# Chapter 2: Machine Learning

## 2.1 Introduction

The idea of a computer machine and intelligence began in the 1950 when Alan Turing questioned “Can machine think?” (Turing, 1950).

Machine learning (ML), a subfield of artificial intelligence (AI), is concerned with the construction of computer programs that automatically improve with experience (Mitchell, 1997). It is about making computer modify or adapt their actions so that these actions get more accurate.

The aims of machine learning is to establish procedures, known as learning algorithm, that allow a machine to learn from examples presented to it and to ultimately let machines teach themselves (Bengio, 2016).

Machine learning has led to the development of machines that can learn intelligent behaviour directly from data rather than being explicitly programmed to display such behaviour (Schölkopf, 2015).

Machine learning methods are sometimes called subsymbolic because no symbols or symbolic manipulation are involved (Marsland, 2015).

## 2.2 Machine learning examples in everyday life

Siri: A voice recognition system uses machine learning to help answer questions and make recommendations.

Facebook: A social media service that uses image recognition algorithm to recognised people in photo.

AVG: An antivirus software that uses machine learning to detect malicious software on computer device.

Google: A search engine that uses machine learning algorithm to improve search results and search suggestions.

PayPal: An online payment platform that uses machine learning algorithm to detect fraud.

## 2.3 Machine learning techniques

### **2.3.1 Supervised Learning**

Given training data consisting of example inputs and the corresponding outputs and comes up with a model to explain those data (Schölkopf, 2015).

### **2.3.2 Unsupervised Learning**

### **2.3.3 Reinforcement Learning**

## 2.4 Machine learning algorithms

### **2.4.1 Decision tree learning**

### **2.4.2 Artificial neural networks (ANN)**

Artificial neural networks (ANN) is a type of machine learning method from biology, designed to simulate the way in which the human brain processes information. ANNs gather their knowledge by detecting the patterns and relationships in data (Agatonovic-Kustrin & Beresford, 2000). The basic unit of ANN is neuron. An artificial neuron corresponds to a nonlinear threshold apparatus with multiples inputs and a single output. (Wang & Li, 2008)



Fig 1: Structure of an Artificial neural networks (ANN) (Agatonovic-Kustrin & Beresford, 2000)

### **2.4.3 Deep Learning (DL)**

Deep learning is a form of machine learning that allows computers to learn from experience. It refers to the simulation of networks of neurons that gradually learn to recognised images, understand speech or even make decisions on their own (Bengio, 2016).

### **2.4.4 Genetic Algorithms (GA)**

Genetic algorithm is a global optimization algorithm that introduces the idea of biology genetics, enhancing the adaptability of each individual by the genetic operation mechanism such as selection, crossover, thus simulating the evolution process of natural selection. (Wang & Li, 2008)

## 2.5 Machine learning and games

# Chapter 3:

## 3.1 Introduction

Artificial Intelligence (AI) has been known in the area of computer science dedicated to produce software capable of sophisticated, intelligent, computations similar to those that the human brain routinely performs (Agatonovic-Kustrin & Beresford, 2000).

## Chapter 4 Chinese Chess

## The first computer chess

Deep Blue, developed by IBM, was the first chess-playing supercomputer that beat against world chess champion Garry Kasparov after a six game match in 1997 (Hsu, 1999).

Deep Blue had an impact on computing in many different industries. It was programmed to solve the complex strategic game of chess, thus allowing researchers to explore and understand the limits of massively parallel processing. This research gave developers deeper understanding into ways they could design a computer to tackle complex problems in other fields, using deep knowledge to analyse a higher number of possible solutions (IBM , n.d.).

## Techniques used in modern chess programs

Sequential Game Tree Search

This is a recursive algorithm to compute the min-max value of the root visits every leaf of the search tree.

# References

Agatonovic-Kustrin, S. & Beresford, R., 2000. Journal of Pharmaceutical and Biomedical Analysis. *American Association of Pharmaceutical Scientists,* 22(5), pp. 717-727.

Bengio, Y., 2016. Machines Who Learn. 01 June, 314(6), pp. 46-51.

Gui, W. & Jun, T., 2016. Chinese Chess Algorithm Design and Implementation in the Computer Game. *Proceedings of the 35th Chinese Control Conference,* pp. 10380-10384.

Hsu, F.-H., 1999. IBM's Deep Blue Chess grandmaster chips. *IEEE Micro,* 19(2), pp. 70-81.

IBM , n.d. *Deep Blue.* [Online]   
Available at: http://www-03.ibm.com/ibm/history/ibm100/us/en/icons/deepblue/  
[Accessed 27 09 2017].

Marsland, S., 2015. *Machine Learning: An Algorithmic Perspective.* 2nd ed. s.l.:CRC Press.

Mitchell, T. M., 1997. *Machine Learning.* s.l.:McGraw-Hill Science/Engineering/Math.

Schölkopf, B., 2015. Artificial intelligence: Learning to see and act. 518(7540), pp. 486-487.

Wang, J. & Li, S., 2008. *Representing evaluation of computer Chinese chess by artificial neural network using genetic algorithm.* Yantai, Shandong, China, Chinese Control and Decision Conference (CCDC), pp. 1226-1232.

Yen, S.-J., Chen, J.-C., Yang, T.-N. & Hsu, S.-C., 2004. Computer Chinese Chess. *ICGA Journal,* p. 18.

Yu, W.-G., 2012. Designing a high-performance Chinese chess computer player for middle game position. *Proceedings of the 2012 International Conference on Machine Learning and Cybernetics,* pp. 571-57.