

Investigating the potential of motion information from radiotherapy image guidance data to improve outcome prediction modelling

Professor Chris Moore & Dr Gareth Price

The Institute of Cancer Sciences invites applications for a 3-year fully-funded PhD due to commence January 2015. The studentship covers UK/EU tuition fees and an annual tax-free stipend at UK Research Council rates (£13, 863 in 2014/15). The studentship is open to UK/EU nationals only due to the nature of the award.

Unaccounted for patient motion during radiotherapy treatment delivery negatively affects the prescribed dose distribution, increasing the risk of missing the tumour target and escalating the irradiation of nearby critical structures. This can result in treatment failure and serious side effects. Accurate prediction of these effects would permit compensatory clinical intervention.

The aim of this PhD is, for the first time, to identify *motion quantification metrics*, describing patient motion and motion variability, that can be obtained from routine clinical Image Guided Radiotherapy (IGRT) data, and investigate their ability to improve prediction of cancer treatment outcomes. In particular the project will focus on the ability of different metrics to aid in the prediction of toxicity, local control and short term survival in lung radiotherapy treatments.

The current state-of-the-art outcome prediction approaches draw information from not just clinical records (e.g. demographics, diagnosis), but also radiotherapy specific data (e.g. dose, fractionation). However, it is very difficult to know whether the dose received by the patient is the same as that planned. Patient motion is well known as one of the main causes of this problem. Knowledge of the magnitude of the disparities between the treatment prescribed and that delivered is fundamental to the accuracy of these models.

IGRT is recommended as the NHS standard of care. Cone Beam CT immediately prior to or following irradiation is the workhorse imaging modality and encodes patient motion patterns. Additionally there is increased uptake of existing real-time motion estimation approaches (e.g. orthogonal X-ray imaging and marker tracking), and emerging new real-time motion measurement technologies such as optical surface measurement.

High fidelity measurements of patient movement during treatment exist, and are becoming more commonplace as sensor technologies proliferate. The challenge is in extracting the salient motion information from these complex data, and investigating its impact upon treatment outcome.

The successful candidate will work alongside experienced clinical scientists in the largest specialist cancer hospital in Europe, and apply their results to state-of-the-art treatment prediction models. They will be expected to publish the outcomes in peer reviewed journals and present at national and international conferences.

The project will be hosted within Christie Medical Physics and Engineering (CMPE) – whose core function is to provide the north-west region with leading edge expertise in medical physics, and to introduce and support the use of complex new technologies in clinical environments.

Candidates are expected to hold (or be due to obtain) a minimum upper-second (or equivalent) undergraduate degree in a relevant area such as computer science, mathematics and/or physical sciences. Previous experience of medical imaging and/or a relevant Masters qualification would be an advantage.

Please direct applications in the following format to Dr Gareth Price (gareth.price@physics.cr.man.ac.uk):

- Academic CV
- Official academic transcripts
- Contact details for two academic referees
- A personal statement (750 words maximum) outlining your suitability for the study, what you hope to achieve from the PhD and your research experience to date.

Any enquiries relating to the project and/or suitability should be directed to Dr Price at the address above.

Deadline for applications: **Friday 3 October 2014.**

<http://www.christie.nhs.uk/the-foundation-trust/treatments-and-clinical-services/christie-medical-physics-and-engineering.aspx>

<http://www.cancer.manchester.ac.uk/>

<http://www.mcrc.manchester.ac.uk/>

<http://www.mhs.manchester.ac.uk/postgraduate/mhs-graduate-school/>

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