



When Machines Think for Themselves

Zach Etier and Dr. Jacob

The Oklahoma Louis Stokes Alliance for Minority Participation, 19th Annual Research Symposium



Introduction

Artificial intelligence is an exciting new field, which has the capability of drastically improving our daily lives. You may be wondering what artificial intelligence actually is. Artificial intelligence is the ability for computers to reason, learn, communicate, and interact with its environment with very little human input. As of 2013 there have been many exciting advancements in artificial intelligence such as Deep Blue, Siri, Wolfram Alpha, and Watson (Pictured Below). One of the remarkable feats of Watson, is the fact that it beat some of the top jeopardy players. Without smart AI, a machine doing well in jeopardy would be next to impossible. This is because Jeopardy has many questions that have subtle analogies, puns, and allusions all of which requires advanced reasoning.



IBM's Watson competing in jeopardy.

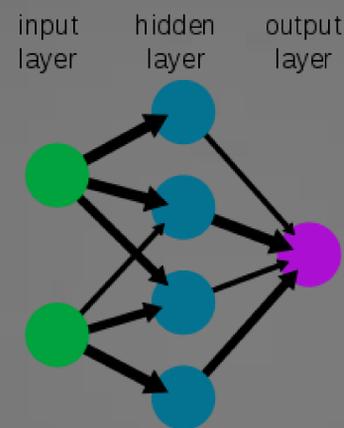
How it Works

To say artificial intelligence is a challenging task, would be a severe understatement. One of the major problems with artificial intelligence advancement today, is the fact that we know very little about our own intelligence. One of the stipulations of artificial intelligence is the ability for a machine to logically learn on it's own. This requires the machine to come to conclusions based on incomplete information. Because of this, artificial intelligence operates on an probabilistic spectrum. Information is constantly weighed and checked for utility. The information that is less likely to be relevant is thrown out, and the highly relevant information is what remains. Many critics of artificial intelligence claim that this method is not truly learning. However it can be argued that our brains operate in similar fashion, always throwing out irrelevant information and placing statistical value on every information we come in contact with.

Neural Networks

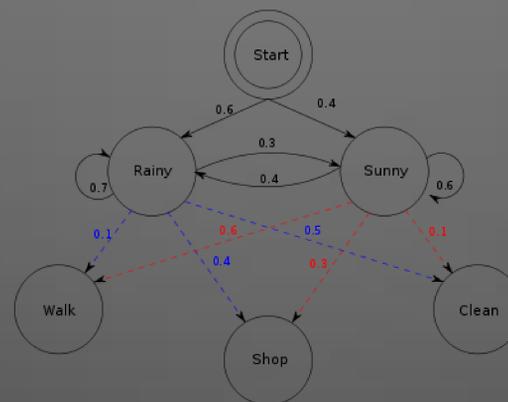
Neural Networks are a model used for artificial intelligence. They work in similar fashion as biological neurons. Connections between information nodes are given weights. When a connections weight is positive it's said to be an stimulating or excitatory connection. When a connections weight is negative it's said to be a inhibitory connection. After all information has been processed, all the connections are summed together, and an output algorithm defined by the programmer performs actions based on the sum of the connections. One of the main criticisms of neural networks is that the connections between information nodes are hardwired, they cannot change. A picture of a simplified neural network is given below.

A simple neural network



Hidden Markov Models

A Hidden Markov Model (HMM) is a very advanced method for artificial intelligence to use in recognizing patterns. HMM use the probability of events based on hidden variables to determine the output that most likely will occur. An example is given below.

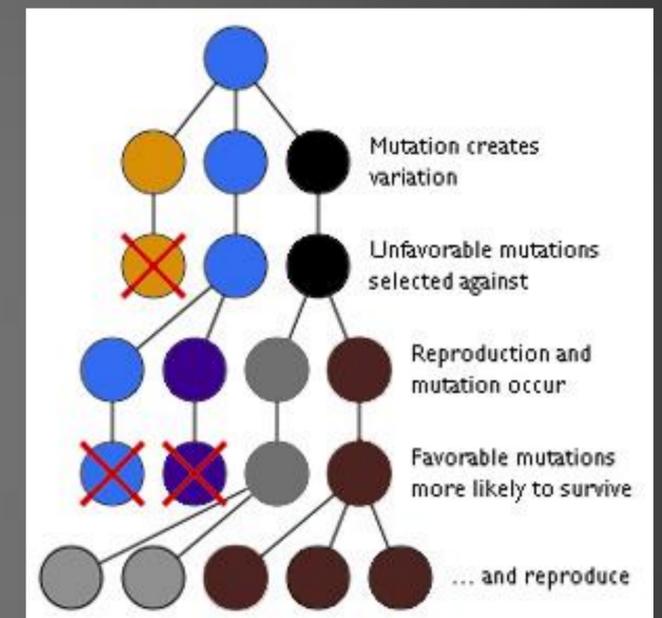


Hidden Markov Model Example

Lets say you have a friend that likes to go shopping, walking, or cleaning solely based on the weather. However you never know what the weather is like where your friend lives. Using the Hidden Markov Model above you could determine what the weather was like based on what your friend was doing.

Genetic Algorithm

Genetic Algorithms (GA's) are algorithms that closely mimic natural selection. GA's take in information and compartmentalize the information into different segments, the algorithm then creates solutions based on different mixtures of these segments. The solution is analyzed and compared with other solutions and ranked. The solutions that have the best results are continually mixed with other solutions until a desired level of optimization is achieve. GA's are very useful in finding optimized solution, or in search problems.



Applications of AI and Aircraft

Now that we know a little bit about AI, lets talk about the applications pertaining to aircraft. As of 2013 artificial intelligence is being used in flight simulators. AI helps simulate the real world and events that "might" happen in a pilots career. This is not only a cool feature, but one that is helping equip pilots with skills that may one day come in handy.

Another application of AI is being used in aircraft is in autopilot systems. The cockpit can be a busy place, because of this, pilot error can come into play. Artificial intelligence helps reduce these errors by not allowing pilots to push aircraft push their limits, limits such as overstressing a structure.

References

- [1] Kurzweil, Ray. *How to Create a Mind*. New York, 2012. Penguin Books.
- [2] Kurzweil, Ray. (2005). *The Singularity is Near*. Penguin Books.
- [3] Penrose, Roger (1989). *The Emperor's New Mind: Concerning Computer, Minds and The Laws of Physics*. Oxford University Press.