

## COMP3190 Project Outline

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Topic: Pattern Recognition Powered by Deep Learning

### Overview of Pattern Recognition

- High level overview of 'pattern recognition'
- Why is it important?
- How is it used?

### Non-AI Pattern Recognition Algorithms

- Naïve Approaches
- Analyze time complexity of non-AI algorithms
- History of research done into these algorithms

### Overview of Deep Learning

- What is 'Deep Learning'?
- Deep Learning is a subfield of Machine Learning, explain the difference

### Deep Learning algorithms

- Low-ish level overview of the math/statistics that make deep learning possible
- Overview of the types of algorithms that exist
- What is 'training'?
- Supervised vs Unsupervised training

### Deep Learning Architectures

- Generative
- Discriminative
- Hybrid

### Deep Learning Models

- Autoencoders
- Deep Belief Net

- Convolutional Neural Networks
- Recurrent Neural Networks
- Reinforcement Learning to Neural Networks

Applications of deep learning to detect patterns

- Fraud detection
- Video game cheat detection (VACnet)
- Voice recognition (Siri/Google/Alexa/etc)
- Handwriting recognition

Deep Learning vs ????

- Are there any other algorithms/heuristics/methods that do better than Deep Learning?

False positives

- How to detect them
- How to mitigate them

tough patterns/boundaries/limitations

- Types of patterns that are very hard/impossible to detect via deep learning
- Ways 'bad actors' can circumvent pattern detecting models

Technical implementation details/writeup

Implement a video game cheat detection model based around detecting mouse movement patterns using Deep Learning. The goal is to build a Deep Learning model that will be able to detect whether the mouse/cursor is being controlled by a human or a program.

I plan to try to use Keras (<https://keras.io/>) as a framework for building the model.

The data will be provided by building a simple application that uses the Windows API to track and record mouse movements. I will use this application to record both human and computer generated mouse movements. This data will then be used to train the neural network.

Learning Resources:

"Learning Deep Architectures for AI" By Yoshua Bengio

"Neural Networks and Deep Learning" by Andrew Ng (<https://www.coursera.org/learn/neural-networks-deep-learning?specialization=deep-learning>)

Possible sources:

A. Shrestha and A. Mahmood, "Review of Deep Learning Algorithms and Architectures," in IEEE Access, vol. 7, pp. 53040-53065, 2019, doi: 10.1109/ACCESS.2019.2912200.

Samira Pouyanfar, Saad Sadiq, Yilin Yan, Haiman Tian, Yudong Tao, Maria Presa Reyes, Mei-Ling Shyu, Shu-Ching Chen, and S. S. Iyengar. 2018. A Survey on Deep Learning: Algorithms, Techniques, and Applications. ACM Comput. Surv. 51, 5, Article 92 (January 2019), 36 pages.  
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S. Hussain, R. Saxena, X. Han, J. A. Khan and H. Shin, "Hand gesture recognition using deep learning," 2017 International SoC Design Conference (ISOCC), Seoul, Korea (South), 2017, pp. 48-49, doi: 10.1109/ISOCC.2017.8368821.

K. Kamijo and T. Tanigawa, "Stock price pattern recognition-a recurrent neural network approach," 1990 IJCNN International Joint Conference on Neural Networks, San Diego, CA, USA, 1990, pp. 215-221 vol.1, doi: 10.1109/IJCNN.1990.137572.

Singh D. et al. (2017) Human Activity Recognition Using Recurrent Neural Networks. In: Holzinger A., Kieseberg P., Tjoa A., Weippl E. (eds) Machine Learning and Knowledge Extraction. CD-MAKE 2017. Lecture Notes in Computer Science, vol 10410. Springer, Cham. [https://doi.org/10.1007/978-3-319-66808-6\\_18](https://doi.org/10.1007/978-3-319-66808-6_18)