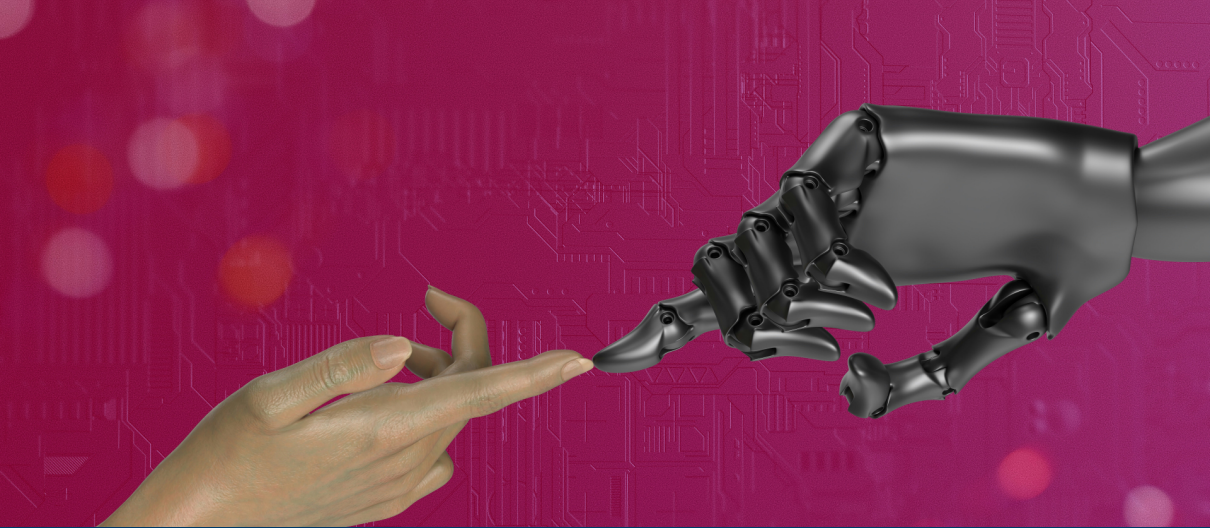




Hands-On Machine Learning

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23. Where Next?

- Congratulations! You have made it through *CS3515 HOML*.
- But what you have studied is just an *introduction* to Machine Learning.
- Assuming you want to deepen your knowledge, what should you study next?
- These slides offer a few ideas.
- They are not intended to be an extra lecture. They are for you to look at in your own time.
- They are not in any way comprehensive.

Visualisation and Statistics

- Visualisation is an interesting field of study in its own right — worthy of further study.
- The study of statistics would add rigour to your knowledge, especially for hypothesis testing and the measurement of statistical significance.

XAI, Bias and Data Ethics

- We had one lecture on each of these.
- But there could have been a whole module on each.

Time-Series and Sequential Data

- We assumed each example was independent of the others.
- This isn't true in time-series data (e.g. daily weather measurements; stock market values) or in sequential data in general (e.g. text, speech, other audio).
- This kind of data needs special preprocessing and special models.

Natural Language

- We looked at bag-of-words — suitable for simple classification tasks.
- But, these days, language processing uses word embeddings, and recurrent neural networks or transformers.
- Transformers are components in Large Language Models, which are themselves components in chatbots and Agentic AI Systems.

Generative AI

- Machine Learning underpins Generative AI.
- How do we build systems that generate text, speech, images, video, code, etc?

Unsupervised Learning and Reinforcement Learning

- We focused on Supervised Learning.
- Our only example of Unsupervised Learning was using Principal Components Analysis for dimensionality reduction.
- Unsupervised Learning includes clustering, anomaly detection and associative rule mining.
- Reinforcement Learning is likely to grow in importance.

Causal Learning

- The Machine Learning that we studied relies on finding correlations.
- Causal Learning shows how to use causal models for more robust Machine Learning.

Deployment

- Deploying models in production systems is challenging.
- As is monitoring them and re-training them in the face of drift.

Large-Scale Applications

- We have not looked at the challenges of Machine Learning at scale.
- How would we handle massive datasets? How would we exploit parallelism? How might we use Federated Learning to delegate some of the processing to edge devices?

Sustainability

- Machine Learning is an environmental threat — consuming large amounts of electricity and water.
- How can we make AI and Machine Learning more frugal?