Job description and selection criteria

Job title	Researcher in Medical Image Segmentation
Division	MPLS
Department	Computer Science
Location	Wolfson Building, Parks Road, Oxford
Grade and Salary	Grade 7 (Salary: £30,434 - £ 37,394 p.a.)
Contract type	One year fixed term contract
Hours	Full time
Vacancy reference	116878

The University

The University of Oxford is a complex and stimulating organisation, which enjoys an international reputation as a world-class centre of excellence in research and teaching. It employs over 10,000 staff and has a student population of over 22,000.

Most staff are directly appointed and managed by one of the University's 130 departments or other units within a highly devolved operational structure - this includes over 6,500 'academic-related' staff (postgraduate research, computing, senior library, and administrative staff) and over 2,700 'support' staff (including clerical, library, technical, and manual staff). There are also over 1,600 academic staff (professors, readers, lecturers), whose appointments are in the main overseen by a combination of broader divisional and local faculty board/departmental structures. Academics are generally all also employed by one of the 38 constituent colleges of the University as well as by the central University itself.

Our annual income in 2012/13 was £1,086.9m. Oxford is one of Europe's most innovative and entrepreneurial universities: income from external research contracts exceeds £436.8m p.a., and more than 80 spin-off companies have been created.

For more information please visit www.ox.ac.uk/staff/about_the_university.html

MPLS Division

The Mathematical, Physical, and Life Sciences Division (MPLS) is one of the four academic divisions of the University.

Oxford is widely recognised as one of the world's leading science universities. In the 2008 UK Research Assessment Exercise over 70% of research activity in MPLS was judged to be world-

leading (4*) or internationally excellent (3*), and Oxford was ranked first in the UK across the mathematical sciences as a whole.

The MPLS division's ten departments and three interdisciplinary units span the full spectrum of the mathematical, computational, physical, engineering and life sciences, and undertake both fundamental research and cutting-edge applied work. We have over 6,000 students and research staff, and generate over half of our funding from external research grants. Our research addresses major societal and technological challenges and is increasingly interdisciplinary in nature. We collaborate closely with colleagues in Oxford across the medical sciences, social sciences and humanities, as well as with researchers from around the world.

For more information, please visit: http://www.mpls.ox.ac.uk/

Department of Computer Science

The Department of Computer Science was established in 1957, making it one of the longest-established Computer Science departments in the country. It is one of the UK's leading Computer Science Departments (ranked first in a number of international rankings). The Research Excellence Framework (REF) in December 2014 resulted in 74 members of the Department having 53% of their research activity ranked in the top category of 4* (world-leading). Overall, we received an average of 3.34 across the department (3* being internationally excellent). A significant majority of the Department are active in externally sponsored research, with both government and industrial funding. At present there are 69 members of academic staff and almost 100 research staff.

The Department has close links with government, industry, and other departments within the University. Among the latter are Mathematics, Engineering, Physics, Statistics and a number of life sciences departments. The Department is housed across multiple sites within the University's South Parks Road Science area, facilitating strong collaborative links with research groups and institutes in closely allied areas (including the Oxford Internet Institute and the Oxford e-Research Centre). This is an essentially inter-disciplinary activity which is at present attracting major funding from a number of sources. At present the Department holds over £50m in external research contracts.

Research in the Department is currently managed in seven themes:

- *Programming Languages and Software Engineering* (led by Professor Jeremy Gibbons, and including Professor Jim Davies) works on a wide variety of areas including model-driven development, functional programming, and static analysis;
- *Security* (led by Professor Bill Roscoe) specialises in cybersecurity (Professor Sadie Creese leads a new Cybersecurity Centre), protocol analysis, trusted computing, networking, and human-centred computing;
- *Automated Verification* (led by Professor Marta Kwiatkowska) covers probabilistic and software model checking (Professor Daniel Kroening), time and concurrency (Professor Joel Ouaknine, Professor James Worrell, and Professors Roscoe and Lowe), and hardware (Professor Tom Melham);
- *Computational Biology* (led by Professor David Gavaghan, and including Professors Kevin Burrage, Helen Byrne, and Blanca Rodriguez) is one of the world's leading groups building computational models of biological systems, and is particularly well-known for its work on the heart;
- *Foundations, Logic and Structures*, (leader Professor Samson Abramsky) which includes groups working on quantum information and computation (Professors Samson Abramsky and Bob Coecke), game semantics and verification (Professor Luke Ong), and constraints (Professor Peter Jeavons);
- *Information Systems* (led by Professor Ian Horrocks, and including Professors Michael Benedikt, Nando de Freitas, Boris Motik, Georg Gottlob, and Michael Wooldridge) has

groups working on databases, knowledge representation and reasoning, multi-agent systems, and computational linguistics (Professor Stephen Pulman);

- *Algorithms* (led by Professor Leslie Ann Goldberg, and including Professors Paul Goldberg and Elias Koutsoupias) covering computational complexity, algorithmic game theory, and constraint satisfaction.

For more information please visit: http://www.cs.ox.ac.uk/

Summary of the University's Equal Opportunities Policy

The policy and practice of the University of Oxford require that all staff are afforded equal opportunities within employment. Entry into employment with the University and progression within employment will be determined only by personal merit and the application of criteria which are related to the duties of each particular post and the relevant salary structure. In all cases, ability to perform the job will be the primary consideration. Subject to statutory provisions, no applicant or member of staff will be treated less favourably than another because of age, disability, gender reassignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief, sex, or sexual orientation.

Job description

Research topic	Segmentation of medical data from MRI scans
Principal supervisor	Dr. Irina Voiculescu, Department of Computer Science
Co-supervisor	Dr. Élise Pegg, NDORMS
Clinical advisors	Mr. Hemant Pandit DPhil (Oxon), Orthopaedic Surgeon, NDORMS
	Prof. David Murray, Consultant Orthopaedic Surgeon, NDORMS
	Dr. Stephen Mellon, NDORMS
Funding	The John Fell OUP Research Fund

Overview of the role

Hip and knee arthritis affects more than 10 million people in the UK and it causes pain and inflammation as a result of both cartilage damage, and of the eventual bone-on-bone articulation when the cartilage is completely worn away. Imaging techniques to assess the extent of cartilage damage are important to clinicians and researchers to help them plan appropriate treatment for individual patients with arthritis.

Currently within NDORMS (Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences) the shapes of the anatomical structures are found through manual segmentation of CT or MRI slices, which is time consuming and subjective.

The Spatial Reasoning Group within the Department of Computer Science has been working on ways to improve this task. A piece of software has been built (for supporting medical decisions), which can automatically segment and analyse medical images. It works on CT images and uses a novel approach to partitioning 3D volumes of voxels into smaller regions and then analysing those

to identify relevant features (bones, organs and blood vessels). This method has been thoroughly tested on abdominal CT scans, with good results.

The goals of this project are to re–design this software to accurately segment geometry from MRI scans, and to perform the validation and testing necessary to ensure user confidence in the software. Experiments with the underlying library functions indicate that the code can be made to read MRI–format data. However the principles of MRI scans are radically different from CTs, so these processes would require re–designing the feature identification algorithms.

We are looking for an enthusiastic and creative individual to join a team of scientists building a medical image segmentation system to assist clinicians in their pre–operative decision making. This is a highly interdisciplinary project, which will involve close collaboration with surgeons, radiologists and researchers at the Botnar Research Centre, which is based on the orthopaedic hospital site.

Specific responsibilities/duties

- Develop and implement novel partitioning and segmentation algorithms for MRI data
- Develop and implement systematic methods for validating any segmentation results
- Prepare and analyse tissue from porcine, bovine, and potentially human joints for scanning and validation
- (Training will be provided for technique as well as ethical aspects.)
- Contribute documented software to the group library
- Maintain and document the software and data repositories
- Write timely reports on research, and publishing these as papers in leading journals
- Perform demonstrations to clinicians and researchers at NDORMS
- Collaborate with graduate students conducting related research
- Represent the research group at internal and external meetings and seminars
- Strengthen the impact of the research by developing links with potential partners
- Collaborate in the preparation of research publications, and book chapters
- Help write grant proposals in order to extend the lifetime of this project (and this post)
- Carry out any other duties as are within the scope, spirit and purpose of the job as requested by the investigators
- The post holder may have the opportunity to teach. This may include lecturing, demonstrating, small-group teaching, or supervision of masters projects in collaboration with the investigators.

Selection criteria

Essential

- PhD or DPhil (awarded, or near completion) in a relevant numerate discipline
- Strong programming and code documentation skills, preferably C++
- Familiarity with the existing literature and research in image segmentation
- Willingness to interact with porcine, bovine or human tissue samples
- Excellent communication skills
    - Ability to write for publication, present research proposals and results, and represent the research group
    - at meetings
    - Ability to interact with other scientists and clinicians, putting across technical information to researchers in other fields
    - Ability to work in a team
- Ability to manage own academic research and co-ordinate multiple activities to meet deadlines

- Previous experience of contributing to publications/presentations
- Ability to travel between Oxford–based sites
- A genuine interest in the aims of the research programme

Desirable

- Familiarity with the MRI data format
- Experience with UNIX and cross–platform software development
- Experience with version control software
- Expertise in gathering and analysing large volumes of data
- Basic knowledge of the anatomy of the knee and hip joints
- Willingness to assist in the preparation of future research proposals
- Experience of ethical issues on technical projects

Working at the University of Oxford

For further information about working at the University of Oxford, please see:
www.ox.ac.uk/about_the_university/jobs/research

Salary and Benefits

The post, which is a full time appointment, is available for 1 year, has a salary on the University grade 07S scale (currently £30,434 - £37,394 p.a.). This includes membership of the University Superannuation Scheme (USS) and has an annual leave entitlement of 38 days per year (inclusive of all public holidays and university closed periods).

How to apply

If you consider that you meet the selection criteria, click on the Apply Now button on the Job Details page and follow the on–screen instructions to register as a user. You will then be required to complete a number of screens with your application details, relating to your skills and experience. When prompted, please provide details of two referees and indicate whether we can contact them at this stage. You will also be required to upload a CV and supporting statement. The supporting statement should describe what you have been doing over at least the last 10 years. This may have been employment, education, or you may have taken time away from these activities in order to raise a family, care for a dependant, or travel for example. Your application will be judged solely on the basis of how you demonstrate that that you meet the selection criteria outlined above and we are happy to consider evidence of transferable skills or experience which you may have gained outside the context of paid employment or education.

Please save all uploaded documents to show your name and the document type.

Candidates must also ask their referees to consider this job description and email their reference directly to **job19@cs.ox.ac.uk** or, alternatively, post or fax it to: The Administrator, Department of Computer Science, Wolfson Building, Parks Road, Oxford OX1 3QD, such that the reference arrives by, or shortly after, the advertised closing date. All applications must be received by **midday** on the closing date stated in the online advertisement.

Should you experience any difficulty using the online application system, you can contact recruitment.support@admin.ox.ac.uk . To return to the online application at any stage, please use the link www.recruit.ox.ac.uk.

Please note that you will be notified of the progress of your application by automatic e-mail from our e-recruitment system. **Please check your spam filter regularly to ensure that you receive all e-mail.**

Informal enquiries about the position can be made to Dr. Irina Voiculescu (irina@cs.ox.ac.uk) or 01865 283501. An informal visit to the Botnar Research Centre can be arranged for shortlisted candidates, where practical clinical details can be discussed.