Statement of Purpose

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1 Background

I have always liked being different. I like being nerdy amongst the cool kids, and cool amongst the nerds supersedes stereotypes and educates everyone. I never knew what I would do when I grow up. I just knew it had to involve mathematics to a large extent. So fast forward, I studied actuarial science at the University of Pretoria and then got a Masters's degree in data science. Between 2015 and 2017, young and full of hope, I worked at Vodafone South Africa as a data scientist in the credit and risk department. It was crazy times, learned a lot, made a huge impact, and won an award in my first year. But the better I got at my job, the clearer it became to me I did not belong there. I quickly found the work too repetitive and boring once automated away. So I left. My Master's research at the university of Pretoria was on comparing adversarial and non-adversarial music-generated music samples. I am a huge music fan. During this period, I got to learn how to use deep learning libraries such as Tensorflow and Pytorch, and learned how to prepare data for different modalities such as audio, text, and images. It was through the work I did in natural language processing and summarization that I got a poster accepted at NeurIPS 2018, where I met Professor Peter Sadowski, who would go on to be my advisor during my Masters's degree in Hawaii.

During my Master's at UH (2019-2021), the game plan was: to take all artificial intelligence classes offered and take at least one class from the core CS competency areas. I enjoyed the software engineering classes (314, 414) designed by Philip Johnson the most. I also enjoyed the advanced AI class taught by David Chin, and the VR and AR class by Professor Jason Leigh a lot. The creative freedom in designing and implementing the final projects was well appreciated. During my masters, a large part of my research with Dr Peter Sadowski was on building machine learning models for large-scale fish stock estimation using a dataset of 1.3 Million fish images belonging to 163 species. In this, all the software engineering skills from ICS314 came in handy: I was writing better code. I found that code repositories that used to intimidate me such as the Detectron2 code base from Facebook, didn't intimidate me anymore. Having worked on: audio, text, and image data, it was during this period I discovered, I want to spend the rest of my Ph.D. working on computer vision.

2 Current and Future Research

In terms of research output since 2019, I have 3 first-author conference papers: (1 accepted, 2 submitted), and 1 coauthor paper in the NLP space submitted to a journal. My current research is centered around active learning algorithms for image data, in the presence of label noise.

My inclination towards this area was inspired by the work I did with Professor Sadowski on fish taxonomic classification and size estimation. Active learning is concerned with the development of learning heuristics that allow the learning to select training samples it is trained on. This is done to ensure only the samples that maximize the model's performance are selected and labeled. This was, we get the best model within our data labeling budget. However, data labeling is prone to human error for a number of reasons, hence the need for noise-robust active learning methods. I am particularly interested in seeing how the current advances in state-of-the-art visual transformers affect active learning on images with noisy labels. Although transformers have surpassed all convolutional neural network-based models on image classification benchmarks, the majority of the active learning literature is still anchored on convolutional neural networks. The reason I picked this area is two-fold, firstly, I have the only copy of the 1.3 Million fish dataset, with noisy labels, and building tools around this specialized dataset would be highly impactful. Secondly, As the world ever more so becomes digital, datasets are likely to grow bigger and noisier, more and more car makers will enter autonomous driving, more and more companies will seek to build in-house image-based document readers, and I would like to be the guy with the best active learning algorithm on noisy labels. I see this as a viable B2B start-up capable of raising venture capital and making an impact, given it is led by experts in the science. I want a Ph.D. in this field because it is intense, and rigorous and will mean I am an expert in my area once all requirements are met. The other reason I want this degree is to someday, be able to retire from industry (hopefully after a $*Xmillion* exit), and teach a course or two at a university. I tend to be good with students, and I like being around them: they still have hope in their eyes.