PhD Studentship

At University College London working with ESRF, and part of the Centre for Doctoral Training in Intelligent, Integrated Imaging In Healthcare (i4health)

STUDENTSHIP TITLE: Deep Learning guided Imaging to correlate imaging from a whole organ to cellular level; SUPERVISORS: *Prof. Simon Walker-Samuel, Dr. Claire Walsh; ESRF: Dr Paul Tafforeau*

Project Background

This allows us to better understand the complex structure and function of the human body, as well as to better understand changes caused by disease.

Our new imaging technique is similar to the X-ray CT used widely in conventional medical imaging but uses a synchrotron X-ray source based at the ESRF (European Synchrotron Radiation facility in Grenoble). This X-ray source offers the brightest and most coherent beam in the world, and, coupled to the HIP-CT technique we're developing, allows us to image entire human organs (including lung, heart, brain) with 25µm resolution, and zoom in on cellular structures at ~1.2µm resolution without cutting the tissue. We have imaged human organs in health and disease (Covid-19 victims, see https://mecheng.ucl.ac.uk/HiP-CT)

The large data sets (~100GB) that this technology produces require advanced tools for meaningful interpretation and analysis, and for which we now apply deep learning. Deep learning (DL) has revolutionised medical imaging. It involves training a neural network (NN) to perform a specific image processing task (e.g. segmentation, classification, super-resolution or modality change) with an accuracy that can equal, or even outperform human experts. Successfully training a neural network, in a manner that can be generalised to new, unseen data, depends on having a large, expertly-labelled dataset. For example, for segmentation of blood vessels, manual labelling of HiP-CT data must be performed; for correlation to other modalities, such as histology, the histological images must be registered to the HiP-CT data

This project will initially develop and apply deep learning techniques to segment HiP-CT data (airways, blood vessels, cells, etc.) to enable biological insights to be drawn and for further biophysical simulations. A secondary aim will be to explore more advanced machine learning techniques such as generative adversarial networks, in order to correlate HiP-CT data with images from other modalities (such as histology, lightsheet, MRI and CT). This type of analysis will enable substantially better interpretation of HiP-CT so that it can provide quantitative biological and medical insights.

The PhD project is jointly supervised by Prof. Simon Walker-Samuel, Drs. Joseph Jacob & Claire Walsh (UCL) with Drs. Paul Tafforeau (ESRF). ***You will be based at ESRF***, but spend significant time at UCL.

Person Specification:

Applicants should ideally have a first class undergraduate degree (or equivalent) in Physical Sciences (Computer Science, Engineering, Mathematics and Physics) with a preferred route through any core Engineering discipline (e.g. Bioengineering/Biomedical Engineering, Mechanical Engineering, Chemical, Electrical Engineering, etc.). Knowledge of basic image processing is required and strong computer programming skills are desirable. Excellent organisational, interpersonal and communication skills, along with a stated interest in interdisciplinary research, are essential.

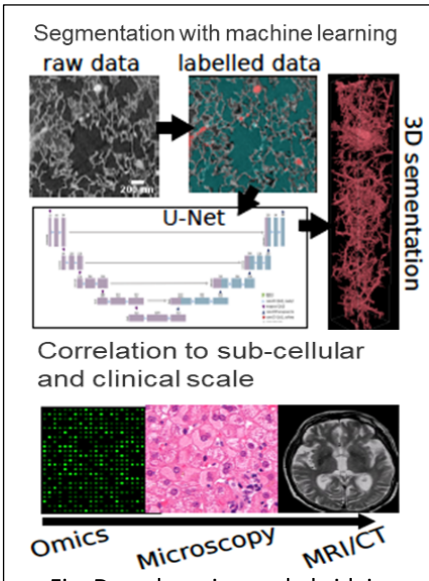

Fig. Deep learning scale bridging from cellular to clinical imaging.

Closing Date and Start Date:

Applications considered on a rolling basis until position is filled. Latest start date available Sept 2021.

Value of award:

Full home student tuition fees and stipend of ca. £17,000 per annum (for up to 3 years, with possible 4th year if required.)

Eligibility:

The position is open to students on Home Fees and applicants whose first language is not English are usually required to provide evidence of proficiency in English by UCL. Please do not enquire about this studentship if you are ineligible. Please refer to the following website for eligibility criteria: https://www.ucl.ac.uk/prospective-students/graduate/research-degrees/mechanical-engineering-mphil-phd

Application Process:

Please send an expression of interest and current CV to Prof Simon Walker-Samuel (simon.walkersamuel@ucl.ac.uk). Further details at ***http://bit.ly/HiP-CT_PhD01***