Final Project Proposal (Written Form)

**Motivation and Background**

**Question:** *What are the practical applications of swarm intelligence in science, technology and business?*

* Swarm theory implementations can turn traditionally long and confusing code to relatively simple and equally effective code for computational algorithms and AI systems.
* Been used to organize servers and manage network trafficking more efficiently, enable robotics systems to follow a simple set of rules to accomplish a complex task, and optimize current search algorithms.
* Further research into swarm intelligence can improve advancements in science and business from faster and more accurate cancer diagnoses to the efficient delegation of tasks.

**State-of-Art and Challenges**

State-of-Art

* Swarm intelligence is incredibly powerful for optimization problems
* Several solutions and applications from swarm intelligence:
  + Traveling Salesman Problem
  + Spatial Planning
  + Network Routing
  + Image Diagnostics and Healthcare
* Information about pioneering swarm-based algorithms such as ACO and ABC.
* I will use the basic principles of Ant Colony Optimization algorithm to run a simulation of a swarm findings its way through a map (possibly a maze)
  + I will do this using python

Challenges for this project include

* Developing a simplified fitness function and other objective functions to evaluate the best path
* Developing a valid map (maze) that is complex enough to show the intelligent capabilities of the swarm
* Figuring out how to use graphics packages/modules in python.
* Learning some graph theory and possibly some regression analysis

**Ideas and Alternatives**

Ideas re: this project include:

* Simulating an intelligent swarm through a map (or maze)
* Simulating a swarm of ants solving the Traveling Salesman Problem
* Analyzing and compiling the time complexities of various swarm-based algorithms against their traditional counterparts for areas such as:
  + image diagnostics and feature selection
  + network routing
  + clustering and/or data analysis

Alternatives include:

* porting certain aspects of swarm-based algorithms into R for data-analysis purposes
  + I am more comfortable with R
* evaluating other modes of bioinspiration and its relation with computer science and technology
  + novel brain-to-computer interfaces
  + neural networks