INSTITUTE OF CANCER RESEARCH

JOB DESCRIPTION

TITLE OF POST: Postdoctoral Training Fellow in diffusion-weighted MRI for MR-guided radiotherapy

LOCATION: Sutton (London)

HOURS PER WEEK: 35 (Fixed term 36 months)

SALARY BAND: This is a fixed-term role, with starting salary in range £32,200\(^*\) – 39,350 p.a. (based on experience)

Diffusion-weighted MRI already plays an important part in cancer diagnosis and therapy. With the rise of MR-guided radiotherapy a new field of applications emerges: Diffusion-weighted imaging as part of the daily workup on an MR-Linac could be used to assess and predict treatment response or identify resistant sub-volumes of the tumour, which require treatment intensification (dose-painting). Further applications are related to the assessment of radiation toxicity in risk organs in the vicinity of the treatment site.

To enable these applications, this project aims at implementing distortion-less diffusion-weighted MRI. While imaging for treatment planning on diagnostic MRI scanners would benefit from the techniques developed within this project, a particular focus will be the implementation of advanced diffusion-weighted MRI techniques on the Unity MR-Linac system. To meet the high requirements of radiotherapy in terms of spatial accuracy, in particular in the context of hypo-fractionated treatments, the successful applicant will have to combine MR pulse programming with state-of-the-art image reconstruction techniques, supported by dedicated high-performance hardware. A key aim of this project is the characterization of intravoxel incoherent motion (IVIM) with tailored diffusion-weighting gradients to characterize changes in microvasculature beyond the ADC.

The post holder will drive the work forward within a multi-disciplinary team of computer scientists, medical physicists and clinicians in the Joint Department of Physics at the Institute of Cancer Research and the Royal Marsden NHS Foundation Trust.

Applicants will hold a PhD in Physics, Engineering or another relevant field and ideally have experience in pulse sequence development and/or MR image reconstruction.

Please contact Professor Uwe Oelfke (uwe.oelfke@icr.ac.uk) or Dr. Andreas Wetscherek (a.wetscherek@icr.ac.uk), if you would like to discuss the job opportunity in more detail. To apply, please complete an application form, upload your CV and the supporting statement (addressing how you meet the person specification and including the names and contact details of two referees) using the ICR’s e-recruitment system: www.icr.ac.uk/jobsearch

\(^*\) as a minimum requirement candidates must have submitted their thesis by the start date of their employment and be awarded their PhD within the six month probation period. After being awarded a PhD, automatic transfer to spine point 2 of the Post Doc Training Fellow scale (£37,850 p.a.) occurs.
1. Main Objective of the Post:

1.1 Devise and implement new image acquisition strategies for diffusion-weighted MRI on diagnostic MRI scanners and on the Unity MR-Linac system.

1.2 Participate in the development of image reconstruction techniques within the Magnetic Resonance Imaging in Radiotherapy team.

1.3 Translate and evaluate the new diffusion-weighted imaging technique by clinical studies performed in collaboration with the clinicians of the Royal Marsden Hospital.

1.4 Mentor scientific staff, e.g. PhD students and undergraduates, in research projects related to MR-guided radiotherapy.

2. Key result areas:

2.1 Develop the pulse sequence and image reconstruction techniques to enable distortion-less diffusion-weighted imaging for MR-guided radiotherapy.

2.2 Implement advanced diffusion gradient schemes to characterize intravoxel incoherent motion on the aforementioned MRI platform and assess their clinical relevance.

2.3 Publish the results of the research in peer reviewed journals and present at national and international conferences.

3. Other Requirements:

Knowledge of C++ (pulse programming) and fluency in at least one scientific programming language (such as Python, MATLAB, R or Julia) are essential. Demonstrated application of machine learning to solve a problem is desirable. Knowledge of the mathematical concepts in state-of-the-art MR image reconstruction is essential. Strong motivation to work in an interdisciplinary team and the drive to translate research results into clinical practice are expected.

4. Main Tasks and Responsibilities:

4.1 Modification of the diffusion-weighted MR imaging implementation of the vendor using pulse programming (Philips MR-Paradise).

4.2 Parallel development of the pulse sequence and prototyping of a tailored image reconstruction technique aiming at minimizing the distortions.

4.3 Implementation of the reconstruction technique on a dedicated image reconstruction server to facilitate “online” availability of the diffusion-weighted images.

4.4 Development of experimental methods / phantoms to assess and validate the newly developed technique.

4.5 Collaboration with external/industrial partners to improve the performance and troubleshoot the developed techniques.

4.6 Expanding the technique by implementing advanced diffusion-weighting gradient schemes to characterize intravoxel incoherent motion (IVIM).
4.7 Adapting the IVIM modelling technique to the developed pulse sequence to enable more accurate modelling.

4.8 Ensure adequate record-keeping and documentation of all experiments and developed source code.

4.9 Carry out the above functions in accordance with the policies of the Institute of Cancer Research and where appropriate, the Royal Marsden NHS Foundation Trust.

5. Communication and Relationships:

The post-holder will:

5.1 Interact with members of the Magnetic Resonance Imaging in Radiotherapy team.

5.2 Collaborate with the external partners.

5.3 Liaise with clinical staff including oncologists, radiologists, radiographers, medical physicists and mechanical engineering staff.

5.4 Attend team and project meetings as required.

5.5 Liaise with other teams working within the fields of imaging for radiotherapy and scientific computing within the ICR.

6. General Responsibilities:

6.1 Staff and Information:

The post-holder will:

6.1.1 Communicate with other staff in order to obtain the necessary information related to the project.

6.1.2 Ensure the development of advanced algorithms which can be integrated into the software environment of the project team.

6.1.3 Ensure the integrity and confidentiality of data collected as part of the project.

6.1.4 All staff must ensure that they familiarise themselves with and adhere to any ICR policies that are relevant to their work and that all personal and sensitive personal data is treated with the utmost confidentiality and in line with the General Data Protection Regulations.

6.2 Effort

The job requires:

6.2.1 Flexibility to work with several teams.

6.2.2 To attend project meetings at different locations of RMH/ICR
6.2.3 To present work at international conferences, in particular the annual ISMRM and MR in RT meetings.

6.2.4 To attend training courses as required and appropriate for the project.

This job description is a reflection of the present position and is subject to review and alteration in detail and emphasis in the light of future changes or development.

Confidentiality

Health and Safety
The post-holders should be aware of the responsibility placed on employees under the Health and Safety at Work Act (1974) to ensure that the agreed safety procedures are carried out to maintain a safe environment.

Information Quality Assurance
As an employee of the ICR it is expected that the post-holders will take due diligence and care in regard to any information collected, recorded, processed or handled by you during the course of your work and that such information is collected, recorded, processed and handled in compliance with data protection/ good clinical practice requirements and instructions. All staff must ensure that they familiarise themselves with and adhere to any ICR policies that are relevant to their work and that all personal and sensitive personal data is treated with the utmost confidentiality and in line with the General Data Protection Regulations.

Equal Opportunities
The ICR is aiming to promote equal opportunities. A copy of our Equality Scheme is available from the Human Resources department. Members of staff must ensure that they treat other members of staff, patients and visitors with dignity and respect at all times and report any breaches of this to the appropriate manager.

No Smoking
The ICR operates a non-smoking policy. Anyone who wishes to smoke may do so only in one of the designated smoking areas at a time agreed with their line manager.

Medical Examinations
All appointments within the ICR are subject to pre-employment health screening.

ICR has a workforce agreement stating that the maximum length of employment for Post-doctoral Training Fellows should be no more than 7 years within ICR and no more than 10 years total postdoctoral employment (at ICR and elsewhere). Consequently, you should be aware that the length of contract offered will be limited by this agreement as well as the availability of funding.
**PERSON SPECIFICATION**

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<th>Criteria</th>
<th>Essential or Desirable?</th>
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<tr>
<td><strong>Education &amp; Knowledge</strong></td>
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<tr>
<td>PhD* in Physics, Engineering, Informatics or a related discipline</td>
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<td>Sound knowledge of spin physics, programming, image analysis, relevant experimental methodology.</td>
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<td>MR Pulse programming experience</td>
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<td><strong>Experience</strong></td>
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<td>In vivo MR image acquisition and analysis</td>
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<td>Proven track record of productive research/good publication record</td>
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<td>Development and application of robust MRI protocols for clinical studies</td>
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<td>Ability to analyse complex functional imaging datasets.</td>
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<td>Experience with MR image reconstruction from raw data.</td>
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<td>Familiarity with radiotherapy treatment workflows.</td>
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<td><strong>Skills</strong></td>
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<td>Ability to assimilate relevant information and initiate new areas of research</td>
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<td>Coordinating, planning and executing research to a high standard.</td>
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<td>Good communication skills and the ability to foster collaborative projects</td>
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<td><strong>General</strong></td>
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<td>Highly self-motivated and enthusiastic, with a keen desire to produce high quality scientific data</td>
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<td>Excellent interpersonal skills with the ability to work flexibly and to establish effective working relationships as part of a team</td>
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<td>Ability to think and work effectively &amp; semi-independently</td>
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<td>Ability to plan, organise &amp; prioritise a busy workload</td>
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