2022 HDR Scholarship – Next-generation soil spectroscopic modelling with explainable machine learning

Status: **Open**
Applications open: 4/07/2022
Applications close: 1/09/2022

About this scholarship

Description/Applicant information

This scholarship is funded by project ‘Next generation soil carbon systems’, funded by the Australian Government, which proposes to develop next-generation measurement and modelling technologies to improve understanding of soil carbon dynamics in terrestrial and coastal marine ecosystems.

Soil carbon connects with ecosystem functions and many UN sustainable development goals. But the dynamics of organic carbon in Australian soils are not well understood. We also do not have quantitative assessments of the carbon storage potential of Australian soils, nor do we know their vulnerability to environmental and anthropogenic change. This Joint Research Centre project will develop next-generation soil carbon systems to measure and understand better soil carbon dynamics in Australia’s terrestrial and coastal marine soils, determine their carbon storage potential and predict their vulnerability to change. Growing this understanding has significant environmental and socio-economic value for Australia. It can help guide climate change mitigation, maintain biodiversity, improve the biological function of ecosystems, improve soil condition, soil fertility, water storage, and productivity.

This scholarship will focus on developing next-generation visible–Infrared (vis–IR; 400–28,000 nm) spectroscopic methods for measuring soil carbon content, carbon composition and other soil properties. The project will involve field, laboratory and computational experiments and will access fresh soil samples, samples stored in archives and continental and large global spectral libraries to develop state-of-the-art algorithms and interpretable spectroscopic machine learning models that are accurate.

Specific task include:

- Participating in field soil sampling, soil sample preparation, soil analytical analysis, and collection of spectra using different spectrometers: miniaturised and portable visible–near-infrared (vis–NIR), benchtops FT-IR mid-infrared (MIR) spectrometers and methods such as Laser Induced Breakdown Spectroscopy (LIBS).
- Developing and implementing algorithms for multivariate data analysis and pre-processing.
- Developing algorithms that enable efficient use of huge spectral libraries for local modelling.
- Developing and implementing machine learning and data fusion for spectroscopic modelling.
- Explore and apply explainable machine learning techniques to generate interpretable spectroscopic models.
- Disseminate research findings through seminars, workshops, and conferences.
- Publish significant research findings.

Student type

- Current Students

Faculty

- Faculty of Science & Engineering
    - Science courses

Course type

- Higher Degree by Research

Citizenship

- Australian Citizen
- Australian Permanent Resident
- New Zealand Citizen
- Permanent Humanitarian Visa
- International Student

Scholarship base

- Merit Based

Value

The scholarship provides a living stipend of $ 28,854 p.a., based on full-time study for a maximum of 3.5 years.

Scholarship Details

Maximum number awarded

1

Eligible courses

HDR student interested in soil science research and in the application of mathematical and statistical methods.

Eligibility criteria

1. Applicants must hold a First or Upper Second-Class Bachelor's degree, or a MSc degree in a related science field (soil science, ecology, agriculture, environment---with emphasis in the application of mathematical and statistical methods), with a Merit and a minimum average grade of 65% and substantial research component.
2. Applicants must be driven and determined to successfully undertake a higher degree program. They must possess ability and confidence to self-manage and execute tasks individually, work well under supervision, be open to feedback and input from others, and ability to collaborate, negotiate, influence, and inspire others.
3. Applicants must demonstrate:

- good understanding of modern, quantitative methods in soil science, especially spectroscopy, multivariate statistical modelling and machine learning including neural networks and deep learning,
- strong aptitude for statistical programming, for example using R, Python,
- fundamental understanding of linear algebra, calculus, and statistics,
- excellent written and communication skills, and
- disposition for scientific communication, writing and publication.

Enrolment requirements

The scholarship is a full-time enrolment. No part time, casual or other allowed.

Progression is subject to passing annual progress reviews.

How to apply

Application process

To apply prepare:

- academic transcripts as per Eligibility Criteria 1.
- a half-page (A4 single spaced) personal statement that demonstrates Eligibility Criteria 2.
- a one-page (A4 single spaced) summary of work that best demonstrates Eligibility Criteria 3.
- curriculum vitae and publications,
- names, telephone number and email of two academic references,

Need more information?

Enquiries

Contact Prof Raphael VISCARRA ROSSEL on +61 467 769 364 or r.viscarra-rossel@curtin.edu

Further information

The Australia-China Science and Research Fund–Joint Research Centre project ‘Next generation soil carbon systems’, funded by the Australian Government. Start date is ASAP.