Towards the Automatic Detection of Pre-existing Termite Mounds in Arid Lands using UAVs, Hyperspectral Cameras and Machine Learning Approaches.

Adam Wooler[1], Felipe Gonzalez[2]

[1]Queensland University of Technology, Brisbane, QLD 4001, adam_wooler@yahoo.com.au
[2]Queensland University of Technology, Brisbane, QLD 4001, felipe.gonzalez@qut.edu.au

Presentation preference: Oral

Inclusion in online conference proceedings: Yes

Keywords: Pre-exisisting Termite Mounds, UAVs, Hyperspectral camera, Machine learning

Abstract:
The increased technological developments in UAS combined with artificial intelligence and machine learning approaches have open the possibility of remote sensing large areas of arid lands. Termite mounds (Figure1) are of special value to the Australia landscape. Cleo *et al*, 2011 for instance, found that termites play a significant role in creating dense nutrient patches through the erosion of soil from the aboveground mounds to the soil surrounding the termite mounds. They have also played a significant role in Aboriginal communities, whereby termites have been used for medicines, dietary supplements and mounds for camp fire. Overtime the termite mounds decompose due to weather, rain or termites moving to a new nest. A band of dense green grass, is found around the old termite mounds (Figure 2).

This paper describes the use of UAVs and advanced sensors; a high resolution 50 MP SLR camera and a 270 bands hyper spectral camera, combined with machine learning artificial intelligence approach for the detection of the previous presence of termite mounds in the landscape. We study the use of Support Vector Machine, AdaBoost and Random Forest (Chan and Paelinckx, 2008) for their role in the image classification of pre-existing termite mounds.

We discuss the detection of old termite mounds at two sites of Cape Range National Park ,WA Australia where a variety of patterns and features to be extracted from the digital imagery (Figure 3). In addition a 270 bands hyper spectral camera was utilised in the work conducted to generate information regarding the spectrum for each individual pixel (Figure 4). Bunting et al, 2009, demonstrated that through the use of image texture, vast improvements can be made in the classification of plant species to derive textural information. The digital and hyperspectral imagery are fed into machine learning which has the ability to divide images into different sub levels, with the ultimate aim of simplifying image analysis by minimising user input requirements. The algorithm has the ability to learn the link between vision descriptors and vegetation (Figure 3) . The results illustrates the limitations and capabilities of several machine learning approaches for the detection of pre-existing termite mounds

Figure 1: Existing termite mound

Figure 2: Old termite mound after decomposing

Figure 3: Area within Cape Range National Park, WA with old termite mound's circled

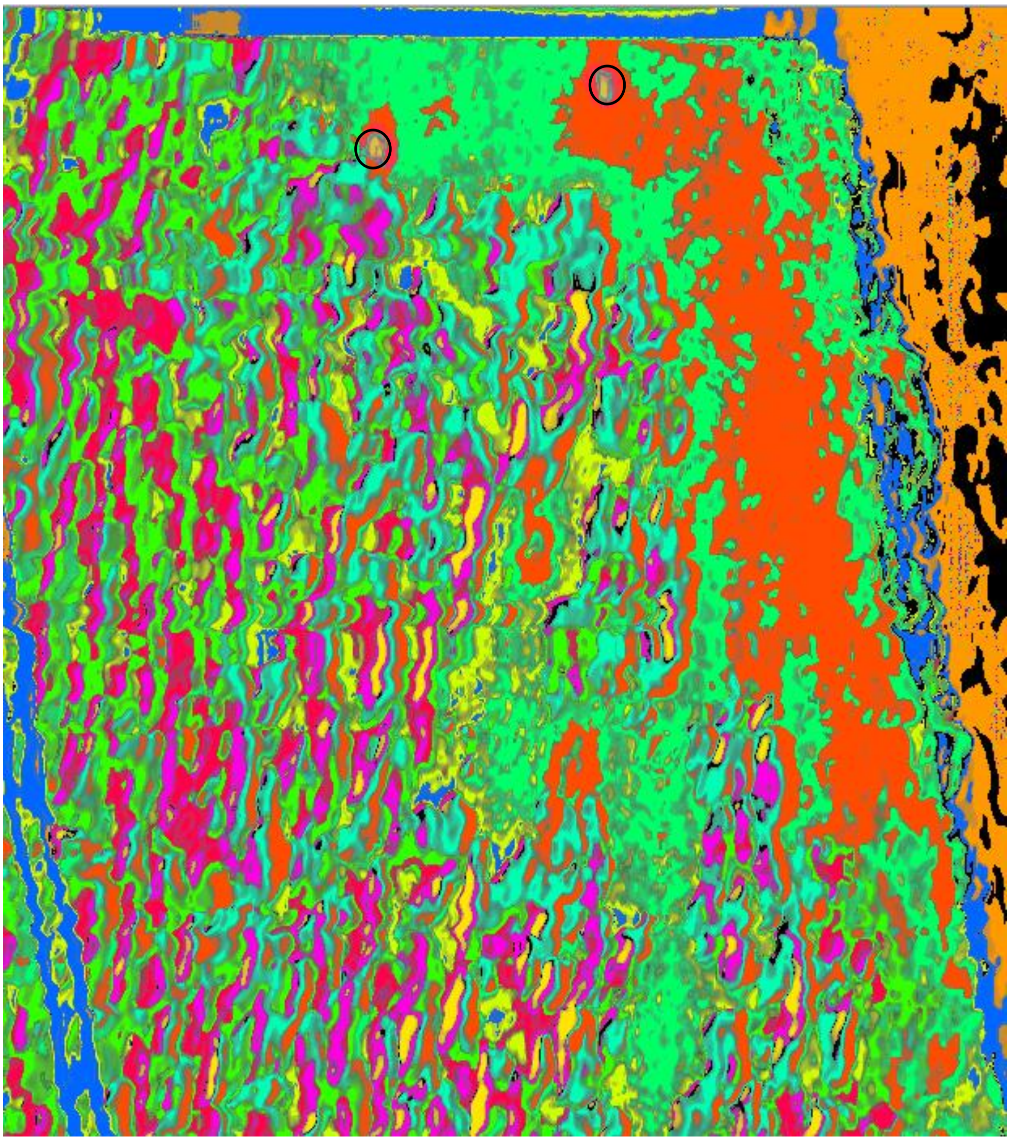

Figure 4: Hyperspectral image with existing termite mounds circled

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