Introduction to Artificial Intelligence & Machine Learning

By Sunil Ghimire - "**Do your best & god will do rest**"

1. Artificial Intelligence

Artificial intelligence can be interpreted as adding human intelligence to a machine. Artificial intelligence is not a system but a discipline that focuses on making machines smart enough to tackle the problem as the human brain does. The ability to learn, understand, imagine are the qualities that are naturally found in Humans. Developing a system that has the same or better level of these qualities artificially is termed Artificial Intelligence.

2. How does Artificial Intelligence work?

| Can machines think? – Alan Turing, 1950

Less than a decade after the Enigma Nazi encryption machine was destroyed and the Aliens Forces win Second World War II, Alan Turing, a mathematician, changed history a second time with the straight forward question: "Can Machine think?"

The fundamental purpose and vision of Artificial Intelligence (AI) were developed by Turing's Paper "Computing Machinery and Intelligence" (1950), and its subsequent Turing Test.

At its root, AI is the computer science branch that seeks to answer Turing's question in the affirmative. In computers, it is the effort to imitate or mimic human intelligence. My questions and controversies have been brought on by the expansive purpose of AI. So much so that there is no widely agreed single description of the field.

The key drawback of describing AI as essentially "building machines that are intelligent" is that it doesn't really describe what artificial intelligence is? What makes a machine smart/intelligent?

Authors Stuart Russel and Peter Norvig address the topic in their pioneering textbook Artificial Intelligence: A new approach by unifying their work on the subject of intelligent agents in computers. ***With this in mind, AI is "the study of agents that receive precepts from the environment and perform actions." (Russel and Norvig viii)***

Norvig and Russell go on to discuss four separate methods that have characterized the field of AI historically.

a. Thinking humanly
b. Thinking rationally
c. Acting humanly
d. Acting rationally

The first two ideas involve mechanisms of thinking and logic, while others deal with actions. In particular, Norvig and Russell concentrate on logical agents that act to obtain the best result, noting "all the skills needed for the Turing Test also allow an agent to act rationally". (***Russel and Norvig 4***).

AI is defined by Patrick Winston, MIT's Ford Professor of artificial intelligence and computer science as "algorithms enabled by constraints, exposed by representations that support models targeted at loops that tie thinking, perception and action together".

While these concepts of AI can sound vague to the ordinary person. But, in the area of computer science, they help and provide a blueprint for the infusion of computers and systems with machine learning and other artificial intelligence subsets.

DataRobot CEO Jeremy Achin initiated his speech while addressing a crowd at the Japan AI experience in 2017 by providing the following description of how AI is used today:
"AI is a computer system able to perform tasks that ordinarily require human intelligence... Many of these artificial intelligence systems are powered by machine learning, some of them are powered by deep learning and some of them are powered by very boring things like rules."

3. How is AI used?

Generally, artificial intelligence comes into two broad categories:

A. **Narrow AI / Weak AI**: This kind of artificial intelligence, often referred to as "Weak AI" works in a small sense and is a human intelligence simulation. Narrow is always incredibly well focused on completing a single task and although these types of AI can appear smart, they work under much more restrictions and constraints than even the most common human intelligence. According to a 2016 report released by the Obama Administration, "Preparing for the future of

Artificial Intelligence, ” states that narrow AI has significant Societal benefits and has contributed to the economic validity of the nation.

Some of the few examples of Narrow AI include:

a. IBM’s Watson
b. Self-driving Car
c. Object recognition software (Example: Face Recognition)
d. Siri, Alexa, and other Personal assistants (Example: Ecommerce Chatbot)
e. Google Search

B. **Artificial General Intelligence (AGI) / Strong AI:** AGI, also referred to as “Solid AI”, is the sort of artificial intelligence that we see in films, such as Data from Star Trek or Westworld: The Next Generation Data. AGI is a general intelligence system and it can use its intelligence to solve any problem, just like a human being.

4. Machine Learning

Machine Learning is a subset of AI. That is, all machine learning counts as AI, but not all AI counts as Machine Learning. Machine Learning refers to the system that can learn by itself. ***Machine Learning is the study of computer algorithms and statistical models that allow computer programs to automatically improve through accuracy.***

“Machine Learning is the tendency of machines to learn from data analysis and achieve Artificial Intelligence.”

Machine Learning is the science of getting computers to act by feeding them data and letting them learn a few tricks on their own without being explicitly programmed. Machine Learning can be further classified into three types:

A. **Supervised Learning**: Supervised means to oversee or direct a certain activity and make sure it is done correctly. In this type of learning the machine learns under guidance. So, at school or teachers guided us and taught us similarly in supervised learning machines by feeding them label data and explicitly telling them that this is the input and this is exactly how the output must look. So, the teacher, in this case, is the training data.

a. Linear regression
b. Logistic Regression
c. Support Vector Machine
d. Naive Bayes Classifier
e. Artificial Neural Network, etc.

B. **Unsupervised Learning**: Unsupervised means to act without anyone's supervision or without anybody's direction. Now, here the data is not labeled. There is no guide and the machine has to figure out the data set given and it has to find hidden patterns in order to make predictions about the output. An example of unsupervised learning is an adult-like you and me. We do not need a guide to help us with our daily activities. We can figure things out on our own without any supervision.
    a. K-Means Clustering
    b. Principal Component Analysis
    c. Generative Adversarial Network, etc.

C. **Reinforced Learning**: Reinforcement means to establish or encourage a pattern of behavior. It is a learning method wherein an agent learns by producing actions and discovers errors or rewards. Once the agent gets trained it gets ready to predict the new data presented to it.

Let's say a child is born. What will he do? But after some months or years, he tries to walk. So here he basically follows the hit and trial concept because he is new to the surroundings and the only way to learn is experience. We notice the baby stretching and kicking his legs and starts to roll over. Then he starts crawling. He then tries to stand up but he fails in doing so for many attempts. Then the baby will learn to support all his weight when held in a standing position. This is what reinforcement learning is.

5. Difference Between Machine Learning and Artificial Intelligence

a. Artificial Intelligence focuses on Success whereas Machine Learning focuses on Accuracy.
b. AI is not a system, but it can be implemented on systems to make systems intelligent. ML is a system that can extract knowledge from datasets.
c. AI is used in decision making whereas ML is used in learning from experience.
d. AI mimics human whereas ML develops self-learning algorithms.
e. AI leads to wisdom or intelligence whereas ML leads to knowledge or experience
f. Machine Learning is one of the way to achieve Artificial Intelligence.

"Happy Math, Happy AI"

☺ Thanks for your time ☺

What do you think of this "**Introduction to Artificial Intelligence and Machine Learning**"? (Appreciation, Suggestions, and Questions are highly appreciated).