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. DOI:https://doi.org/10.1145/3234150

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