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Detecting Ash Middens using Remote Sensing techniques: a comparative study in Southern Gauteng, South Africa

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List of changes

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Introduction

It was clear from the comments made by the examiners that the use of LiDAR was rather over-emphasised. Rightly so, the focus was to be on the performance of multispectral resolutions in detecting ash middens. As a result, it was decided that the LiDAR component of the MSc be removed for further analysis at a later stage (outside the scope of the MSc).

Examiner 1

Abstract

I would work with the abstract a little more – especially with the first two sentences. The first sentence is vague, and doesn't link up to anything discussed in the report. If you were to explain your thesis to other archaeologists or even your uni friends, what would you say the report is about?

The abstract has been revised considering these comments. The sentences have been changed to make it clear.

Introduction and Literature Review

Introductions can be tough, because you have a lot of ground to cover with introducing new concepts and setting up your argument, but you don't want to go too in depth with the background yet (saving it for the lit review) and the techniques for the methods section. Organization is key, and an outline for the upcoming paper (usually the last paragraph of the intro) can be a really good thing for your reader.
Another quick tip throughout, especially for the lit review: write on the side margins for each paragraph what point you are hoping to make. Remember, you are building up a story.

Rather than listing them here, I have put the majority of my comments in the text. Look at these closely. You'll see what I mean about "building," as they will regularly be comments such as "why is this important?" next to it. You and I know that this is important, but you're going to have to spell it out for the reader. These are the two sections that need the most work, and it'll be the most time intensive.
But, I can guarantee you, revising this will be helpful, and really engage the reader right from the start.
Your thesis statement on the first page and the conceptual framework are strong and clear – well done!
In the Remote sensing in archaeology section (2.2), you'll want to introduce and describe for the reader the remote sensing platforms you will be using (Spot5, Geoeye). I would also add something here about

the availability, cost, pros and cons of each. Make it clear for the reader which they might be interested in from the start!

The introduction has been changed as per the comments on page 1. In the literature review, the candidate has expanded some sections, rephrased others and even removed some to spell out and explain concepts. For example, the section on the description of remote sensing platforms has been expanded according to the comments on pages 9 and 10.

Methods and Materials

3.2.1: Explain why you used the selected bands (what one can pick out with NIR) and especially why the three sets in combination. There should be good literature on this.

The use of bands has been elaborated on page 15.

Results and Discussion

With respect to the data and data analysis, some aesthetic thoughts and content requests. Thicken study area lines on Fig 1, and Figs 2 and 3. In Figs 4-7, I don't love the color of the ash midden vs. the classification layers soil and sws, especially as these often border/surround ash middens. You lose a lot of the smaller midden anomalies in the sea of pink on the bottom of the upper left quadrant of Fig 7 (for one example of a number). To contrast, the red soil layer – which is not an important one – pops well because of the chosen color palette. Remember, you're used to seeing these images a lot, and it's the first time the reader is looking at them. Help them to see, and guide them to find what is important. On that note, substance. The images themselves are indications of the hard work and technical expertise you have gained during the course of your Master's. I know each of those images took many hours to produce. So, talk about them. Describe them more. Again, guide your reader through the images, especially since the reader is likely not going to stare at each figure for 5 minutes trying to read and match details in and among the various classification maps. What is interesting? You have boiled it down to one or two comments in each set, but I want more, especially on this classification bit. The section on the confusion matrix and kappa, and on band combinations are fine in terms of explanation. When you get to the discussion section, add a conclusion sentence(s) at the end of each section. It'll help punch your point, making it very clear what you learned from each of these sets of analyses.

Fig 8 and 9, reverse the MLC and SVM columns on each to be consistent with how you presented the data in the previous figures (where MLC came first on each set of images).
On the LiDAR section, I don't love the opaque polygons over the middens on every image. Can you have one with just an outline, so that the reader can see what these anomalies look like on the original image? Fig12 is pretty, but since it is turned and angled you can't really match it up with 13 and 14.

The study area lines have been made thicker and darker, making it easy to visualize them. The colours have been changed on the maps to make ash middens easily distinguishable and contrast with other land cover types. A much more detailed description and guide through the images has been provided on the last paragraph of page 18. Conclusion sentences have been added to sections about the kappa coefficient and the accuracy assessment on page 23. For example, "As a consequence, adding Mid IR to green and red bands on SPOT increased MLC and SVM accuracy results to go higher than when using NIR with green and red." For LiDAR, please refer to the introduction on page 2 of this document.

Conclusion

You mostly restate your analysis results, which is fine, but you need to broaden this back up to your earlier points. How is this useful for understanding middens in the study area? How is it useful for understanding middens in southern Africa more broadly (can it be done elsewhere? You are the expert now: what is your recommendation?). Are there cost issues, or availability issues for specific regions where you could make a "second best" recommendation? Could it be useful for other features associated with LIA sites? What might it mean for locating more middens, and therefore for our understanding of these societies? How does this contribute to remote sensing techniques in archaeology? What do you recommend for the future? You don't have to address all of these, but consider at least some.

The candidate has addressed the examiner's comments under the conclusion section on pages 30.

Comments on grammar and style

Although I realize there are differences between American English with respect to grammar and structure, the use of transitionals (e.g. moreover, nevertheless) are sometimes overused and interrupts the flow. Remember, you are stating and building an argument. State your sentence (throw it out there!) and insert these things when needed to keep movement. An overuse example from the manuscript, from p.9: It is worth noting that the spatial resolution of satellite imagery can be insufficient to identify and measure objects in their full detail, looking at their shape for instance. This can be a somewhat a problem such as archaeology, for example, where interest lies in the complexity, detail and full context of discovered objects. Spectral measurements therefore…" I've marked a number of these sections in the text. Read the text out loud and see whether the flow seems natural or choppy.
Don't use etc. or "and the like" when making lists: add them, or don't. "This is because" is a phrase you shouldn't use. Say it and mean it.

My biggest comment on the writing style that will improve a finished report is to modify the use of citations. Citations are good things. We need resources to learn from and build our arguments; they back up what we say, and they give credit to ideas, research, and/or methods that are not our own so that others can utilize them as well: in essence, they are a necessary component to academic papers.
However, they do not serve in place of an argument; i.e. a citation does not solve a point, especially when you don't list out what you're hoping to argue (or, even better, what that citation argues that supports the point you are trying to make). This happens repeatedly, particularly in the earlier sections of the report. I have marked them in the text, but to give you a quick example here: "More specifically, in southern African archaeology, remote sensing has inspired and directed scholars to quite comprehensive discussions and conclusions with regards to the people and their settlements (Seddon 1968; Denbow 1979; Mason 1986; Huffman 2007)." You imply that each of these citations is a case study for how remote sensing has led to new conclusions, but without the reader individually reading each of these case studies, they are not sure if your statement here is even true. Give one or some examples of what these might be. Also, if embedded within a more comprehensive paper/book (e.g. Huffman 2007), you're going to need to be specific about page numbers, as the purpose of the Iron Age Handbook was not to prove that remote sensing is a good technique for archaeology.

Be deliberate with the use of your citations. By that, I mean make sure what you are saying is specific enough that it helps build your arguments. Yes, some citations are for general/foundational work (e.g.

Sadier and Rodier 2012, Renfrew and Bahn 2011) or for specific techniques (Parcak 2009, White 2013) rather than a specific case example (e.g. Sadr 2015), but regardless of use, they have to be specific enough to do something. A sentence/citation that does not hit the mark, for example, would be "Hence different satellites record reflected radiation in various parts of the electromagnetic spectrum in somewhat different ways (Woldai 2004)." A statement as general as that would need to be preceded by and/or followed by what types of satellites, what parts of the spectrum, what different ways. I may seem to be a stickler for these small details, but it is going to improve your report immensely.

The candidate has changed the grammar and style where necessary. Page numbers have been included in the citations, especially broad ones where books where used. For example, Moreover, historic records have helped archaeologists identify the presence of Sotho-Tswana groups (from parts of the west) known as the Kwena in the Suikerbosrand (Huffman, 2007: 433).
Phrases such as "etc" and "the like" have been removed. The candidate has made attempts to be deliberate in his writing style by eliminating some words that were overused such as "however".

Specific comments have been addressed in the research report as per examiners comments.

Examiner 2

1. The first aim was to assess the spectral separability of ash middens. This is a bit misleading on what was done in this research. As it stands, it appears as if the one of the research aim focused on the spectral discrimination of different ash midden types or between ash middens and other land cover types, hence I would have expected a field or lab spectral measurements from ash middens and other land cover types and spectral analysis followed in the research to investigate the spectral separability of ash middens. This was not the case here. I suggest to completely remove this from the report.

The aim was removed and another more relevant one was used which looks into multispectral resolutions at high and medium levels. Page 4.

2. The second aim of the study is also a bit misleading since it is emphasizing the use of LiDAR in detecting ash middens, which was not clearly addressed in the methodology and the results sections.

The objectives should therefore be changed to focus only one the use of optical remote sensing data (SPOT and GeoEye) in detecting ash middens.

The second aim was rephrased to focus on multispectral resolutions on page 4.

3. There is a clear evidence of appropriate readings and relevant literature and terminologies. However, the literature review provided a description of ash middens as well as brief touch on application of remote sensing in archaeology. The candidate should have interrogated more on physical and chemical structure and components of ash middens that may contribute to their spectral characteristics and the approaches used in detecting and mapping ash middens as well as the challenges and opportunities of using remote sensing in detecting ash and mapping ash middens.

There are added sections on the literature review under remote sensing in archaeology that look into the opportunities and challenges in using remote sensing platforms that will have an influence on detecting archaeological material. Pages 9 and 10.

4. The candidate indicates that two classification algorithms were used in this study (MLC and SVM). This has not come clearly in the research methodology. You need to provide a general description of the basic principles of these two classifiers and how they handle the remote sensing data.

Principles and distinctions of the two classifiers have been provided on page 14 (last paragraph) and 15 (first paragraph).

5. In the data analysis section the candidate indicates that "LiDAR, SPOT and GeoEye imagery was processed using ENVI" No clear description on LiDAR data process has been provided. The use of LiDAR data is very confusing in study since I haven't seen any specific method for LiDAR data process. This is section must be removed or a clear details method for LiDAR processing must be provided.

Please refer to introduction on page 2 of this document.

6. In general, the candidate was able to generate acceptable results through the use of good data collection and data analysis methods. However, the results section is lacking organizing and clear description. With the current situation, it would be very difficult for the reader to fully understand the results. Please use your research objectives to guide your results presentation and description. Provide a clear description for every single figure. Do not just copy and paste your results.

The results have been re-organized. More descriptions of the results have been added. The first two paragraphs on page 18 first describe the maps and colours of the main features (ash middens and SWS) which help the reader understand the maps.

7. The discussion section is lacking strong discussion that links between the research problems, the research findings and the previous studies. Was the use of remote sensing in detection ash middens successful? You have compared different data and different classification algorithm, which one was more useful? And why? The section could be improved in general organization, removing result description. Citations must be carefully selected. Finally some discussion topic could be deepening to make the research more interesting e.g. what about the limitation of the RS in detecting ash middens.

The questions asked by the examiner have answered in either the discussion section or the conclusion, explicitly. The candidate has made attempts to establish links between the research problems and the discussion.

For example, on page 29 “According to the high user and producer accuracies, ash middens were classified more accurately irrespective of the band combination or platform as opposed to red soil, for example”. This sentence shows that the remote sensing techniques were successful in detecting ash middens, than other targeted features. Also, the last paragraph on page 29 reflects on the limitations of conducting such a study and the results.

Specific comments have been addressed in the research report as per examiners comments.