

Udacity Artificial Intelligence Nanodegree

Project – Development of Artificial Intelligence

Research Review

Instruction: Write a one-page report on three of these developments, highlighting the relationships between the developments and their impact on the field of AI as a whole.

According to Oxford Living Dictionaries [1], artificial intelligence (AI) can be defined as the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. Simply speaking, it is the intelligent reasoning and decision-making by machines.

In 1950, Alan Turing established the idea of artificial intelligence by speculating about the possibility of creating machines that think. In [2], Turing test (or Turing's test) was proposed. After posing some written questions, if a human interrogator cannot tell whether the written responses come from a person or from a computer, then the computer which provides the response passes the test [3]. As one can imagine, the computer has to be intelligent enough in order to imitate any human response, and has to be capable in the areas of natural language processing, knowledge representation, automated reasoning and machine learning, among fields in AI. The famous Turing test was later extended by Jim Gray in 2003 to speech understanding, speaking and recognizing objects and behavior [4].

Modern AI consists of the following areas: reasoning, knowledge representation, planning, (machine) learning, natural language processing, (vision and speech) perception, motion and manipulation (of robotics) and social intelligence [5]. In the following, the development of 1) machine learning, 2) natural language processing and 3) motion and manipulation are highlighted and analyzed.

Machine learning (ML) is defined as the capacity of a computer to learn from experience, i.e. to modify its processing on the basis of newly acquired information [6]. It grew out of artificial intelligence that machines attempted to learn from data. The exemplary algorithm in machine learning, neural network, was designed to mimic how a human being thinks. Later on, machine learning was successfully applied to solve practical problems in academia and industry in 21st century, especially when modern machinery is capable of storing and processing data of very big size, better known as big data. There are three kinds of learning in machine learning – supervised, unsupervised and reinforcement learning.

Natural language processing (NLP) can be defined as the application of computational techniques to the analysis and synthesis of natural language and speech [8]. With NLP, machines can understand, organize and structure knowledge in human language in order better perform task a human can do such as summarization, translation, sentiment analysis and topic segmentation [8]. Well-known examples include Siri, an intelligent personal assistant available in most of the apple's product, and Amazon Alexa, another intelligent personal assistant developed by Amazon. These intelligent personal assistants aim at taking questions from a human being, interpreting them and providing appropriate response to the human being.

Motion and manipulation is closely related to robotics. A human being is able to handle tasks such as object manipulation and navigation [9], and so as the goal of developing robotics. Boston Dynamics successfully developed Handle, a research robot which operates in wheels and legs and can pick up heavy loads with speed and balance. A success robot has to be able to understand the surrounding visually, figure out how to move from one point to another, execute the movement and perform any associated task, if any.

The relationship between these fields is simple – to mimic what a human being thinks and acts. With NLP and ML, a system that can better understand language can be built. With ML and robotics, the robot can better plan the movement or action as desired by utilizing the algorithms in ML such as prediction between distances. With NLP and robotics, intelligent personal assistant can be developed. The end goal of all these goals would thus be amazing – machine imitation of a human being in every way as one can image – from movement to thinking, from reasoning to emotion, and much more.

Reference:

- [1] https://en.oxforddictionaries.com/definition/artificial_intelligence
- [2] Turing, Alan M. "Computing machinery and intelligence." *Mind* 59.236 (1950): 433-460.
- [3] Russell S, Norving P. *Artificial Intelligence*. 3rd ed. New Jersey: Pearson; 2010.
- [4] Gray, Jim. "What next?: A dozen information-technology research goals." *Journal of the ACM (JACM)* 50.1 (2003): 41-57.
- [5] https://en.wikipedia.org/wiki/Artificial_intelligence
- [6] https://en.oxforddictionaries.com/definition/machine_learning
- [7] https://en.oxforddictionaries.com/definition/natural_language_processing
- [8] <http://blog.algorithmia.com/introduction-natural-language-processing-nlp/>
- [9] https://en.wikipedia.org/wiki/Artificial_intelligence#Motion_and_manipulation