Swansea University Fully-funded PhD Scholarship 2018/2019

Title: Topological Data Analysis

Project Supervisors:
Supervisor 1: Pawel Dlotko
Supervisor 2: Jeffrey Giansiracusa

Closing date for applications: 28 February 2018

Start date: 1 October 2018

Project description:
As part of the major new Oxford-Swansea-Liverpool Centre for Topological Data Analysis (funded by EPSRC grant EP/R018472/1), we are looking for a PhD student to join the Swansea team in investigating applications of topology to data science and physics.

Our interdisciplinary team will consist of:
- Dr Pawel Dlotko - an expert in applied and computational topology and data analysis.
- Dr Jeffrey Giansiracusa - an expert in topology and tropical algebraic geometry.
- Prof. Biagio Lucini - an expert in computational physics and quantum theory.
- A postdoc with research interests in topological data analysis.
- Multiple PhD students

The precise focus of the project will be adapted to the interests and background of the successful candidate. Potential emphasis could be in one or more of the following: new computational methods in topological data analysis, algebraic/geometric and category theoretic aspects of topology, topological analysis of phase transitions and topological objects in quantum field theory and other systems.

The successful applicant will also be a part of the Swansea Science Doctoral Training Centre, having access to an array of training and networking opportunities.

Background on the Centre for Topological Data Analysis:

Modern science and technology generates data at an unprecedented rate. A major challenge is that this data is often complex, high dimensional, may include temporal and/or spatial information. The "shape" of the data can be important but it is difficult to extract and quantify it using standard machine learning or statistical techniques. For example, an image of blood vessels near a tumour looks very different than an image of healthy blood vessels; statistics alone cannot quantify this difference and the new shape analysis methods are required.

The focus of the work of this Centre is to study the shape of data, through the development of new mathematics and algorithms, and build on existing data science techniques in order to obtain and interpret the shape of data. A theoretical field of mathematics that enables the study of shapes is geometry and topology. The ability to quantify the shape of complicated objects is only possible with advanced mathematics and algorithms. The field known as topological data analysis (TDA), enables one to use methods of topology and geometry to study the shape of data. In particular, a method within TDA known as persistent homology, provides a summary of the shape of the data (e.g., features such as holes) at multiple scales. A key success of persistent homology is the ability to provide robust results, even if the data are noisy. There are theoretical and computational challenges in the application of these algorithms to large scale, real-world data.

The aim of this Centre is to build on current persistent homology tools, extending it theoretically, computationally, and adapting it for practical applications. Our core team is

composed of experts in pure and applied mathematicians, computer scientists, and statisticians whose combined expertise covers cutting edge pure mathematics, mathematical modelling, algorithm design and data analysis. This core team will work closely with our collaborators in a range of scientific and industrial domains.

Requirements:
Candidates must have a strong undergraduate degree (equivalent to a UK first or upper second class honours) or a Masters degree, in a relevant discipline. Informal enquiries before the deadline for formal applications are welcome by emailing Dr Jeffrey Giansiracusa (j.h.giansiracusa@swansea.ac.uk.)

For candidates whose first language is not English, we require IELTS 6.5 (with 6.0 in each component) or equivalent. Please visit our website for a list of acceptable English language tests.

Funding:
This is a three year fully-funded Swansea University scholarship, which covers UK/EU tuition fees plus an annual stipend (£14,553 for 2017/2018 full-time students, updated each year). Additional funding is available to cover costs such as research consumables, training, conferences and travel.

Please note that international (non-EU) students may apply, but a portion of the stipend would have to be used to cover the difference between UK/EU fees and full international fees.

How to apply:
Applicants must complete and submit the following documentation by the stated deadline. To apply for this studentship, please download the research scholarship form at http://www.swansea.ac.uk/maths/postgraduate/phdopportunities/ (click on the link 'How to apply' on the right) and return it to the College of Science with the following:

➢ Academic References – all scholarship applications require two supporting references to be submitted. Please ensure that your chosen referees are aware of the funding deadline, as their references form a vital part of the evaluation process. Please either include these with your scholarship application or ask your referees to send them directly to science-scholarships@swansea.ac.uk

➢ Academic Transcripts and Degree Certificates – academic transcripts and degree certificates must be submitted along with the scholarship application by the funding deadline. We will be using these to verify your academic qualifications.

➢ A recent CV

➢ Applicants should use the 'Supplementary Personal Statement' section of the application form to explain why the award they are applying for particularly matches their skills and experience and how they would choose to develop the project.

Please email the documents to science-scholarships@swansea.ac.uk or post them to:

Recruitment and Marketing Team
College of Science
Wallace Building
Swansea University
Singleton Park
Swansea SA2 8PP