Newcastle University PhD Studentship award

Title
Integration of machine learning and Earth Observations for rapid response to earthquake induced landslides

Value of award
100% of International tuition fees paid

Number of awards
1

Start date and duration
September 2019 for 3 years

Application closing date
8th February 2019

Overview
Landslides represent a major geologic hazard. They are widespread, resulting in hundreds of deaths and billions of dollars of damage every year (Petley, 2012). Landslides are frequently triggered by strong ground motions and they are an important secondary earthquake hazard. Earthquake-triggered landslides can cause severe and persistent damage over large areas and disrupt normal communications. Because survival times for victims can be short in the absence of rescue, it is vital that relief teams receive timely and precise information on the distribution and intensity landslide impacts (Williams et al., 2018). The most commonly used EO data for rapid mapping of landslides is very-high-resolution (VHR) to medium-resolution satellite optical imagery (e.g. Zhuang et al., 2018; Williams et al., 2018). However, optical data is not always useful for rapid mapping applications due to its sensitivity to the presence of clouds. The advantages of satellite radar (synthetic aperture radar or SAR) compared to optical sensors are (I) day and night availability, and (II) its all-weather capability. In most cases, SAR data of a given crisis event is available earlier than cloud-free optical imagery. Hence, a time-effective disaster response is enabled by rapid mapping procedures based on both optical and SAR imagery. The ESA Sentinel-1A and -1B radar satellites became operational in 2014 and 2016 respectively, and are able to provide global coverage every 6 days (Europe and Canada in less than 2 days). The ESA Sentinel-2 optical satellites provide a global coverage of land surfaces with a 5-day revisit time at the Equator. The free, full and open access to ESA’s Sentinel data has been revolutionising the way we work in natural disaster response. This also makes it possible for us to rapidly respond to geohazards using satellite Eos. Yet there remain considerable challenges: SAR data has never yet been used to develop a co-seismic landslide inventory and even using optical data the inventories are generated through time-consuming manual mapping.

However, this dependence on manual feature identification is rapidly changing in many research fields. Machine learning (ML) technologies have been widely implemented in the field of computer science, where statistical techniques are employed to learn specific and complex tasks from given data. Recent studies suggest that ML has the capability to identify signals associated with geohazards from large data sets (e.g. Anantrasirichai et al., 2018; Zhu et al., 2017).

This PhD project aims to apply ML in combination with optical and radar satellite EO techniques to develop an automatic and robust landslide detection system with ESA’s Sentinel-1/2 data.
**Sponsor**
Faculty of Science Agriculture and Engineering and Chinese Scholarship Council (CSC)

**Name of supervisor(s)**
- **Professor Zhenhong Li**, School of Engineering
  [https://www.ncl.ac.uk/engineering/staff/profile/zhenhongli.html](https://www.ncl.ac.uk/engineering/staff/profile/zhenhongli.html)
- **Dr David Milledge**, School of Engineering
  [https://www.ncl.ac.uk/engineering/staff/profile/davidmilledge.html](https://www.ncl.ac.uk/engineering/staff/profile/davidmilledge.html)
- **Dr Jian Qing Shi**, School of Mathematics Statistics and Physics
  [https://www.ncl.ac.uk/maths-physics/staff/profile/jianshi.html](https://www.ncl.ac.uk/maths-physics/staff/profile/jianshi.html)
- **Professor Jieping Ye**, DiDi AI Labs
  [https://medicine.umich.edu/dept/dcmb/jieping-ye-phd](https://medicine.umich.edu/dept/dcmb/jieping-ye-phd)

**Eligibility Criteria**
You must be a citizen and permanent resident of the People's Republic of China at the time of application.
You are expected to have a quantitative background (e.g. mathematics, computing, engineering, geomatics/remote sensing) and an interest in Earth Sciences & Geohazards.

**How to apply**
You must apply through the University’s online postgraduate application system. [Apply here](https://www.ncl.ac.uk/). To do this please ‘Create a new account’. All relevant fields marked with a red asterisk must to be completed.

The following information will help us to process your application. You will need to:
- Insert the programme code **8040F** in the programme of study section
- Select **PhD Civil Engineering (full time) - Geomatics** as the programme of study
- Insert the studentship code **CSC1815** in the studentship/partnership reference field
- Attach a covering letter and CV. The covering letter must state the title of the studentship, quote reference code **CSC1815** and state how your interests and experience relate to the project
- Attach degree transcripts and certificates and, if English is not your first language, a copy of your English language qualifications

**Contact**
[Zhenhong.Li@newcastle.ac.uk](mailto:Zhenhong.Li@newcastle.ac.uk), 0191 208 5704
[http://www.ncl.ac.uk/engineering/staff/profile/zhenhongli.html](http://www.ncl.ac.uk/engineering/staff/profile/zhenhongli.html)