Annual Progress Report Scholarships & Fellowships 2016

UID:102314
25 Jan 2017

A. STUDENT/FELLOW DETAILS (Masters, Doctoral and Postdoctoral)

Title	Name	Initials	Surname	Maiden name
Mr	Dugal	DJ	Harris	
ID Number	7511115069089		**Student No.**	17447585
Current Organisation	Stellenbosch University			
Email	dugalh@gmail.com		**Phone/Mobile No.**	0828439679
Degree for which APR is completed			Doctoral	
Date of first registration for this degree/research			2015/02/01 12:00:00 AM	
Anticipated date of completion for this degree/research			31 Dec 2018	
Year of study/research 2017	3rd	**Year NRF funding commenced**	2	

B. SUPERVISOR / HOST OF RESEARCH DETAILS

Title	Initials	Surname	Organisation	
Prof	A	Van Niekerk	Stellenbosch University	
Department	Geography and Environmental Studies			
Email	avn@sun.ac.za		**Phone No.**	0218083101

C. PROGRESS REPORT

1. Research Project Title

Very high resolution remote sensing of carbon stocks in Subtropical Thicket

2. Research Description

There is a need for spatial information, in the form of total above-ground carbon (TAGC) stock and P. afra (Spekboom) canopy cover maps, to support the planning and monitoring of Subtropical Thicket restoration projects in the Eastern Cape and Little Karoo.

This research aims to develop an automated or semi-automated image analysis technique to accurately estimate Spekboom canopy cover and TAGC in pristine and transformed Subtropical Thicket, over large areas. A secondary aim is for the mapping techniques to make use of freely available, uncalibrated, very high resolution (VHR) aerial imagery from Chief Directorate: National Geospatial Information (NGI).

3. Progress to date

Work completed:
- Made improvements to radiometric calibration algorithm and regenerated results (objective 3)
- Conducted work on developing a theoretical basis for radiometric calibration (objective 3)
- Established empirical results supporting assumptions of the radiometric calibration algorithm (objective 3)
- Reworked the existing radiometric calibration chapter with new results into a paper (objective 3)
- Conducted a literature survey of existing feature selection methods for high dimensional redundant data (objective 4)
- Established the value of the novel “feature clustering and ranking” technique. This was done by comparing the stability and accuracy performance against existing feature selection methods using a number of remote sensing data sets (objective 4)
- Completed a draft paper describing the “feature clustering and ranking” method and presenting the results of the feature selection comparison (objective 4)
- Conducted a literature survey of vegetation mapping studies using very high resolution imagery (objective 4)
- Completed a draft paper on the Spekboom canopy cover mapping technique and its application (objectives 4 and 5)
- Conducted initial work to gather and collate data from different sources for carbon stock ground truth (objective 7)
- WWF and other stakeholders were engaged with to co-ordinate future carbon stock research (objective 7)

Notes:
Time frames were adjusted due to additional unplanned work being conducted to improve and extend on the canopy cover mapping (new feature selection comparison, new radiometric calibration theoretical development and results, and associated literature surveys). There were delays due to a spinal injury I suffered and some employment responsibilities (ending in 2015).

Item	Cost
Total	**0.00**

Proposed research plan

Anticipated date of completion of this degree		31 December 2018
Activity	**End Date**	**Start Date**
Revise radiometric calibration paper, "Retrieval of Surface Reflectance from Aerial Imagery" (chapter 2), with new data and results supporting assumptions.	31 Mar 2017	09 Jan 2017
Correct and regenerate feature selection results	28 Apr 2017	03 Apr 2017
Revise feature selection paper, "Feature Clustering and Ranking for Selecting Stable Features from Remotely Sensed Data" (chapter 3), with new results	31 May 2017	01 May 2017
Revise canopy cover mapping paper, "Very High Resolution Mapping of Spekboom Canopy Cover" (chapter 4)	30 Jun 2017	01 Jun 2017
Acquire and calibrate imagery of the Baviaanskloof study area	31 Jul 2017	03 Jul 2017
Conduct Baviaanskloof field trip	31 Aug 2017	01 Aug 2017
Conduct initial carbon stock mapping study	31 Oct 2017	01 Sep 2017
Write paper on Baviaanskloof carbon stock mapping, "Very High Resolution Remote Sensing of Carbon Stocks in Subtropical Thicket" (chapter 5)	15 Dec 2017	01 Nov 2017
Write introductory and concluding chapters (chapter 1 and chapter 6 respectively)	28 Feb 2018	15 Jan 2018

Articles in Refereed/Peer-reviewed Journals

Books

Chapters in Books

Refereed/Peer-reviewed Conference Outputs

Articles in Non-refereed/Non-peer Reviewed Journals

Patents

Description	A method for correcting the digital numbers of aerial imagery to surface reflectance values. A collocated and concurrent, well calibrated satellite image is used as a surface reflectance reference to which the images are calibrated. The relationship between the surface reflectance of the reference image and digital numbers of the aerial images is approximated with a spatially varying local linear model. The method implicitly corrects for atmospheric and coarse-scale bidirectional reflectance distribution function (BRDF) effects and does not require spectral measurements of field sites or placement of known reflectance targets and produces seamless mosaics. [Utility patent]
Application Date	23 September 2016
Application Type	National Phase
Grant Date	01 January 0001
Inventor	Adriaan van Niekerk, Dugal Jeremy Harris
Patent Status	Filed
Registration Country	South Africa

Other Significant Conference Outputs

Products

Keynote/Plenary Addresses

Artefacts

Technical/Policy Reports

Other Recognised Research Outputs

Description	Draft paper on "Feature clustering and ranking". A technique for feature selection in high dimensional, redundant feature spaces.
Other Authors	Harris DJ, Van Niekerk A
Status	Published/produced

Other Recognised Research Outputs

Description	Draft paper on "Retrieval of surface reflectance from aerial imagery by calibration with satellite data". A technique for radiometric calibration of aerial imagery using a concurrent and collocated satellite image as reference.
Other Authors	Harris DJ, Van Niekerk A
Status	Published/produced
Description	Draft paper on "Very high resolution mapping of Spekboom canopy cover". Remote sensing of Spekboom canopy cover using multi-spectral aerial imagery.
Other Authors	Harris DJ, Vlok J, Van Niekerk A
Status	Published/produced