

Lecture 3

Machine Learning – Applications

Machine learning is one of the most exciting technologies that one would have ever come across. As it is evident from the name, it gives the computer that which makes it more similar to humans: The ability to learn. Machine learning is actively being used today, perhaps in many more places than one would expect. We probably use a learning algorithm dozens of times without even knowing it. Applications of Machine Learning include:

- **Web Search Engine:** One of the reasons why search engines like Google, Bing etc work so well is because the system has learnt how to rank pages through a complex learning algorithm.
- **Photo tagging Applications:** Be it Facebook or any other photo tagging application, the ability to tag friends makes it even more happening. It is all possible because of a face recognition algorithm that runs behind the application.
- **Spam Detector:** Our mail agent like Gmail or Hotmail does a lot of hard work for us in classifying the mails and moving the spam mails to spam folder. This is again achieved by a spam classifier running in the back end of mail application.
- **Voice Recognition:** Apple's Siri service that is on many iOS devices is another example of software machine learning. You ask Siri a question a question, and it works out what you want to do.
- **Stock Trading:** There are lots of platforms that aim to help users make better stock trades. These platforms have to do a large amount of analysis and computation to make recommendations. From a machine learning perspective, decisions are being made for you on whether to buy or sell a stock at the current price. It takes into account the historical opening and closing prices and the buy and sell volumes of that stock.
- **Robotics:** Robots can acquire skills such as object placement, grasping objects, and locomotion skills through either automated learning or learning via human intervention.
- **Medicine and Healthcare:** The number of startups are looking at the advantages of using machine learning with Big Data to provide healthcare professionals with better-informed data to enable them to make better decisions.

- **Advertising:** Log file analysis is another tactic that advertisers use to see the things that interest us. They are able to cluster results and segment user groups according to who may be interested in specific types of products. Couple that with mobile location awareness and you have highly targeted advertisements sent directly to you.
- **Retail and E-commerce:** Machine learning is heavily used in retail, both in e-commerce and bricks-and-mortar. At a high level, the obvious use case is the loyalty card. Retailers that issue loyalty cards often struggle to make sense of the data that's coming back to them.
- **Gaming Analytics:** Game companies putting machine learning into infrastructure to make the games better. With more and more games appearing on small devices, such as those with the iOS and android platforms, the real learning is in how to make players come back and play more and more.
- **The Internet of Things:** Connected devices that can collate all manner of data are sprouting up all over the place. With the low cost of manufacture and distribution, now devices are being used in the home just as much as they are in industry. Uses include home automation, shopping and smart meters for measuring energy consumption. With the like of Arduino and Raspberry Pi computers, it's relatively cheap to get started measuring the likes of motion, temperature, and sound and then extracting the data for analysis, either after it's been collated or in real time.

Today, companies are using Machine Learning to improve business decisions, increase productivity, detect disease, forecast weather, and do many more things. With the exponential growth of technology, we not only need better tools to understand the data we currently have, but we also need to prepare ourselves for the data we will have. To achieve this goal we need to build intelligent machines. We can write a program to do simple things. But for most of times Hardwiring Intelligence in it is difficult. Best way to do it is to have some way for machines to learn things themselves. A mechanism for learning – if a machine can learn from input then it does the hard work for us.

Goal of Machine Learning

The goal of learning is prediction. The learning problem consists of inferring the function that maps between the input and the output in a predictive fashion, such that the learned function can be used to predict output from future input. Depending on the type of output, supervised learning problems are either problems of regression or problems of classification. If the output takes a continuous range of values, it is a regression problem.

Broadly speaking, the main tasks machine learning is employed for can be led back to the following four goals:

1. **Classification**, that is, given a finite set of classes, deciding to which of them a statistical unit belongs, based on its attributes.
2. **Prediction**, that is, estimating a numerical outcome, based on the attributes of the statistical units (in a sense, classification can be seen as a form of prediction).
3. **Density estimation**, that is, identifying and representing the subsets of the input space where the most part of the input data, and of the underlying multidimensional probability distribution, lies.
4. **Pattern recognition**, that is, reproducing in lower dimensionality the shape and the geometry of high dimensional data (pattern recognition is tightly linked to density estimation).