# Statement of Purpose

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## 1 Background

Born and raised in Lesotho, with a lot of hardwork and substantial luck I found myself studying Actuarial Science at the University of Pretoria. I then then got a Masters's degree with distinction in data science with a research dissertation titled "Comparision of Adversarial and Non-adversarial LSTM Music Generative Models", while at the same time working at Vodafone South Africa as a data scientist in the credit and risk department. I learned a lot, made a huge impact, and won an award in my first year.

For my dissertation at the university of Pretoria, I compared 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 with professor Jan Platos of the Technical University of Ostrava 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 published in proceedings, 1 accepted for publication, 1 submitted), and 1 coauthor paper in the NLP space ongoing for a potential journal submission. I have also been an active reviewer for the following conference venues: (1) Computing Conference 2023, and (2) Future Technologies Conference 2023. My current research under the supervision of professor Kyungim Baek,

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, thus we get the best model within a predetermined 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.

Existing literature in this space relies heavily on medium image datasets and the use of convolutional neural networks. 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. having also written a literature review on this area, it has become evident ther is a need for more standardized evaluation methods for active learning algorithms on noisy labels. The reason I picked this area is two-fold, firstly, I have access to a 1.3 Million fish dataset, with noisy labels that has not been explored, and building tools around this specialized dataset would be highly impactful. Secondly, as the world becomes ever more so 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 contribute towards building the best active learning algorithms 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 likely 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 $X million$ exit), and teach a course or two at a university back in my home country. I like being around students, they are full of exciting ideas and still have hope in their eyes.