**Independent Study - Deep Learning and its Applications**

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**Project Advisor: Mr. Jump**

**Goals**

1. Master concepts in statistics and linear algebra required for deep learning. In my final report, I will briefly describe the concepts in statistics and linear algebra that I’ve learned.
2. Master machine libraries TensorFlow and Keras in Python. Most of the projects will use these libraries. During my final report, I will briefly go over what these libraries are, how they work, and how I used them.
3. Use a basic neural network to solve prediction/classification problems. I will be working with the MNIST handwritten digit dataset. Furthermore, use a Convolutional Neural Network (CNN). Compare the two results.
4. Reproduce a research result of a recent machine learning architecture. Success is defined as achieving a similar loss/accuracy to that of the paper, or prove that a concept in the paper works.
5. Understand the concepts and intuitions behind CNNs (Convolutional Neural Network) and computer vision and successfully implement a CNN on an image recognition problem. Success is defined as following the CNN architecture, the code running, and fine tuning the hyperparameters and architecture to increase the accuracy until no further improvements can be made upon the accuracy on the test set.
6. Successfully implement a sliding window algorithm and understand the idea behind bounding boxes. Apply it to the CNN. Success is defined as the sliding window algorithm working with a CNN model.
7. Using a Generative Adversarial Network.
8. Use a reinforcement learning agent to play a strategy game. I have decided to use the social deduction game “Secret Hitler”. Success is defined as the model performing at around or above human levels.

**Recourses**

* Coursera machine learning course taught by Professor Andrew Ng (Finished)
* Coursera deep learning specification taught by Professor Andrew Ng (5 courses total) (Finished)
* Deep Learning textbook by Ian Goodfellow, Yoshua Bengio, and Aaron Courcille.
* Accompanying lectures found on http://www.deeplearningbook.org/lecture\_slides.html
* Library Documentation of Tensorflow, Keras, Numpy, and other related libraries.
* Academic papers from arxiv.org, and those mentioned in the Coursera courses and the deep learning book. These academic papers will have information on the YOLO algorithm, the LSTM, and many other topics that I need to look up during my research.

**Schedule/Rough plans**

Winter

* Midterm: Outcomes 1, 2, 3, 4,
* End of term: Outcome 5, 6

Spring

* Midterm: Outcome 7
* End of term: Outcome 8

**Final Report**

My final presentation will be a written report and a demonstration of at least one of the programs running.