IT2024 Lecture Diary October 11, 2024

October 12, 2024

1 Announcements

(1) Course homepage `https://john.digi-pack.io/IT/IT2024_Fall.html` has been modified. Please check.

(2) Homepage for addition news/information `https://john.digi-pack.io/IT/IT2024_Fall_AI_News.html` has been updated. Please check.

(3) Assignment 02 has been released.

2 Lecture Outlines

(1) The recipients of the Nobel Prize in Physics 2024 are John Hopfield and Geoffrey Hinton, who are pioneers in AI.

(2) Their backgrounds are introduced. Before 1980s, both of them were major in physics. In the 1970s, many physicists were working on AI models.

(3) Brief history of AI research is introduced. Basically, the first hot period of AI research was around 1950s to 1960s. Notable scholars in that period are Marvin Minsky and Frank Rosenblatt.

- Marvin Minsky in his doctoral research, finished by 1954, implemented a electric circuit for a *neural network* with three neurons together with a learning algorithm. This work influenced the later work by Frank Rosenblatt in his work on *Perceptron*.

- Frank Rosenblatt, based upon the ideas from psychology, proposed and built a machine which is able to recognize symbols.

- The models proposed and investigated by Marvin Minsky, Frank Rosenblatt and other scholars in the 1940s to 1950s were influenced by a seminal paper authored by Warren McCulloch and Walter Pitts in 1943 and its title is *A Logical Calculus of Ideas Immanent in Nervous Activity*. In this paper, McCulloch and Pitts laid the foundations for the properties of a network of neurons in which the neuron is defined as a threshold logic function. One important finding is that a network of neurons is able to perform logical operations as a computing machine as introduced by Alan Turing.

- Modelling the property of a neuron as a threshold logic function by Walter Pitts is essentially inspired by earlier works by Sir Charles Scott Sherrington and Prof. Edgar Douglas Adrian. They were the Nobel Prize winners in 1932 for their groundbreaking work on the function of neurons and the discovery on the all-or-nothing law of neural response. In simple words, *a neuron will fire a signal if it has got strong enough excitation.*

- From these, it could see that at least four Nobel Prize winners have contributed to today AI contributions.
- From the middle of 1950s to the middle of 1960s, many researches along this direction had been presented. Many scholars from the fields of electrical engineering, signal processing and control engineering had been involved. Some of these scholars were from UC Berkeley, EE department. They were top scholars at that period of time in electrical engineering.
- The mathematical definitions of many *learning rules* in ideas of the works from Marvin Minsky and Frank Rosenblatt are essentially overlapping with the idea in control theory.
- However, the claim initiated from Frank Rosenblatt on the goal of this *Perceptron*-like researches was *too ambitious*. After some years, additional achievements on these researches were not significant. In the end, research funding for this type of research had been diminished.
- *Perceptron*-like research had almost obsoleted in the end of 1960s till 1970s. This period is now called the AI winter.
- In the earlier 1980s, scholars in UCSD Department of Psychology initiated a collaborative project on the parallel information processing models of human brain. These models might not be biological plausible but these models could mimic certain human behaviors, and/or for human thinking. One participant of this group is Geoffrey Hinton.Eventually, the results obtained from this research group were compiled in three books. Two of them are collections of the research results in form of technical report. The third book includes all the programs for running the computer simulations in the technical reports. These books were published in around 1986.
- Apart from publishing the research results in 1986, the group of researchers organized conference in 1987 to get together scholars from all over the world to exchange their ideas along this line of research. The conference is called *Neural Information Processing Systems* (NIPS). The proceedings of the conference is then published with title *Advances in Neural Information Processing Systems*. No wonder, one participant of this conference is Geoffrey Hinton.
- Starting from the middle 1980s, the researches on the neural information processing systems (resp. models) have been shifted, from (a) mimicking human learning/behaviors to (b) brain-inspired model development for real-world application to (c) model (brain-inspired and non-brain-inspired) development for real-world application to (d) application-oriented model development.
- European Union in 2013 launched a big project called *Human Brain Project*, which is not targeted on application. It is entirely on the understanding and mimicking how human brain works.
- Today, those AI models like ChatGPT and Sora are not brain-inspired models while some developers still claimed that. Strictly speaking, they are not.
- The history of AI research has already been introduced in a lecture note. Find it, read it and get it.

(4) What will you do if your notebook's WiFi connection is off while you have already submitted *Confirm* in paying the product from an online shop? Re-do the purchase steps?

(5) Today, the war of AI tools competition is similar to the war of DOTCOM competition in the 1990s. Which firm(s) will survive?

(6) Introducing Type I and Type II intelligent systems.

- The definitions for Type I and Type II intelligent systems are from John Sum.
- Type I intelligent systems refer to those systems their models are *brain-inspired models.*
- Type II intelligent systems refer to those systems which are application-oriented. They are essentially not *brain-inspired.*

(7) Introducing processor architectures. Today, some processor developers like AMD and Intel have designed their own processor architectures.

  - Those architectures are patented and are the intellectual properties (IPs) of the developers.
  - Apart from AMD and Intel, ARM (an UK-based processor developer) and Nivida have also been designing their processor architectures.
  - Clearly, those architectures cover the designs for CPU, GPU and other modules.
  - ARM Holding is an processor architecture developer which licenses their architectures to other processor development firms.
  - Apple, Google and HiSillicon are three of them.

(8) Discussions on the survival of Intel.

(9) Please do not access your smartphone during the lecture. If you need to do so, please be excuse. Access your smartphone outside the lecture room. I do not want to be disturbed by your phone accessing behavior.