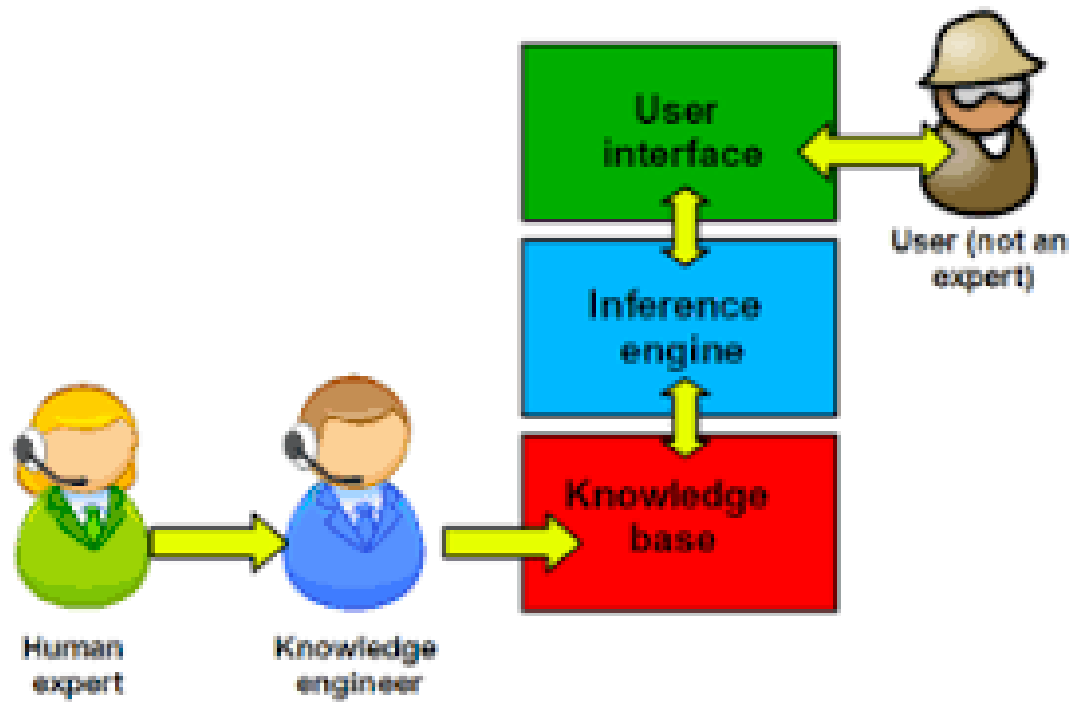


ML is a subset of AI, DL is a subset of ML.

AI stands for artificial intelligence. Artificial intelligence is the ability of a computer or computer-controlled robot to perform tasks that are commonly associated with the intellectual processes characteristic of humans, such as the ability to reason.

Intelligence is made of pattern recognition(coding or puzzle solving), creativity, imagination, emotional intelligence. AI is a subset of actual intelligence (the intelligence we human beings have). We are trying to create such an intelligence that behaves like us but it's actually very difficult. So we people go to the specific part and that is pattern recognition. Most of the AI stuff we go through is related to pattern recognition. We can't go for creativity and imagination, because that is hard to quantify(Because emotion or creativity cant be measured). Pattern recognition is quantifiable and measurable. In the 50s, Alan Turing and others started thinking about whether we can put artificial intelligence into machines or not. On that point, some systems were made which were intelligent. The wave of AI in that time is called "Symbolic AI". In symbolic AI, you make a big knowledge system using if-else conditions. Those symbolic AI's led the path of expert systems. If you play chess against a computer, then this type of system is called an expert system. Where we extract knowledge from an expert, convert it into code, and then we play chess against that code.

In an expert system there is a knowledge base where we take it from the expert and there is also an inference engine and this engine makes decision from that knowledge base.



In the 80s, everyone thought that an expert system is the future of AI and AI is synonymous with an expert system. But later people realized, expert systems have some flaws. Expert systems work on very closed problems or specific problems like playing chess, lung cancer detection for medical purposes. If you give an expert system a fuzzy problem, like detecting dogs in an image, then this is so hard because there are so many breeds of dogs. Voice recognition is also hard. For those hard problems, expert systems were not applicable.

Then came machine learning which has solved those problems. Technique to learn patterns in data is called ML. Difference between ML and symbolic AI is that in ML, we don't do explicit programming or logic based programming. ML model creates mathematical patterns or rules from given input and outputs. In ML, you don't have to write rules, the system will generate the rules, you just have to give the correct data. For example, to find a dog in an image, the system will automatically try to find an underlined representation of the data (this is called pattern learning or

pattern recognizing). If you give the system a lot of pictures, it will eventually be ready to classify whether a given image has a dog or not. So rather than writing rules, you will provide data and rules will be generated automatically. This has changed the industry.

Let's discuss deep learning in two parts. Deep learning is basically a class of algorithms. First of all it is machine learning, it is not different. Same procedures are used in deep learning as it is used in machine learning. Just the algorithms used here are different. Deep learning is inspired by our biology. But we can't say that a deep learning algorithm works the same way as our brain works. Deep learning is a mathematical model. The core or smallest unit of deep learning called perceptron that is based on biological demand. That is why it is a biological correction.

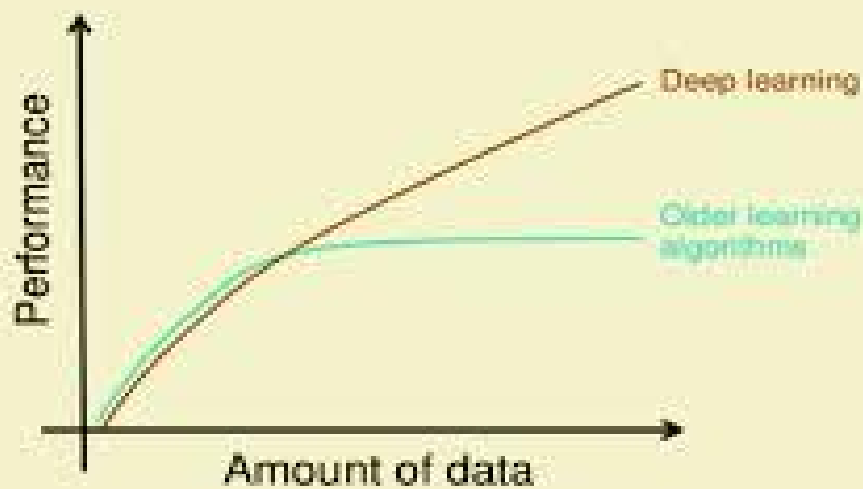
Why is DL famous?

There are certain things that ML can't do that efficiently. In ML, you have to provide features in inputs. Like you have to classify dogs and cats in an image, then you have to specify and define the features differently. Dogs have different features and cats have different features.

But in deep learning, these features are created or detected by the system automatically. If you are working on fuzzy logics where you don't know what type of features can exist, deep learning can be useful.

Suppose we are working with a system where after seeing the resumes we will predict if job placement will happen or not. In ML, you have to give features and give the specific data. But you can give data only when you have knowledge about them. If you are working with DL, then you have to give only raw text and the model will automatically create features. In DL, you don't have to be concerned with features. If you add new layers of neurons in DL, the classifications or regressions become better, the efficiency of the system and the power of prediction of the system increases. Because with the help of each layer, you can find out what is hidden in the inside of the data. Machine learning model's performance increases by giving more data, but after a certain point it is stabilized. But a deep learning model's performance always increases if you give it more data.

Why deep learning



How do data science techniques scale with amount of data?

DL is used in these tasks: image classification, text related tasks.

Why should we use ML when we have DL?

Where a glass of water is needed we won't use a water tank there.

We use DL on big data. We use ML on small data.