Development in Africa with Radio Astronomy Big Data Advanced Training Programme UK Prospectus – Round 3 2019-2020

Introduction

We are pleased to announce advanced training opportunities in the form of Masters places at UK universities as part of the Development in Africa with Radio Astronomy (DARA) Big Data project funded by the UK's Newton Fund. The opportunities are open to nationals of all AVN partner countries, namely: Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia and Zambia.

These places are fully funded such that the Newton Fund will cover all tuition fees, bench fees and maintenance allowance at the UKRI recommended level of ~£14,990 per year. Also, costs for an Inbound/Outgoing flight to and from the UK and initial visa and health surcharge costs will be covered by the Newton Fund.

The DARA Big Data project will target the translation of data intensive science skills from radio astronomy (Astro Big Data; AST) to other big data areas such as Food Security & Sustainable Agriculture (AGRI Big Data; ABD) and Health Care (Health Big Data; HBD).

Projects are offered at the University of Manchester.

The 2019/2020 Round

This round of funding can provide for x2 Masters by research places. The projects on offer are described on the following pages. Candidates will be required to apply for the funding from DARA Big Data first and a decision on who to fund will be made by the Newton Project Steering Committee. The selected candidates will then apply as a fully funded applicant to their chosen host university to obtain an actual place on the course. The timetable for the 2019/2020 process is set out below.

Opportunity Announced	18 March 2019
Deadline for applications for funding	**12 April 2019 (23:59 BST)**
Selection of applicants to be funded	26 April 2019 (approx)
Deadline for selected applicants to apply to selected host university	31 May 2019
Start of advanced study	No later than 1st October 2019

We expect that all candidates selected for full funding will obtain a place, but in the unlikely event that this is not the case we will offer funding to the next candidate on the priority list drawn up by the Newton Project Steering Committee.

Eligibility

Applicants for funding must:

- be nationals of one of the AVN countries listed above or resident in one of these countries for at least the past 3 years
- have a good first degree in Physics or a relevant related subject
- satisfy the **English Language** requirements of the host university
- satisfy any other entry conditions of the host university
- preferably undergone the basic training programme of the Newton Project or have similar relevant experience

Application Procedure

You can find all the details including the application form here: www.darabigdata.com

Please complete the DARA Big Data Advanced Programme Application Form to apply. You must include a ranked list of at least two projects from the list below to indicate which projects you are interested in pursuing. All documentation should be received before the deadline for your application to be considered.

Included with your application should be:

- Certificate of your relevant higher education degree
- Transcript of your degree modules/grades
- Two Letters of Recommendation (a template can be found on the website)
- A copy of your Passport
- CV

Please send your application form and all required documents via email to Dr Sally Cooper sally.cooper@manchester.ac.uk. The two Letters of Recommendation can be sent by someone else but should also be sent to this address before the application deadline. Applications with incomplete supporting documents may be rejected. Inquiries can also be made to the UK Principal Investigator Professor Anna Scaife at anna.scaife@manchester.ac.uk.

List of Projects

SBD1: Country(region)-specific science policy/science communication/science diplomacy assessment
Supervisor: Simone Turchetti (University of Manchester)
Co-supervisor: Kieron Flanagan (University of Manchester), David Kirby (University of Manchester)

The elaboration of effective science communication strategies, specific policy measures on research, and innovative schemes to foster international scientific relations are increasingly perceived as decisive to the development of a scientific research infrastructure in many world countries. In this project we ask the student to provide an assessment of one of these key aspects with regards to one country or geographical region of her/his interest. The project will entail the gathering of open quantitative and qualitative data regarding either science communication, science policy or scientific relations in that country/region and will aim to produce an assessment emphasizing main trends, relevant issues and contextual factors informing the current circumstances. Depending on progress, the report may be extended to include specific provisions and recommendations.

AST1: Machine learning for radio astronomy
Supervisor: Anna Scaife (University of Manchester)
Co-supervisor: TBC

Simulating realistic representations of the radio sky at varying resolutions becomes increasingly challenging as radio interferometers increase in both sensitivity and spatial dynamic range. In this project the student will design and implement a deep generative model for different classes of galaxies in radio surveys, with a view to producing SKA-scale survey simulations. The project will work initially with data from the NVSS and FIRST radio surveys and will aim to produce simulated versions of these surveys using a generative model. Depending on progress, this work can be extended to include the development of a generative adversarial network for classification of sources within next generation radio surveys.

ABD1: Using machine learning to track a weed from space
Supervisor: Joseph Fennell (University of Manchester)
Co-supervisors: Rene Breton (University of Manchester), Arne Witt (CABI)

It is projected that food demand will more than double by 2050 due to a growing population. Unfortunately, many invasive species – including weeds, pathogens and insects – are affecting our global food security by affecting the world's agricultural and environmental health and potential. Parthenium is a highly adaptable species of global concern due to its aggressive nature,

establishing itself and expanding rapidly on a wide range of environmental and climatic conditions. It reduces crop yields, poisons livestock and smallholder farmers working in their fields, and reduces biodiversity. The new generation of Earth observation data, including the Sentinel missions, offer the potential to identify and monitor invasive species' presence and spread across the globe. This research project seeks to address food security, livelihoods, and human and environmental health concerns in Kenya by applying remote sensing expertise to the monitoring and mapping of Parthenium, so that it can be more effectively managed by national stakeholders. This project aims to combine field data collection activities with Earth observation analysis techniques. Among other approaches, the scientist involved will utilise UAVs and handheld devices to collect high quality ground reference data. These will be combined with cutting-edge data science techniques such as Bayesian modelling and machine learning to analyse large datasets from multi-band imaging surveys in order to deliver maps for the current extent of Parthenium, helping future efforts to monitor and manage this highly destructive weed.

HBD1: Big Data for better treatments against cervix cancer

Supervisor: Marianne Aznar (University of Manchester, Marianne.aznar@manchester.ac.uk)
Co-supervisors: Gareth Price, Alan McWilliam (University of Manchester)

Cervix cancer is a growing problem in Africa. Thanks for continuous improvements in cancer treatments, such as radiotherapy, many women survive their disease but they can also experience side effects from their treatments. For example, patients can experience considerable gastro-intestinal side effects, bladder inflammation as well as fatigue and weakness.

In this project, we will use Big Data to improve radiotherapy for cervix cancer and minimize side effects. Using large-scale data from over 800 cervix cancer patients, we will correlate the radiation dose to healthy surrounding organs with the risk of developing side effects. We will then show that these data can be used to improve radiotherapy treatments and reduce each patient's individual risk of developing side effects.

This project will combine image processing and recognition techniques, statistics and machine learning along with radiotherapy planning data and clinical patient and tumour characteristics. Briefly, the student will:

- help in the collection of imaging and treatment related data
- use non-rigid registration to normalise all the data to a reference patient anatomy using a method developed and published by our group (McWilliam et al, EJC 2017)
- identify sub-regions related to side effects and, time-permitting, generate new treatment plans to demonstrate the possibility of reducing those side effects in future patients.