Machine Learning And Neural Networks (CM3015)

Course Notes

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Contents

Week 1

Key Concepts

- explain the concepts of clustering and dimensionality reduction

- Describe various types of machine learning problem

- Describe various applications of machine learning

1.101 Applications of Machine Learning

Machine Learning is a branch of artificial intelligence that enables machines to learn by example. Carried by the increase in data availability and computational power, we can already experiences applications of machine learning in our everyday lives: mobile phones, personal assistants, language translators, etc.

One application of machine learning are the e-passport gates at some airports which rely on face recognition to identify passengers with high probability.

Computer Vision systems can also be used to detect and classify human posture and facial expressions. Machine Learning can also be applied to other types of data such as text (handwriting recognition) or audio (speech recognition).

These systems collect and process vast amounts of data and the issue of privacy arises. We must be conscious about what data has been recorded, who has access to it, and how it can be used.

Autonomous Vehicles are a focus in machine learning research. They pose interesting and complex challenges both technically and ethically. Vehicles need to be able to detect and avoid pedestrians and other objets on the road. In the case of the accident, who's to blame? The owner of the vehicle? The company who made the car? The software engineers who built the system?

Another common system in our daily lives are recommender systems. We encounter them in streaming services, online shopping experiences, MOOC education providers, and many more. The main goal of these systems is to recommend other items similar to what we have already *consumed*. Because these systems are also used to suggest similar content to what we already watch, they may end up skewing our view of the world.

Generative Machine Learning are models that can generate new data based on a sample, for example given a sample of someone's handwriting, we want to produce more text in the same style.

Another application is related to Sensor-based Activity Recognition. Here the goal is to detect what activity the user is executing (sitting, walking, running, playing footbal) based on the data from sensors the user's wearing.

1.102 Types of ML

Machine Learning is used when we want to learn from data rather than hardcode a solution. There are two types of machine learning

Supervised Learning in supervised learning, the label y is associated with every sample x. We're trying to learning mapping from x to y

Unsupervices Learning here the goal is usually about clustering data in subgroups. For example, given a dataset containing pictures of animals, separate the images by animal.

We can use the decision tree depicted in figure 1 to decide which type of Machine Learning application to apply:
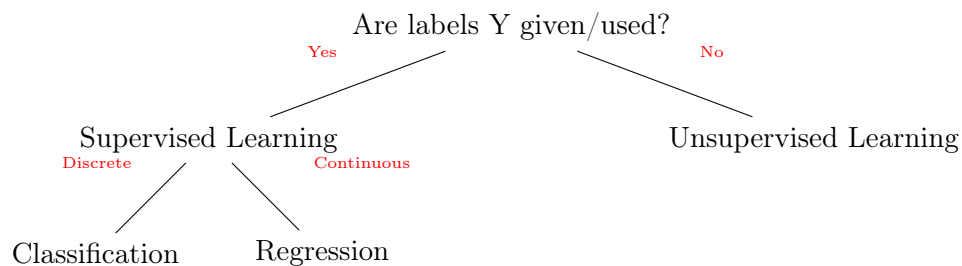

Figure 1: Decision Tree

One final type is Reinforcement Learning where the goal is to learn a sequence of actions that entail some reward. This can be used to teach a machine how to play a specific video game.