THE UNIVERSITY OF MANCHESTER

PARTICULARS OF APPOINTMENT

FACULTY OF SCIENCE & ENGINEERING

SCHOOL OF MATERIALS

RESEARCH ASSOCIATE: A RECONSTRUCTION TOOLKIT FOR MULTICHANNEL CT

VACANCY REF: S&E-12380

Salary: Grade 6 £31,604 to £38,833 per annum depending on experience

Hours: Full time

Duration: Fixed term from 1 September 2018 until 28 February 2020

Location: Manchester

Enquiries about the vacancy, shortlisting and interviews:
Name: Dr Martin Turner
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BACKGROUND

The goal of research project is to develop a new Reconstruction Toolkit for Multi-channel Computer Tomography (RT-MCT). The purpose is to provide novel functionality for reconstructing multi-spectral tomographic datasets. A key goal of this programme will be to find iterative solutions and optimisation strategies to improve robustness of multi-spectral image reconstruction towards low dose imaging, under-sampled projections and various artefacts. In addition to producing a set of multi-channel regularises to improve single-to-noise ratio and resolution of reconstructed images.

One of the most important new products in X-ray detector technology is energy-sensitive detectors. The spectrum of X-rays produced by X-ray sources has always been problematic, as it leads to reconstruction artefacts. Energy-sensitive detectors provide the hardware part of solving this problem, but at present the accompanying mathematical reconstruction methods and software have yet to be developed. This project will bridge this knowledge gap by delivering a software toolkit of suitable reconstruction methods integrated into existing imaging data pipelines.

CT imaging is still in a black and white (1 channel) era, but the recent development of energy sensitive detectors has the potential to revolutionise CT. This project aims to exploit the full polychromatic range of conventional X-ray sources to bring in a new era of tomographic imaging using multiple channels. Multichannel or “colour” imaging has the potential to truly revolutionise materials science, enabling drastically shortened scan times for laboratory-based multichannel X-ray imaging. This project is funded by EPSRC.

JOB DESCRIPTION

Overall Purpose of the Job

You will have a central role in co-ordinating the research project and advancing the programme of work, contributing to both theoretical studies and software deployment. You will be expected to assist some of the major national facilities (IMAT ISIS neutron facility and Diamond Light Source) and laboratory–based systems to adopt and implement this new analytical capability. You will be expected to work with current staff within the Henry Moseley X-ray Imaging Facility (HMXIF) at the University of Manchester where laboratory based “colour” imaging was pioneered. You will be expected to prototype algorithms and verify theoretical hypothesis using proof of concept studies using known solutions, manage the implementation and embedding of successful algorithms in cross platform modules and oversee the deployment of the software to project partners. You will be expected to manage their time and prioritise tasks with minimal supervision, demonstrating a high level of self-motivation and will also be expected to assist in supervision and training of research students involved in the programme.

Key Responsibilities, Accountabilities or Duties:

Professor Wither’s research group is evolving and dynamic, you will therefore be expected to demonstrate flexibility and adaptability to meet its developing needs. The indicative range of duties is expected to include, but is not limited to, the following:

- Develop new reconstruction algorithms for hyperspectral tomography with applications in X-ray and neutron imaging
- Implement reconstruction methods and contribute to development of high-quality user-friendly software for multichannel reconstruction in the Core Imaging Library (CIL)
- Design and develop a set of realistic test phantoms to validate mathematical models of the capability of each type of scanner available at each of the partner imaging centres
- Design and conduct reconstruction experiments with simulated and real hyperspectral tomography data
- Work with lab and synchrotron facilities to embed reconstruction software for use at facilities
- Publish and present methods, software and results in leading journals and conferences

- Able to routinely communicate complex and conceptual ideas to those with limited knowledge as well as to peers using high level skills and a range of media
- To work alongside other members of the CCPi network and to maintain the scientific life of the CCPi
- Contributing to the writing of research proposals, especially those which would maintain the network or augment its capability
- Assisting external users, undergraduates and postgraduates in the application of reconstruction software to their individual projects
- Produce reports and presentations, including contributing to preparing manuscripts for publication
- Assist with supervising PhD and project students in relevant related projects

PERSON SPECIFICATION

Essential:

- A PhD or equivalent in applied mathematics or software development
- Experience of developing algorithms for image reconstruction, ideally focused on computer tomography
- Knowledge and demonstrational experience of scientific software development in one or more of Python, MATLAB, C/C++, CUDA
- Experience of working on synchrotron beamlines or other large scale facilities and laboratory based X-ray CT instruments
- Demonstrable experience of developing novel iterative reconstruction methods for X-ray and neutron tomography
- Demonstrable experience of working on fundamental science with multiple collaborators
- High level of initiative and autonomy with the organisation and time management skills to effectively and efficiently plan and organise activities
- Relevant peer-reviewed publications

Desirable:

- Familiarity with large-scale tomography data sets from lab and/or synchrotron sources
- Experience with convex optimisation theory and algorithms, such as proximal algorithms.
- Experience with inverse problems and regularisation methods, such as sparsity (e.g. Total Variation) regularisation for reduced data reconstruction.
- Experience with mathematical modelling and software version control
- Experience with machine learning techniques
- Experience with materials science applications
- Experience of assisting academic supervisors in the supervision of PhD and Masters level research students