni[2], and Brian Rutt[2]

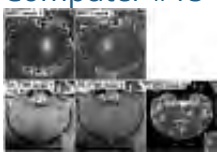
[1]Electrical Engineering, Stanford University, Stanford, CA, United States, [2]Radiology, Stanford University, Stanford, CA, United States, [3]Neuroradiology, Bordeaux University Hospital, Bordeaux, France, [4]Radiology, University of Arizona, Tucson, AZ, United States, [5]Neurosurgery, Stanford University, Stanford, CA, United States, [6]Neurology, Stanford University, Stanford, CA, United States

This retrospective analysis of MR-guided focused ultrasound ablation for essential tremor (ET) treatment is centered on clinical outcome (CRST A+B) and segmentation of ablation lesions using the white-matter-nulled MP-RAGE contrast. There is no significant correlation between the volume of ablation and clinical outcome at 1 month. We identify a new potential target region based on the best-responding patient and compute the percent coverage of that region by each subject's ablation via nonlinear registration. This measure correlates with the outcome after 1 month in 8 subjects with r^2=0.8 and p=0.003, a remarkable association that may aid future targeting strategies in ET.

555

Evaluation of thermal ablation with a 230 kHz transcranial MRI-guided

Computer #15



focused ultrasound system in a large animal model

Nathan McDannold[1], Jonathan Sutton[1], Natalia Vykhodtseva[1], and Margaret Livingstone[2]

[1]Radiology, Brigham and Women's Hospital, Boston, MA, United States, [2]Neurobiology, Harvard Medical School, Boston, MA, United States

This work evaluated the feasibility of thermal ablation in the brain in nonhuman primates using a 230 kHz transcranial MRI-guided focused ultrasound system. We aimed to determine whether using this low frequency can expand the treatment envelope where focused ultrasound can be used in the brain without overheating the skull. We found that focal heating was increased and skull heating decreased compared to prior work in macaques that tested a higher frequency version of this system, suggesting that it can indeed increase this envelope. Furthermore, closed-loop feedback maintained a low level of cavitation activity.

556

Computer #16

MR safety screening - Is it really worth the time investment?

Derek K Jones[1], John Evans[1], and Richard G Wise[1]

[1]CUBRIC, Cardiff University, Cardiff, United Kingdom

Safety screening is considered essential to any MR lab's working practice. However, it is time-consuming and reduces participant throughput. Here, we capitalise on the rare opportunity to experiment with a 3T system prior to it being decommissioned. We test the hypothesis that large ferrous-containing objects, if released into the magnet with a participant inside, do indeed inflict pain and injury. A selection of house-hold objects was used and a subjective pain rating employed to quantify the response. Our results are highly consistent with the main hypothesis, lending support to continued safety screening. However, we discuss alternative options to improve workflow

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Electronic Power Pitch Poster

Controversies in fMRI

Power Pitch Theatre, Exhibition Hall

Wednesday, May 11, 2016: 14:30 - 15:30

631

The sensitivity of diffusion MRI in direct detection neuronal activity: an

summa cum laude

Computer #1

in-vitro assessment

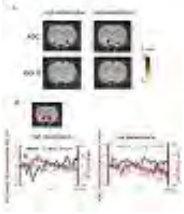
Ruiliang Bai[1,2], Craig Stewart[3], Dietmar Plenz[3], and Peter J Basser[1]

[1]Section on Quantitative Imaging and Tissue Science, DIBGI, NICHD, National Institutes of Health, Bethesda, MD, United States, [2]Biophysics Program, Institute for Physical Science and Technology, University of Maryland, College Park, MD, United States, [3]Section on Critical Brain Dynamics, LSN, NIMH, National Institutes of Health, Bethesda, MD, United States

Diffusion MRI has been proposed as a noninvasive neuroimaging method to detect neuronal activity more directly than BOLD fMRI, yet, initial findings have proven difficult to interpret and reproduce. Here, we study the possible relationship between water diffusion and neuronal activity by simultaneous intracellular calcium fluorescence imaging and diffusion MR of organotypic rat brain cortex cultures. Although we found that diffusion MR can follow pathological changes during hyperexcitability, e.g., as those seen in epilepsy or during anoxia, it does not appear to be sensitive or specific enough to detect or follow normal neuronal activity.

632

Computer #2



Apparent diffusion coefficient correlates with gamma oscillation of local field potentials

Tomokazu Tsurugizawa[1], Yoshifumi Abe[1], and Denis Le Bihan[1]

[1]NeuroSpin, Bât 145, Commissariat à l'Energie Atomique-Saclay Center, 91191, France, Gif-sur-Yvette, France

BOLD fMRI which relies on neurovascular coupling may fail when neurovascular coupling is weakened, such as anesthesia or alcohol intoxication. In contrast, diffusion fMRI has been shown to be more directly linked to neuronal activation even in the absence of neurovascular coupling. We compared BOLD fMRI and diffusion fMRI (ADC) time-courses with local field potentials (LFPs) in rat nucleus accumbens following alcohol stimulation under two different doses of medetomidine anesthesia. The ADC responses were correlated with LFP signals while BOLD signals were not. These results show the interest of diffusion fMRI to avoid confounds from varying conditions of neurovascular coupling.

633

Computer #3

Fast Dynamic Measurement of Functional T1 and Grey Matter Thickness Changes During Brain Activation at 7T

Laurentius Huber[1], Sean Marrett[1], Daniel A Handwerker[1], Adam Thomas[1], Benjamin Gutierrez[1], Dimo Ivanov[2], Benedikt A Poser[2], and

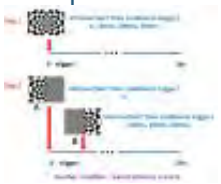
Peter A Bandettini[1]

[1]*Section of Functional Imaging Methods, National Institute of Mental Health, Bethesda, MD, United States,* [2]*MBIC, Maastricht University, Maastricht, Netherlands*

We present a fast new method for obtaining quantitative T_1 maps with high spatial (1 mm) and temporal resolutions (3 s). This method can be useful to investigate morphological dynamics of brain GM, e.g. during brain activity changes, plasticity changes, or pathology. The robustness of the developed method is demonstrated with a finger tapping fMRI experiment. We report a functional GM T_1 increase of up to 100 ms, and a *GM thickness increase* by up to 0.25 mm.

634

Computer #4



Cognitive Application of Multi-Phase Passband Balanced SSFP fMRI with 50ms Sampling rate at 7 Tesla

Zhongwei Chen[1,2], Rong Xue[1], Jing An[3], Kaibao Sun[1,2], Zhentao Zuo[1], Peng Zhang[1], and Danny JJ Wang[4]

[1]*State Key Laboratory of Brain and Cognitive Science, Institute of Biophysics, Chinese Academy of Sciences, Beijing, China, People's Republic of,* [2]*Graduate School, University of Chinese Academy of Sciences, Beijing, China, People's Republic of,* [3]*Siemens Shenzhen Magnetic Resonance Ltd, Shenzhen, China, People's Republic of,* [4]*Laboratory of FMRI Technology (LOFT), Department of Neurology, University of California Los Angeles, Los Angeles, CA, United States*

Multi-phase passband steady state free precession (SSFP) cine fMRI can achieve a spatial resolution of a few mm3 and a temporal sampling rate of 50ms at 7 Tesla , while maintaining low geometric distortion and signal dropout. In this study, the feasibility and accuracy of the technique are demonstrated by two visual event-related functional MRI experiments.

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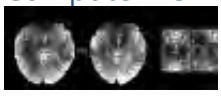
Computer #5



Depth-Dependence of Visual Signals in the Human Superior Colliculus at 9.4T: Comparison with 3T

Joana Alves Loureiro[1,2], Gisela Hagberg[1], Thomas Ethofer[2], Michael Erb[2], Klaus Scheffler[1], and Marc Himmelbach[3]

[1]*High-Field Magnetic Resonance, Max Planck Institute for Biological Cybernetics, Tuebingen, Germany,* [2]*BMMR, University Hospital Tuebingen, Tuebingen, Germany,* [3]*Division of Neuropsychology, Centre for neurology, Tuebingen, Germany*

The superior colliculus (SC) is a layered structure involved in visual and multisensory control. Due to its small size and location it is challenging to evaluate its function with the conventional MR fields. In this study we compare the depth-dependence of visual signals in SC for 9.4T and 3T data. The highest signal was observed in the superficial zone of the superior colliculus (for both datasets). However, the increase in sensitivity in the blood oxygen level dependent size allowed us to get higher response lateralization and a significative higher depth-dependence of visual signals in the 9.4T.

636

Computer #6

Resting State Functional Connectivity is Sensitive to Layer-specific Connectional Architecture in Cortical Columns

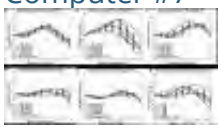
Yun Wang[1], Jennifer Robinson[1,2,3], and Gopikrishna Deshpande[1,2,3]

[1]AU MRI Research Center, Department of Electrical and Computer Engineering, Auburn University, Auburn, AL, United States, [2]Department of Psychology, Auburn University, Auburn, AL, United States, [3]Alabama Advanced Imaging Consortium,Auburn University and University of Alabama Birmingham, Birmingham, AL, United States

We investigated whether resting-state functional connectivity (FC) is sensitive to cortical layer-specific connectional differences using high resolution resting-state fMRI data obtained from healthy humans at 7T. Based on rat tracing studies, we hypothesized that FC between the thalamus and cortical layer I must be significantly greater than between the thalamus and other layers. Our results support this hypothesis. Further, there were no global connectivity differences between layers, ruling out artifactual influences from vasculature. This also opens the future possibility of microscopic investigations of the brain connectome using ultra-high field fMRI and will likely move the field away from blobology.

637

Computer #7



Deconvolving the laminar gradient echo activation profiles with the spatial PSF: an approach to revealing underlying activation patterns

Irati Markuerkiaga[1] and David G. Norris[1]

[1]Donders Institute, Nijmegen, Netherlands

The specificity of GE-BOLD profiles is suspected to be degraded by intracortical veins. In this work experimentally obtained GE-BOLD profiles for different subjects are deconvolved with a laminar point spread functions obtained from a model of cortical vasculature. The

obtained underlying activation profiles are closer to the activity profiles expected from electrophysiology for the type of stimulus used.

638

Computer #8

Effects of Anesthesia on White Matter BOLD Signals in Monkeys

Tung-Lin Wu[1,2], Feng Wang[1,3], Li Min Chen[1,3], Adam W. Anderson[1,2,3], Zhaohua Ding[1,3], and John C. Gore[1,2,3]

[1]Vanderbilt University Institute of Imaging Science, Nashville, TN, United States, [2]Biomedical Engineering, Vanderbilt University, Nashville, TN, United States, [3]Radiology and Radiological Sciences, Vanderbilt University, Nashville, TN, United States

We previously reported the first evidence of anisotropic rsfMRI-BOLD signals in white matter which appear to reflect a functional structure not previously detected. To prove these signals have a functional basis, we performed imaging of live squirrel monkeys under different baselines of neural activity by altering anesthesia levels. Specifically, we compared how different anesthesia levels modulate fractional power and spatio-temporal correlation tensors in white matter. Our results demonstrate that low frequency BOLD signal fluctuations behave similarly in grey and white matter. This indicates that anisotropic rsfMRI-BOLD signals in white matter encode neural activity.

639

Computer #9

Cerebral vascular reactivity and baseline cerebral blood volume contributions to the slow fluctuating baseline BOLD signal.

Jeroen C.W. Siero[1], Jill B. de Vis[1], and Jeroen Hendrikse[1]

[1]Radiology, University Medical Center Utrecht, Utrecht, Netherlands

Slow fluctuating (< 0.1 Hz) BOLD signals during baseline conditions or 'resting-state' have seen interest in numerous studies, both in healthy and disease. Here we investigate cerebral vascular reactivity and baseline cerebral blood volume contributions to the slow fluctuating baseline BOLD signal.

640

Computer #10

Frequency specificity of functional connectivity in rat brain networks

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[1]Neuroimaging Research Branch, National institute on drug abuse, Baltimore, MD, United States

Intrinsic brain networks seen in humans, including the default-mode network (DMN), have been demonstrated in non-human primates and rodents using resting-state functional fMRI (rs-fMRI). Characteristics of these brain networks, such as frequency specificity, have been assessed in humans, but are much less known in animal models. These characteristics are of importance when translating findings from preclinical models to clinical applications. The frequency range used in a human rs-fMRI analysis is typically ≤ 0.1 Hz; however, an appropriate frequency range in rodents remains unclear. In this study, we investigated the resting-state functional connectivity (rsFC) of rat brains in three frequency ranges: 1) 0.01 – 0.1 Hz, 2) 0.1 – 0.25 Hz, and 3) 0.25 – 0.5 Hz, and compared the result with that in human brains.

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641 Computer #11

The resting state fMRI global signal is negatively correlated with time-varying EEG vigilance

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[1]Center for Functional Magnetic Resonance Imaging, University of California San Diego, San Diego, CA, United States

Global signal (GS) regression is a commonly used preprocessing approach in the analysis of resting-state fMRI data. However GSR should be used with caution as it can not only induce spurious anti-correlations, but may also remove signal of neural origin. Here we used simultaneously acquired EEG/fMRI data to study the relation between the GS and an EEG-based measure of vigilance at rest. We found that there is a significant negative correlation between the GS and EEG vigilance. Our results indicate that GS has a significant neuronal component and further emphasizes the need to exercise caution when regressing out the GS.

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642 Computer #12

Detection of epileptic networks using wavelet coherence analysis of dynamic local fMRI connectivity and simultaneous scalp EEG

Amir Omidvarnia[1], David Vaughan[1,2], Mangor Pedersen[1], Mira Semmelroch[1], David Abbott[1], and Graeme Jackson[1,2,3]

[1]Epilepsy Imaging, The Florey Institute of Neuroscience and Mental Health, Melbourne, Australia, [2]Department of Neurology, Austin Health, Melbourne, Australia, [3]Department of Medicine, The University of Melbourne, Melbourne, Australia

In this study, we aimed at developing an objective method for detecting clinically suspected epileptic networks through possible association

between interictal EEG discharges and dynamic local fMRI connectivity in focal epilepsy. We designed a time-frequency framework for analysis of wavelet coherence between scalp EEG band amplitude fluctuations (BAFs) and dynamic regional phase synchrony (DRePS) of task-free fMRI in seven patients. The proposed method reveals nonstationary relationship between scalp interictal epileptic discharges (IEDs) and DRePS within ultra-slow frequencies (~0.003 – 0.03Hz). Evaluation of dynamic fMRI phase synchrony at rest, particularly using data-fusion with interictal scalp EEG, may provide useful markers of localized and transient brain connectivity disturbance in epilepsy.

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643 Computer #13

Large-scale Brain Activation upon Strong Low Frequency Visual Stimulation

Leon C. Ho[1,2], Russell W. Chan[1,2], Patrick P. Gao[1,2], Alex T.L. Leong[1,2], Celia M. Dong[1,2], and Ed X. Wu[1,2]

[1]Laboratory of Biomedical Imaging and Signal Processing, The University of Hong Kong, Hong Kong, China, People's Republic of, [2]Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, China, People's Republic of

Visual inputs are primarily processed by the visual system. However visual input also interacts with other sensory cortices to speed up or improve sensory perception. While the effect of different parameters of visual input to crossmodal influences remains largely unexplored, this study showed strong low frequency light evoked responses in auditory cortex, secondary somatosensory cortex, cingulate cortex and caudate putamen. The activations in those brain regions likely propagated from the visual cortex and influenced subcortical responses. Our current study provides a functional understanding to cortical crossmodal processing and its influences to subcortex upon visual stimuli of different intensities and frequencies.

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644 Computer #14

Relative latency and temporal variability of BOLD fMRI signal within human visual cortex

Jo-Fu Lotus Lin[1], Jonathan R Polimeni[2], Wen-Jui Kuo[3], and Fa-Hsuan Lin[1]

[1]Institute of Biomedical Engineering, National Taiwan University, Taipei, Taiwan, [2]Athinoula A. Martinos Center, Department of Radiology, Harvard Medical School, Massachusetts General Hospital, Charlestown, MA, United States, [3]Institute of Neuroscience, National Yang Ming University, Taipei, Taiwan

We used inverse imaging to spatiotemporally characterize the relative latency and variability of the BOLD signal at human visual cortex with 0.1 s precision. The relative BOLD latency in the left and right visual cortex was 0.12 (s) +/- 0.33 (s). The BOLD variability in the left and right visual cortex was 0.39 (s) +/- 0.25 (s). Local relative BOLD latency was linearly related to local BOLD variability. The least variability (< 0.2 s) and the earliest onset of the BOLD signal were found at the trough of the calcarine sulcus.

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645 Computer #15

Globally conditioned multivariate causal influence estimates in whole-brain functional connectivity

Andrea Duggento[1], Luca Passamonti[2,3], Maria Guerrisi[1], and Nicola Toschi[1,4]

[1]Department of biomedicine and prevention, University of Rome "Tor Vergata", Rome, Italy, [2]Institute of Bioimaging and Molecular Physiology, National Research Council, Catanzaro, Italy, [3]Department of Clinical Neurosciences, University of Cambridge, Cambridge, United Kingdom, [4]Department of Radiology, Martinos Center for Biomedical Imaging and Harvard Medical School, Boston, MA, United States

Reconstructing the direction of information flow ("causality") is crucial when studying evidence-based network models of the brain. We use multivariate analysis to develop a conditioning approach which measures the true directed coupling between two signals which are also indirectly connected through a large number of additional interdependent sources. After validation through synthetics noisy oscillator networks, we study data from 100 HCP subjects, revealing a clear-cut, sparse resting-state directed network structure and providing first-time evidence of a concerted directional interaction between subnetworks of the brain, with the salience network performing top-down integration of sensory-motor and cognitive processes.

Electronic Power Pitch Poster

Body MRI

Power Pitch Theatre, Exhibition Hall

Wednesday, May 11, 2016: 17:00 - 18:00

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715 Computer #1

Abdominal and Body Imaging Using a 16 Channel Dipole RF Array at 7.0 T

Celal Oezerdem[1], Till Huelnhagen[1], Lukas Winter[1], and Thoralf

Niendorf[1,2]

[1]*Berlin Ultrahigh Field Facility (B.U.F.F), Max Delbrück Center for Molecular Medicine in the Helmholtz Association (MDC), Berlin, Germany,* [2]*Experimental and Clinical Research Center, a joint cooperation between the Charité Medical Faculty and the Max Delbrück Center for Molecular Medicine in the Helmholtz Association, Berlin, Germany*

This pilot study demonstrates the feasibility of abdominal imaging and parametric T_2^* mapping of the liver and kidney at 7.0T by employing a 16 channel electrical dipole RF array. The large field of view and rather uniform excitation field enabled by the proposed bow tie antenna array affords comprehensive anatomic coverage and enhanced spatial resolution. Our initial results suggest that high spatial resolution anatomic and functional UHF-MR can be of benefit for clinical liver and kidney imaging.

716

Computer #2

Free-Breathing 3D Abdominal Magnetic Resonance Fingerprinting Using Navigators

Yong Chen[1], Bhairav Mehta[1], Jesse Hamilton[2], Dan Ma[1], Nicole Seiberlich[2], Mark Griswold[1], and Vikas Gulani[1]

[1]*Department of Radiology, Case Western Reserve University, Cleveland, OH, United States,* [2]*Department of Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States*

In this study, a free-breathing quantitative abdominal imaging method was developed using the MRF technique in combined with navigators, which allows simultaneous and volumetric quantification of multiple tissue properties in abdomen.

717

Computer #3

Multiple Linear Regression for Predicting Fibrosis in the Kidney using T1 Mapping and 'RESOLVE' Diffusion-Weighted MRI

Iris FRIEDLI[1], Lindsey Alexandra CROWE[1], Lena BERCHTOLD[2], Solange MOLL[3], Karine HADAYA[2], Thomas DE PERROT[1], Pierre-Yves MARTIN[2], Sophie DE SEIGNEUX[2], and Jean-Paul VALLEE[1]

[1]*Department of Radiology, Geneva University Hospitals, Geneva, Switzerland,* [2]*Department of Nephrology, Geneva University Hospitals, Geneva, Switzerland,* [3]*Department of Pathology, Geneva University Hospitals, Geneva, Switzerland*

Multi-parametric studies are beginning to emerge in renal disease

assessment. However these studies investigated each MR parameter independently and compare the MR sequences but do not combine multiple parameters in a single statistic. In this multi-parametric 3T MR study, the sensitivity of T1 mapping and Readout Segmentation Of Long Variable Echo train (RESOLVE) DWI parameters was first independently evaluated and compared against interstitial fibrosis of 31 Chronic Kidney Disease patients undergoing renal biopsy. The two MR parameters were then associated in a single statistic with the hypothesis that used together they can improve the non-invasive detection of interstitial fibrosis.

718

Computer #4

Towards Quantitative Renal MR Blood Oximetry by Combined Monitoring of T2*, T2 and Blood Volume Fraction

Andreas Pohlmann[1], Karen Arakelyan[1,2], Leili Riazy[1], Till Huelnhagen[1], Stefanie Kox[1], Kathleen Cantow[2], Sonia Waiczies[1], Bert Flemming[2], Erdmann Seeliger[2], and Thoralf Niendorf[1]

[1]Berlin Ultrahigh Field Facility, Max Delbrueck Center for Molecular Medicine, Berlin, Germany, [2]Institute of Physiology, Charite Universitaetsmedizin, Berlin, Germany

Acute kidney injuries are often characterized by tissue oxygen hypoxia. T_2*-mapping permits probing renal oxygenation but provides a surrogate rather than a quantitative measure of oxygen saturation. The link between pO_2 and T_2* is influenced by changes in blood volume fraction (BVf). Monitoring BVf in combination with recently developed quantitative BOLD approaches could permit unambiguous interpretation of renal T_2*. To test the feasibility of this new approach we monitored renal T_2*/T_2 during baseline and short periods of venous occlusion. This was performed in the same animal under naïve conditions and again with USPIO to permit estimation of BVf and SO_2.

719

Computer #5

BOLD MRI of human placenta and fetuses under maternal hyperoxygenation in growth restricted twin pregnancies

Jie Luo[1,2], Esra Abaci Turk[1,2], Carolina Bibbo[3], Borjan Gagoski[1], Mark Vangel[4], Clare M Tempany-Afdhal[5], Norberto Malpica[6], Arvind Palanisamy[7], Elfar Adalsteinsson[2,8,9], Julian N Robinson[3], and Patricia Ellen Grant[1]

[1]Fetal-Neonatal Neuroimaging & Developmental Science Center, Boston Children's Hospital, Harvard Medical School, Boston, MA, United States, [2]Madrid-MIT M+Vision Consortium in RLE, Massachusetts Institute of Technology, Cambridge, MA, United States, [3]Maternal and Fetal Medicine,

Brigham and Women's Hospital, Boston, MA, United States, [4]Department of Radiology, Harvard Medical School, Boston, MA, United States, [5]Department of Radiology, Brigham and Women's Hospital, Boston, MA, United States, [6]Medical Image Analysis and Biometry Laboratory, Universidad Rey Juan Carlos, Madrid, Spain, [7]Division of Obstetric Anesthesia, Brigham and Women's Hospital, Boston, MA, United States, [8]Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States, [9]Harvard- MIT Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA, United States

Adequate oxygen transport across the placenta from mother to fetus is critical for fetal growth and development. In this pilot study, BOLD MRI with maternal hyperoxygenation show great potential in differentiating IUGR fetuses from controls. Not only the placentae show significant difference in rate of oxygen uptake, fetal organs also have distinct response to exposure to hyperoxia. Differences between fetal brain and liver responses to hyperoxygenation are observed in some cases, which might suggest variations in fetal hemodynamic autoregulation.

720

Computer #6

Ingestion of carbohydrate solutions of glucose-fructose versus glucose-alone during a prolonged exercise in individuals with type 1 diabetes

Tania Buehler[1], Lia Bally[2], Ayse Sila Dokumaci[1], Christoph Stettler[2], and Chris Boesch[1]

[1]Depts. Radiology and Clinical Research, University of Bern, Bern, Switzerland, [2]Division of Endocrinology, Diabetes and Clinical Nutrition, Inselspital Bern, Bern, Switzerland

In comparison to healthy subjects, there is scarce data on the influence of different carbohydrate-types on the metabolism in exercising individuals with type 1 diabetes mellitus (T1DM). Based on ^{13}C-MRS, blood sampling, stable isotopes, and indirect calorimetry the impact of glucose-fructose and glucose-alone was investigated in T1DM subjects without prior insulin reduction. Glucose-fructose ingestion showed a shift in fuel metabolism towards increased fat oxidation and potential glycogen sparing effects. Despite the negative reputation of fructose it seems to be a more efficient fuel in exercising T1DM subjects, since blood glucose levels are not immediately elevated due to its different metabolization.

721

Computer #7

Pancreatic disease in obesity: observations on fat content, diffusion, T2* relaxometric and mechanical properties in the rat ex vivo

Philippe Garteiser[1], Sabrina Doblas[1], Jean-Baptiste Cavin[1], André Bado[1], Vinciane Rebours[1,2], Maude Le Gall[1], Anne Couvelard[1,3], and Bernard E Van Beers[1,4]

[1]Center For Research on Inflammation, Inserm U1149, Paris, France, [2]Pancreatology Unit, AP-HP, Beaujon Hospital, Clichy, France, [3]Pathology department, AP-HP, Bichat Hospital, Paris, France, [4]Radiology department, AP-HP, Beaujon Hospital, Clichy, France

Multiparametric assessment of pancreas in the obese rat was used to evaluate alterations linked to obesity-mediated inflammation. Mechanical properties and T2* values are significantly affected by disease, and reflect accurately the histological features of the obese pancreas.

722

Computer #8

MR of hyperpolarized Xe-129 dissolved in the human brain at 1.5 T and 3.0 T

Madhwesha Rao[1], Neil J Stewart[1], Graham Norquay[1], Paul D Griffiths[1], and Jim M Wild[1]

[1]Academic unit of Radiology, University of Sheffield, Sheffield, United Kingdom

Xenon is an inert noble gas which can be safely inhaled. In the lungs, it diffuses into the bloodstream and is then transported to distal organs (brain, kidneys and liver). In this study, we have directly imaged the uptake of hyperpolarized ^{129}Xe in the human brain in vivo. Thus demonstrated the feasibility as a safe and non-invasive contrast agent for functional imaging of the brain in diagnosing diseases related to cerebral perfusion such as brain ischemia. In addition, using tracer kinetic analysis we provide quantitative measurement for the intrinsic physiological characteristic of the blood brain barrier.

723

Computer #9

Pulmonary Thin-Section MRI with Ultrashort TE: Capability for Lung Nodule Screening and Subtype Classification as Compared with Low- and Standard-Dose CTs

Yoshiharu Ohno[1,2], Yuji Kishida[2], Shinichiro Seki[2], Hisanobu Koyama[2], Takeshi Yoshikawa[1,2], Daisuke Takenaka[3], Masao Yui[4], Aiming Lu[5], Mitsue Miyazaki[5], Katsusuke Kyotani[6], and Kazuro Sugimura[2]

[1]Advanced Biomedical Imaging Research Center, Kobe University Graduate School of Medicine, Kobe, Japan, [2]Radiology, Kobe University Graduate School of Medicine, Kobe, Japan, [3]Radiology, Hyogo Cancer Center, Akashi,

Japan, [4]Toshiba Medical Systems Corporation, Otawara, Japan, [5]Toshiba Medical Research Institute USA, Vernon Hills, IL, United States, [6]Center for Radiology and Radiation Oncology, Kobe University Hospital, Kobe, Japan

MRI with ultrashort TE (UTE) has been suggested as useful for morphological assessment of lung as well as CT. However, no reports have been found to study the capability of thin-section MRI with UTE for pulmonary nodule detection and nodule type assessment as compared with thin-section CTs. We hypothesized that pulmonary MRI with UTE has a similar potential for nodule detection and nodule type evaluation as compared with thin-section CT. The purpose of this study was to compare the capability of pulmonary MRI with UTE for nodule detection and nodule type assessment with low- and standard-dose CTs.

724

Computer #10

Quantitative Assessment of Pulmonary Blood Flow in Infants with Congenital Diaphragmatic Hernia by CINE Phase Contrast MRI

Jean A Tkach[1], Ryan A Moore[2], Nara S Higano[1,3,4], Laura L Walkup[1,3], Mantosh S Rattan[5], Paul S Kingma[6], Michael D Taylor[2], and Jason C Woods[1,3,4]

[1]Imaging Research Center, Department of Radiology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [2]The Heart Institute, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [3]Center for Pulmonary Imaging Research, Division of Pulmonary Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [4]Department of Physics, Washington University, St. Louis, MO, United States, [5]Department of Radiology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States, [6]Division of Neonatology and Pulmonary Biology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, United States

Pulmonary arterial hypertension (PAH) is common in congenital diaphragmatic hernia (CDH) and is a major contributor to morbidity and mortality. Echocardiography and cardiac catheterization are the current standards for evaluating pulmonary hemodynamics in CDH infants, but both have significant limitations and/or risks. Phase contrast (PC) MRI can provide quantitative information about velocity and flow longitudinally, with minimal risk. We demonstrate the feasibility of applying PC MRI in the neonatal ICU (NICU) to obtain a quantitative assessment of pulmonary blood flow in CDH infants with the long-term goal to establish imaging biomarkers to predict PAH and assess therapeutic response.

725

Computer #11

Pretreatment intravoxel incoherent motion diffusion-weighted imaging for predicting the response of locally advanced rectal cancer to neoadjuvant chemoradiation therapy

Hongliang Sun[1], Yanyan Xu[1], Kaining Shi[2], and Wu Wang[1]

[1]Radiology, China-Japan Friendship hospital, Beijing, China, People's Republic of, [2]Philips Healthcare China, Beijing, China, People's Republic of

Neoadjuvant chemoradiation therapy (CRT) followed by surgery has been established as the standard for locally advanced rectal cancer[1]. The treatment response after CRT is normally evaluated by MRI. However, MRI morphology techniques suffer from limitations in the interpretation of fibrotic scar tissue and inflammation. Diffusion weighted MRI has shown its potentially beneficial role for response evaluation, but with conflicting results[2]. Intravoxel incoherent motion (IVIM) which enable quantitative parameters that separately reflect tissue diffusivity and tissue microcapillary perfusion[3-4]. However, the pretreatment tumor IVIM MRI parameters predicting treatment response were not clarified.

726

Computer #12

Prostate cancer detection with multi-parametric MRI : PI-RADS version 1 versus version 2

Zhaoyan Feng[1], Xiangde Min[1], and Liang Wang[1]

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The new PI-RADS version 2 classification (PI-RADS v2) was proposed together with the European Society of Urogenital Radiology (ESUR) and the American College of Radiology (ACR) in December 2014. In contrast to PI-RADS v1, the v2 regulate how to classify final PI-RADS score. for routine clinical use, test of the validity of v2, including its sensitivity and specificity for prostate cancer (PCa) detection should raise concerns, and literature of them less. So, the purpose of our study was to compare the diagnostic performance of v1 and v2 for the detection of PCa.

727

Computer #13

Radiomic features on T2w MRI to predict tumor invasiveness for pre-operative planning in colorectal cancer: preliminary results

Jacob Antunes[1], Scott Steele[2], Conor Delaney[2], Joseph Willis[3], Justin Brady[4], Rajmohan Paspulati[5], Anant Madabhushi[1], and Satish Viswanath[1]

[1]Department of Biomedical Engineering, Case Western Reserve University,

Cleveland, OH, United States, [2]Department of Colon and Rectal Surgery, University Hospitals Case Medical Center, Cleveland, OH, United States, [3]Department of Anatomic Pathology, University Hospitals Case Medical Center, Cleveland, OH, United States, [4]Department of General Surgery, University Hospitals Case Medical Center, Cleveland, OH, United States, [5]Department of Radiology, University Hospitals Case Medical Center, Cleveland, OH, United States

Pre-operative planning in colorectal cancer is highly dependent on extent of tumor into the mesorectum, but tumor margin is currently only assessed on excised pathology. Radiomic features may capture subtle microarchitectural changes on a restaging MRI, enabling characterization of tumor extent prior to surgery, even when residual disease may not be visually discernible. We present preliminary results for identifying radiomic features which discriminate invasive from noninvasive tumor on a 3 Tesla restaging T2w MRI in colorectal cancer. In a cohort of 24 patients, multi-scale gradient (Gabor) radiomic features demonstrated high accuracy in segregating patients with invasive colorectal cancer.

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Computer #14

Motion Compensated Diffusion-Weighted MRI in the Liver with Convex Optimized Diffusion Encoding (CODE)

Eric Aliotta[1,2], Holden H Wu[1,2], and Daniel B Ennis[1,2]

[1]Radiological Sciences, UCLA, Los Angeles, CA, United States, [2]Biomedical Physics IDP, UCLA, Los Angeles, CA, United States

Bulk motion artifacts in liver DWI can be substantially reduced with first moment nulled diffusion encoding. However, the bipolar diffusion encoding gradient waveforms generally used for this purpose extend TE and limit SNR. We have developed a Convex Optimized Diffusion Encoding (CODE) framework to design time-optimal, motion compensated diffusion encoding gradients that remove sequence dead times and minimize TE. CODE gradients were designed and implemented for liver DWI on a 3.0T clinical scanner, then evaluated in healthy volunteers and patients. Bulk motion artifacts were significantly reduced and ADC maps were improved compared to conventional monopolar encoding.

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Computer #15

Quantitative Analysis of Arterial Phase Transient Respiratory Motions Induced by Two Contrast Agents for Dynamic Liver MR Imaging

Yuxi Pang[1], Dariya Malyarenko[1], Matthew Davenport[1], Hero Hussain[1], and Thomas Chenevert[1]

[1]*Department of Radiology, UNIVERSITY OF MICHIGAN, ANN ARBOR, MI, United States*

This work is to analyze the respiratory waveforms from dynamic liver MR images related to the motion artifacts in arterial phase images induced by the contrast-media administration. The discriminative metrics were defined to quantify the likelihood of the acutely and temporally impaired breath-holding by the subjects who received gadoxetate disodium and gadobenate dimeglumine contrast agents. Our preliminary results show that the indicative metrics derived from recorded respiratory waveforms objectively confirm prior reported observations that gadoxetate disodium has a significantly higher likelihood of inducing acute transient breath-holding difficulties that adversely affect arterial phase image quality.

Electronic Power Pitch Poster

Contrast Mechanisms: Novel Imaging Biomarkers

Power Pitch Theatre, Exhibition Hall

Thursday, May 12, 2016: 11:30 - 12:30

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Computer #1

Antibody Therapy Against Tau Pathology Improves Neuronal Transport as Assessed In Vivo by Tract-Tracing Manganese-Enhanced MRI

Maria F Baron[1], Hameetha Banu Rajamohamed Sait[2], Wajitha J RajaMohamed Sait [2], D Minh Hoang[1], Einar M Sigurdsson[2,3], and Youssef Z Wadghiri[1]

[1]*Radiology, Center for Advanced Imaging Innovation & Research (CAI2R) and Bernard and Irene Schwartz Center for Biomedical Imaging, NYU School of Medicine, New York, NY, United States,* [2]*Neuroscience and Physiology, NYU School of Medicine, New York, NY, United States,* [3]*Psychiatry, NYU School of Medicine, New York, NY, United States*

Immunotherapies to target Alzheimer's pathology have been developed in recent years. Amyloid-ß centric approaches have shown limited efficacy, resulting in emphasis on immunotherapies for clearing pathological tau protein (τ-Thx). Our group has demonstrated that Tract-Tracing Manganese Enhanced MRI (TT-MEMRI) is effective to monitor the deleterious effect of tau pathology on neuronal transport in transgenic (τ-Tg) mice. In this study, our TT-MEMRI protocol was used effectively to show the efficacy of acute tau antibody therapy in an advanced stage of tauopathy in the Tg model we previously characterized with TT-MEMRI.

Specifically, neuronal transport can be restored after a four-week treatment period.

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Computer #2

In-vivo measurement of a new source of tissue contrast, the dipolar relaxation time,T_{1D}, using a modified ihMT sequence

Gopal Varma[1], Valentin H Prevost[2], Olivier M Girard[2], Guillaume Duhamel[2], and David C Alsop[1]

[1]Radiology, Division of MR Research, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, United States, [2]CRMBM-CEMEREM UMR 7339, CNRS-AMU, Aix Marseille Université, Marseille, France

The enhanced inhomogeneous magnetization transfer (ihMT) in certain tissues, especially white matter, has recently been explained as a result of longer dipolar relaxation times, T_{1D}s in those tissues. Measurement of T_{1D} by modeling the frequency and power dependence of steady state ihMT has yielded T_{1D} estimates but with great uncertainty. Here we introduce a dynamic ihMT experiment that switches between positive and negative frequency irradiation at varying times. Fits to the ihMT signal decay curve as a function of switching time at one (absolute) offset frequency and power enabled highly precise mapping of T_{1D} that was largely independent of other MT parameters. A T_{1D} of 6.4±0.5ms for white matter was in good agreement with reported ex-vivo measurements using Jeener-Broekaert echoes.

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Computer #3

Imaging Reactive Oxygen Species (ROS) using CEST MRI

Rong-Wen Tain[1,2], Alessandro Scotti[2,3], Weiguo Li[4,5], Xiaohong Joe Zhou[1,2,3,6], and Kejia Cai[1,2,3]

[1]Radiology, College of Medicine, University of Illinois, Chicago, IL, United States, [2]3T Research Program, Center for MR Research, College of Medicine, University of Illinois, Chicago, IL, United States, [3]Bioengineering, College of Engineering, University of Illinois, Chicago, IL, United States, [4]Research Resource Center, University of Illinois, Chicago, IL, United States, [5]Radiology, Northwestern University, Chicago, IL, United States, [6]Neurosurgery, College of Medicine, University of Illinois, Chicago, IL, United States

It is extremely challenging to non-invasively measure tissue ROS due to its low concentration and short lifetime. This study aims to demonstrate a fully non-invasive CEST MRI method to measure ROS concentration. CEST Z-spectra were acquired from egg white samples with and without hydrogen peroxide treatment. In addition, proton exchange rate, T_1, and T_2 relaxation time maps were acquired for further clarification on CEST

contrast origin. We have demonstrated that ROS is paramagnetic and can greatly enhance proton exchange rate leading to reduced CEST contrast.

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Computer #4

A new NOE-mediated MT signal at -1.6 ppm for detecting ischemic stroke in rat brain

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We recently reported a new NOE-mediated MT signal at around -1.6 ppm, named NOE(-1.6). In the present work, we evaluated the changes of this signal that occur early in ischemic stroke and found that both NOE(-1.6) and Amide Proton Transfer (APT) signals from stroke lesions have significant changes after MCAO. Compared with APT, NOE(-1.6) showed much stronger contrast between stroke and contralateral normal tissues. We conclude that a new NOE(-1.6) signal in rat brain could be used as a biomarker for assessment of acute ischemic stroke.

805

summa cum laude

Computer #5

3D Amide-Proton-Transfer-Weighted (APTw) Image-Guided Stereotactic Biopsy in Patients with Newly Diagnosed Gliomas

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We evaluated the accuracy of the APTw image-guided tissue biopsy via the neuro-navigation system in newly diagnosed gliomas. Patients (n = 24) with suspected gliomas of varying grades were recruited and scanned. APTw image-guided needle biopsy samples were obtained and analyzed histologically. Results showed that the APTw signal intensities

were significantly higher in high-grade gliomas than in low-grade gliomas and that APTw signal intensities had a strong positive correlation with pathologic cellularity and proliferation. APTw image-guided biopsy in newly diagnosed gliomas has the potential to reduce the randomness of surgical decisions due to tumor heterogeneity.

806

Computer #6

Magnetic resonance imaging biomarkers for assessment of vascular pathologies in gliomas

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Knowledge about the tumor microvasculature is important for monitoring of disease progression and treatment response. Forty-six patients with known or suspected brain tumors were examined using the vascular architecture mapping (VAM) technique. $\Delta R_{2,GE}$ versus $(\Delta R_{2,SE})^{3/2}$ diagrams were evaluated with new versions of microvessel radius (R_U) and density (N_U), which showed increased levels of heterogeneous structures in glioblastoma and meningioma. Three new imaging biomarkers were introduced: Microvessel type indicator (MTI), which allowed differentiation between supplying arterial and draining venous microvasculature. Vascular induced peak shift (VIPS), which is more sensitive to early angiogenic activity. Curvature was increased in peritumoral vasogenic edema.

807

Computer #7

Multi-parametric estimation of brain hemodynamics with Fingerprinting ASL

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MR Fingerprinting (MRF) based Arterial Spin Labeling (ASL) has the ability to estimate multiple physiological parameters in a single scan. In this study, we explored the potential of this technique by fitting the data to a three-compartment model to get seven hemodynamic parameters

concomitantly. Hypercapnia study in healthy subjects and clinical scan in stroke patients were conducted to test these estimations. Results show that this technique is able to provide multi-parametric estimations of hemodynamic markers in healthy and diseased brain.

808

Computer #8

Transit time mapping in the mouse brain using time-encoded pCASL

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Arterial transit time (ATT) is known to influence CBF-quantification and is interesting in itself, as it may reflect underlying vascular pathologies. Currently, no MRI sequence exists to measure ATT in mice. Recently, time-encoded labeling schemes have been implemented in rats and men, enabling ATT-mapping with higher SNR and less scan-time than multi-delay ASL. In this study, we show that time-encoded pCASL (te-pCASL) enables transit times measurements in mice. Furthermore, ATT was found to be preserved in old WT mice.

809

Computer #9

Measuring Subtle Leakage in Patients with Cerebrovascular Disease Using Dual Temporal Resolution DCE-MRI: Is it Reproducible?

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Measuring subtle leakage through the blood-brain barrier using DCE-MRI is challenging since their magnitude is lower than in high-grade tumors. To have a clinical application, this method has to be reproducible. The reproducibility of the transfer constant (K_i) and fractional plasma volume (v_p) using dual temporal resolution DCE-MRI was investigated in 14 patients with cerebrovascular disease. Low CVs and moderate to high ICCs demonstrate that despite the noisy nature of the measurement, the method is moderately reproducible. Still, cautious interpretation of the K_i and v_p in individual patients is needed.

Day-to-day variations may be partly compensated by using session-averaged VIFs.

810

Computer #10

Modeling demyelination in white matter: the effect of realistic geometries on the susceptibility-weighted MR signal.

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Biophysical modeling of axons has conventionally assumed cylindrical geometries. In reality, axons vary in shape. Models consisting of circles benefit from simplicity, however the consequences of this assumption have not been studied. In this work, simulations incorporating realistic myelin shape derived from electron microscopy are employed to model white matter demyelination. Simulations are compared to a cohort of mice with varying levels of demyelination. Predictions from models that incorporate realistic myelin shape are in better agreement with experimental results in a mouse model of demyelination than those from circular models.

811

Computer #11

Thalamic nuclei-specific deposits of iron and calcium in the epileptogenic rat brain revealed by quantitative susceptibility mapping

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We investigate microstructural pathological alterations in the epileptogenic rat brain using quantitative susceptibility mapping (QSM). Using the established model of pilocarpine-induced status epilepticus (SE), we show for the first time, localized paramagnetic and diamagnetic alterations in tissue susceptibility in specific thalamic-nuclei. QSM contrasts in SE and control rats were further compared with histological Alizarin and Perls' stainings, which revealed calcium and iron depositions in areas corresponding to significant ($p<0.005$) alterations in magnetic susceptibility detected in the SE brains. Findings demonstrate the potential of QSM to sensitively detect and differentiate localized

thalamic nuclei-specific iron and calcium deposits in the epileptogenic brain.

812

Computer #12

Functional Quantitative Susceptibility Mapping at 7-Tesla: Resolving Neuronal Activation Localized in Grey-Matter

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Functional-QSM, promises to offer quantitative information more directly related to neuronal-activity than BOLD-fMRI and to partially ameliorate the inherent problem of spatial mismatch between locations of neuronal-activation and apparent BOLD-detected-activation. The data for fQSM and fMRI can be simultaneously acquired and mostly processed with the well-established fMRI toolchains. The current high-field study, evaluates details of the processing-chain, provides clear evidence that fQSM is capable (1) to detect neuronal-activation in well-resolved volumes that unambiguously reside within grey-matter, even after removal of apparent activations associated with larger-veins, and (2) to identify the visual-network in resting-state-experiments, thus highlighting a considerable potential of fQSM.

813

Computer #13

Assessing the (ani)sotropic component of R2 as a mean of studying White Matter properties

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In this study we investigate the orientation dependence of transverse relaxivity (R_2) maps in white matter (WM) due to susceptibility effects of myelin microstructure. Subjects' heads were rotated along different orientations with respect to B_0 and R_2 values (within different WM fibre populations) were decomposed into R_2 isotropic and anisotropic components (orientation independent and dependent respectively). Differences found in isotropic values were associated with fibres

different diameter whereas differences found in anisotropic values were associated with the susceptibility effects from myelin. It was showed that the orientation of WM fibres influences R_2 contrast and coherence between hemispheres was also observed.

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814 Computer #14

IN VIVO HYPERCEST DETECTION OF CUCURBIT[6]URIL IN RAT ABDOMEN

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We used the MRI HyperCEST technique to detect the presence of the xenon encapsulating cage molecule cucurbit[6]uril (CB6) in the abdomen of a rat. We believe that this is the first in vivo demonstration of a xenon based biosensor. We were able to observe a HyperCEST signal depletion of 53% within the intraperitoneal space of the rat. Our results demonstrate the feasibility of HyperCEST biosensors to move from in vitro to in vivo studies.

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815 Computer #15

Hyperpolarized saline for contrast-enhanced MR at Ultra-Low field

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Radiologists routinely use contrast-enhanced MRI with applications mainly in oncology and abdominal imaging. Over the last decade, researchers have put significant efforts in developing new probes for molecular imaging where contrast agents would target only specific cells and/or regions. In all cases, one main question remains: what is the potential toxicity of this new contrast agent? We propose here a safe approach to contrast-enhanced MRI, using pre-polarized biocompatible saline combined with imaging at ultra-low field (0.0065 T).

Electronic Power Pitch Poster

Molecular Imaging & Metabolomics

895

Computer #1

Vascular injury triggers a systemic response that promotes atherosclerosis progression at a remote site of injury.

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Atherothrombosis is a systemic arterial disease mainly involving the intima of large- and medium-sized arteries including the carotid, aorta, coronary, and peripheral arteries. Although it has long been known that atherosclerosis is a systemic disease, the effects of vascular alteration distally from the site of injury and the underlying mechanisms responsible for the systemic response have not been elucidated. In this study, we used an albumin-binding contrast agent to assess whether (1) vascular injury in the abdominal aorta triggers plaque progression in the brachiocephalic artery located distally to the site of injury and (2) whether neutrophils can be the link involved in this systemic response.

896

Computer #2

Translation of high-field fluorine-19 cell tracking techniques into the clinical realm

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Cellular MRI can be used to improve outcomes of cancer immunotherapy by tracking the fate of these cells after their administration. In this study, we used fluorine-19 MRI to track and quantify migration of antigen-presenting peripheral blood mononuclear cells (PBMC). Mice were imaged at both high-field and clinical field strengths. PBMC migration to the node was quantified and compared under different conditions. This study is the first to report on fluorine-19 imaging of PBMC and demonstrates the potential of cellular MRI to aid in the optimization of cellular therapy.

897

Computer #3

Propionate as a Probe For Myocardial Metabolism – A Biochemical and Hyperpolarized MR Study

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In this study, the utility of sodium propionate for accentuating changes in cardiac metabolism is evaluated. The study is performed using a murine model of cardiac hypertrophy and employs hyperpolarized magnetic resonance spectroscopy, mass spectrometry and a biochemical assay to determine the cardiac redox state. Results show propionate modulates cardiac metabolism across a range of different concentrations.

898

Computer #4

In-vivo evaluation of hypometabolism associated with muscular dystrophy using Creatine CEST MRI

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This study aims to measure hypometabolism in the muscle due to muscular dystrophy using creatine CEST MRI. We acquired images of the lower limbs from the diseased and wild-type mice. Differences in the Z-spectrum and creatine CEST contrast map were seen between fibrotic and normal muscles. This suggested that CrCEST MRI may serve as a sensitive imaging biomarker for metabolic changes associated with muscular dystrophy.

899

Computer #5

3D Dynamic Hyperpolarized 13C-Pyruvate MR Metabolic Imaging of Human Prostate Cancer

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To measure the 3D spatial and temporal dynamics of hyperpolarized [1-^{13}C]pyruvate for patient studies, a new compressed-sensing EPSI sequence was developed for prostate cancer clinical research. Utilizing multiband, variable flip angle RF excitation, this sequence provided high temporal (2s) and spatial (0.5cm^3) resolution data detecting pyruvate uptake and its rate of conversion to lactate. This approach provided a significant advance over initial human HP-^{13}C studies in which just 1D or 2D dynamics were measured and 15s single-timepoint 3D spectra were acquired. Following phantom tests, patient data demonstrated high pyruvate to lactate conversion in regions corresponding to biopsy-confirmed prostate cancer.

900

Computer #6

Positive-contrast cellular MRI of embryonic stem cells for tissue regeneration using a highly efficient T1 MRI contrast agent

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Embryonic stem (ES) cells offer promise for regenerating a variety of tissue types. One difficult aspect to advancing this technology is determining the fate of these cells once they are introduced inside the body. MRI can play an important role for non-invasive monitoring in

patients, but conventional methods based on iron oxides have limited specificity. In this study, a novel, highly efficient T1 agent is investigated for labelling mouse ES cells. A drastic decrease in T1 was obtained and sustained for at least 24 hours. Viability and proliferation were unaffected, and labelled ES cells were differentiated into beating cardiomyocytes.

901

Computer #7

Testing the Efficacy of GdDO3NI: A Novel Hypoxia-Targeting T1 Contrast Agent

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Tumor hypoxia is a severe problem in oncology, leading to enhanced metastatic potential and poor response to therapies. The advent of GdDO3NI—a hypoxia-binding contrast agent, serves to facilitate therapies by highlighting hypoxic regions on tumors. Relaxivity studies were performed and image registration were executed between modalities to validate the efficacy of this novel contrast agent to pimonidazole: the gold standard for immunohistochemical hypoxia imaging. Results showed a strong correlation in tumor boundaries and hypoxic fractions between modalities. The hypoxic regions showed lower correlation than expected however, attributed to the difference in tissue content resulting from discrepancies in slice thickness.

902

Computer #8

Tracking transplanted cells with paramagnetic fluorinated nanoemulsions

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Fluorine-19 magnetic resonance imaging (MRI) probes are used to label cells for quantitative in vivo tracking of cell therapies and visualizing inflammation. To reduce the ^{19}F spin-lattice relaxation time (T_1) and enable rapid imaging and improved cell detection sensitivity, we prepared metal-binding fluorinated nanoemulsions, and then metalated them with a panel of transition and lanthanide ions. Iron(III) tris-β-

diketonate PFPE nanoemulsion was observed to have superior MRI properties (^{19}F T_1 as low as 6 ms). Overall, these agents can yield a multifold improvement in detection sensitivity over previously employed ^{19}F MRI methods to track transplanted cells.

903

Computer #9

Influence of Gender and Age on the Metabolic Profile of Blood Plasma in Celiac Disease Using Proton NMR Spectroscopy

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Metabonomics study on blood plasma of patients with Celiac disease (CeD) using NMR spectroscopy revealed gender and age specific variations. The concentrations of acetate, pyruvate, creatine and glycine were significantly higher in males with CeD compared to healthy males. While, levels of β-hydroxybutyrate, glycine and alanine were significantly elevated in females with CeD than healthy females. These metabolic differences indicated impairment in both catabolic and anabolic pathways of carbohydrate metabolism in CeD patients of both genders, however, fuel preference for energy requirement was gender specific, fatty acids were used in males while ketone bodies were preferred in females.

904

Computer #10

Specificity and sensitivity of early predictive urinary metabolic biomarker of radiation injury: a 1H NMR based metabolomic study

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Increasing radiation exposure is a big threat to population worldwide. The present study predicts the early predictive biomarker for radiation injury using ^{1}H NMR based metabolomics. The animals were exposed to 7.5 Gy whole body radiation. The variable importance of projection (VIP) score showed six most significant metabolites having VIP score of >1. The partial least square discriminant analysis (PLS-DA) based receiver-operating characteristic (ROC) curve of all the six metabolites showed

taurine with highest area under curve (AUC) value of 0.996 and with sensitivity (100%) and specificity (90%). It could be used as early prognostic biomarker for radiation injury.

905

Computer #11

Filtered serum-based metabolomics of prostate cancer using 1H NMR spectroscopy

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To address the shortcomings of clinical indexes for the precise identification of prostate cancer (PC) and differentiation from benign prostatic hyperplasia (BPH) and healthy controls (HC), we applied 1H NMR spectroscopy as a surrogate tactic for probing of PC and BPH. The study comprises filtered sera from PC (n=75), BPH (n=70) and the HC (n=65). NMR-measured metabolites and clinical evaluation data were examined separately using multivariate discriminant function analysis (DFA) to probe the signature descriptors for each cohort. DFA reveals that filtered serum based metabolic profiling can differentiate not only HC from BPH and PC but also BPH from PC.

906

Computer #12

Increased metabolites in lower quality sperm suggest altered metabolism and increased cytoplasm compared to higher quality sperm

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Sperm movement is necessary for reproduction and low sperm motility can impede fertilization. There is a need for greater understanding of the metabolic processes that drive sperm motility. In this study, we examined differences in sperm metabolite profiles between high and low quality sperm in order to identify possible intracellular biomarkers of sperm quality and motility. Sperm motility was significantly different between the two fractions and fell either side of the WHO lower reference limit. Low quality sperm contained higher concentrations of choline, methyls, citrate and lactate, indicative of increased cell membrane and altered metabolism towards glycolysis.

907

Computer #13

Assessment of changes in metabolic profile of small intestinal mucosal biopsy of Celiac Disease patients after gluten-free diet: An in-vitro Proton NMR Spectroscopy study

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Present in vitro proton NMR study demonstrated the metabolic changes associated with villous abnormalities and its recovery following gluten free diet (GFD) in patients with Celiac disease (CeD). The concentration of glutamate and glutamine was significantly reduced in intestinal mucosa of CeD patients after GFD, indicating the use of these metabolites as oxidative fuels for energy generation. The level of glycerophosphocholine was significantly increased after GFD in CeD patients suggesting increased turnover of enterocytes essential for healing of intestinal mucosa in CeD patients. The results may have implications in determining the alternative biomarker/s for diagnosis and treatment management of CeD.

908

Computer #14

Filtered Serum Metabolomics of Myocardial Ischemia in Unstable Angina Patients

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This study addresses myocardial ischemia in patients presenting with unstable angina using 1H NMR metabolomics of filtered serum. The study includes serum samples from 65 unstable angina patients (UA) and 62 healthy controls (HC). Principal component analysis and orthogonal partial least square discriminant analysis were applied to generate a prediction model. Results revealed that five biomarkers—valine, alanine, glutamine, inosine and adenine—could differentiate 95% of UA from HC with utmost sensitivity and specificity. 1H NMR-based filtered serum metabolic profiling appears to be an assuring, least invasive and faster way to screen and identify myocardial ischemia in UA patients.

909

Computer #15

Correlations between cervicovaginal fluid metabolites and gestational age at delivery

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Magnetic Resonance Spectroscopy (^{1}H-MRS) can detect the metabolite profile of the vaginal microniche and reflects the vaginal bacterial community function. This study assessed the correlation between ^{1}H-MRS vaginal fluid metabolites and maternal parameters related to preterm birth. As expected, vaginal pH, fetal fibronectin, and cervical length correlated with gestational age at delivery (GAAD). Vaginal pH also correlated with lactate and acetate integrals in all study cohorts. Additionally, lactate and glutamine/glutamate integrals in women studied at 20-22 gestational weeks; and succinate/lactate ratio in women studied at 26-28 gestational weeks, correlated modestly with GAAD. Further correlations between metabolites were found.