VISIT

THE WORLD OF MACHINE LEARNING

SO YOU WON'T MISS THE ADVENTURE

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From AI to Deep Learning

20+ Real world Applications

How top tech companies are using AI?

IN JUST 10 PAGES

VISIT DAY 1/2

Introduction to Machine Learning

Objectives

- What is machine learning?
- Differences between AI, machine learning Vs Deep Learning?
- Why we should learn machine Learning?
- What are different types of machine Learning?

What is Artificial Intelligence (AI)?

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions.

What is Machine Learning?

Machine learning is a subset of artificial intelligence (AI). It is focused on teaching computers to learn from data and improve with experience (accuracy) – instead of being explicitly programmed to do so.

> *Machine Learning is the science (and art) of giving computers the ability to learn and make decisions from data without explicitly programmed.*

What is Deep Learning?

Deep Learning is a subfield of machine learning concerned with algorithms inspired by the structure and function of the brain called artificial neural networks.

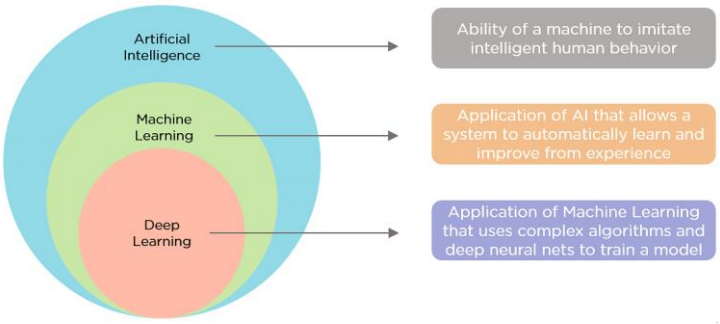
The "Deep" inside Deep Learning?

Deep learning is a branch of machine learning that uses neural networks with many (deep) layers. A deep neural network analyzes data with learned representations similarly to the way a person would look at a problem. Deep learning networks will often improve as you increase the amount of data being used to train them.

In traditional machine learning, the algorithm is given a set of relevant features to analyze a given data. However, in deep learning, the algorithm is given raw data and decides for itself what features are relevant.

Artificial Intelligence Vs Machine Learning Vs Deep Learning

Artificial intelligence is essentially when machines do tasks that typically require human intelligence. The field of artificial intelligence includes machine learning, where machines can learn by experience and acquire skills without human involvement whereas Deep learning is a branch of machine learning where neural networks – algorithms inspired by the human brain – learn from large amounts of data.



Why we should learn Machine Learning?

- Big data explosion
- Hunger for new business and revenue
- Advancement in Machine Learning Algorithms
- Development of extremely powerful machines with high capacity and faster computing ability.
- Storage capacity

Types of classical machine Learning

Based on the amount and type of supervision they get during training, machine learning can be classified into five types.

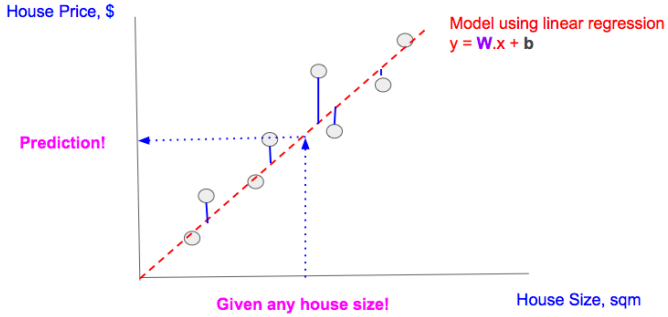
1. **Supervised Learning** is a type of machine learning where well-labelled training data is used to train the machines.

> *Definition of supervise: observe and direct the execution of (a task or activity).*

- Regression is a supervised learning technique which helps in finding the correlation between variables and enables us to predict the continuous output variable based on the one or more predictor variables.

> *Definition of regress: re (back) + gress (a Latin word meaning step) then regress mean step back to the best fit line or curve.*

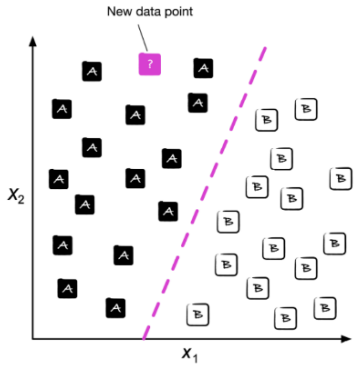
Example: *House price prediction using a given set of features (like area in square meter).*



- Classification is a supervised learning technique which helps in finding the correlation between variables and enables us to predict class label output variable based on the one or more predictor variables.

Definition of classify: to consider (someone or something) as belonging to a particular group.

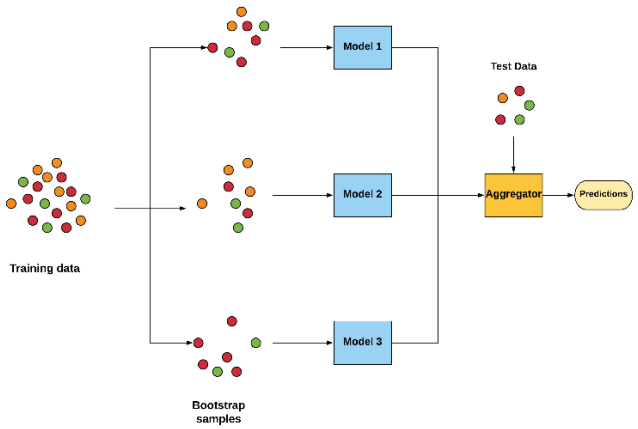
Example: *Spam email filtering using flag words*



> *The goal of supervised machine learning problem is to find a single model that will best predict our wanted outcome. Rather than making one model it is better to ensemble models into account, and average those models to produce one final super model.*

- Ensemble method is a machine learning technique that combines several base models (weak learners) in order to produce one optimal predictive model.

Definition of ensemble: a group of items viewed as a whole rather than individually.

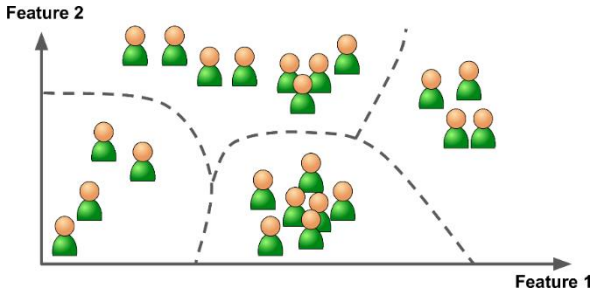


2. **Unsupervised Learning** is a type of machine learning where unlabelled datasets are used to finds all kind of unknown patterns in data.

- Clustering is a pattern discovery technique that divides data points into a number of groups without having any prior knowledge of their group memberships rather based on their similarities.

Definition of cluster: a group of similar things or people positioned or occurring closely together.

Example: *Customer segmentation based on their experience*



- Association Rule Learning is a rule-based machine learning technique which is used to find interesting relationships and associations hidden in large data-sets.

Definition of association: a connection or cooperative link between people or organizations..

Example: *Market Basket Analysis based on association between items*

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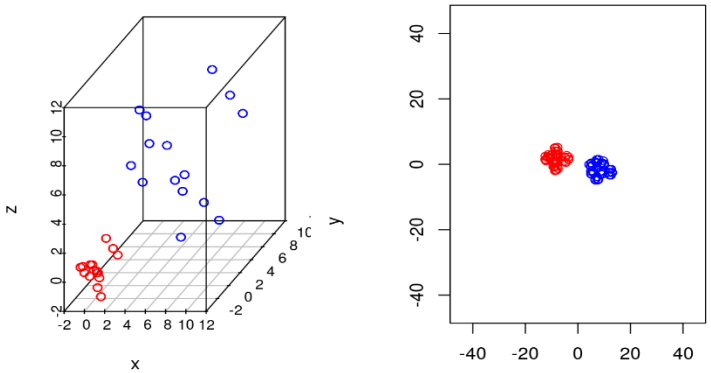
Large numbers of input features can cause poor performance for machine learning algorithms. It is a good idea to try to reduce the dimension of your training data using dimensionality reduction techniques before you feed it to a machine learning algorithm. It will run much faster, the data will take up less memory and computational time. Moreover it is easy to visualize features using 2D plots.

”

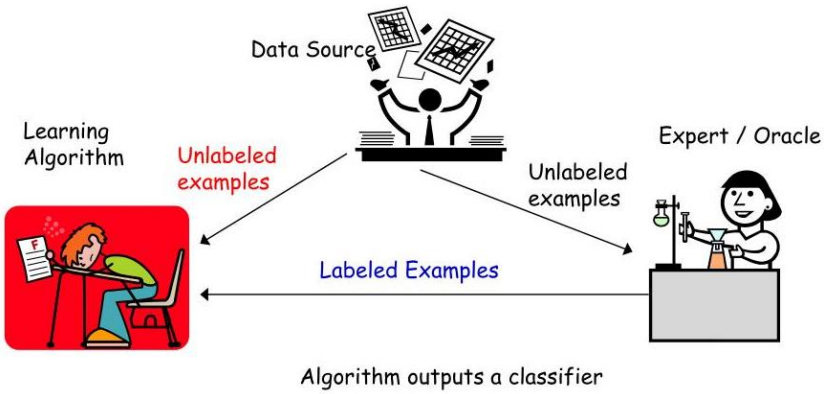
- Dimensionality Reduction refers to techniques for reducing the number of input variables in training data without losing too much information.

Example: *Suppose if you want to predict a student's exam result, the number of pages a student reads may be strongly correlated with how long he/she read, so the dimensionality algorithm will merge them into one feature that represents the number of pages per minute.*



3. **Semi-supervised Learning** is a type of machine learning that combines a small amount of labelled data with a large amount of unlabelled data during training.

   Example: *Some photo hosting services, such as **Google photos**, are good examples of this. Once you upload all your family photos to the service. It automatically recognizes that the same person A shows up in photos 1, 5, and 11, while another person B shows up in photos 2, 5, and 7. This is the unsupervised part of the algorithm (clustering). Now all the system needs is for you to tell it who these people are. Just add one label per person and it is able to name everyone in every photo, which is useful for searching photos.*



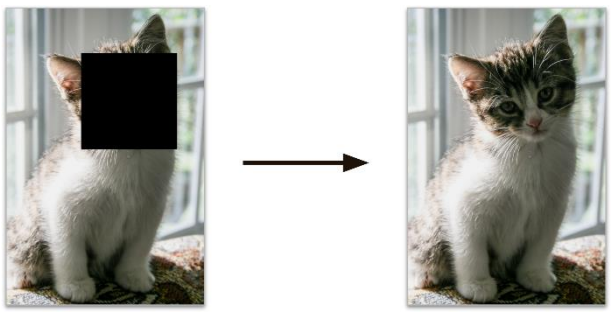
4. **Self-supervised Learning** is a type of machine learning that doesn't require human input to perform data labelling. The results are obtained by models that analyze data, label, and categorize information independently without any human input.

   > *Self-supervised learning exploits unlabelled data to yield labels. This eliminates the need for manually labelling data, which is a tedious process.*

   The only difference is that, unlike unsupervised learning, self-supervised learning does not perform the grouping and clustering of data, as is the case with unsupervised learning.

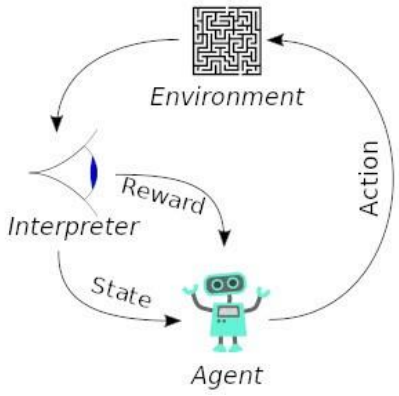
   This learning type allows machines to examine part of a data example to figure out the remaining part. In simple terms, self-supervised learning learns from unlabelled data to fill in the blanks for missing pieces. This data can be in the form of images, text, audio, and videos.

   Example: *If you have a large dataset of unlabelled images, you can randomly mask a small part of each image and then train a model to recover the original image. During training, the masked images are used as the inputs to the model, and the original images are used as the labels.*



5. **Reinforcement Learning** is a feedback-based Machine learning technique in which an agent learns to behave in an environment by performing the actions and seeing the results of actions. For each good action, the agent gets positive feedback or reward, and for each bad action, the agent gets negative feedback or penalty. A Policy defines what action the agent should choose when it is in a given situation.

Definition of reinforcement: the action of strengthening or encouraging something.



Example: *DeepMinds's AlphaGo program is a good example of Reinforcement learning: it made the headlines in May 2017 when it beat the world's champion Ke Jie at the Chinese popular board game. It learned its winning policy by analysing millions of games, and then playing many games against itself. Note that the learning was turned off during the game against the champion; AlphaGo was just applying the policy it had learned.*

So these were the most kick-starting fundamentals of machine learning. Which of these topics or machine learning types have you been interested?

Key takeaways

- AI refers to simulation human intelligence in machines.
- ML is the study of training computers to learn from data without being explicitly programmed.
- DL is the study of training computers to learn like a human brain.

- Supervised Learning is a type of ML where machines train with well-labelled training data.
- Regression is a supervised learning technique which helps to predict numerical outputs.
- Classification is a supervised learning technique which helps to predict categorical outputs.
- Ensemble method is a ML technique that combines models to produce one optimal model.

- Unsupervised Learning is a type of ML where unlabelled data is used to find unknown pattern.
- Clustering is a pattern discovery technique that divides data points into a number of groups.
- Association is a ML technique used to find relationships & associations hidden in large dataset.
- Dimensionality Reduction is a technique for reducing no. of input variables in the training data.

- Semi-supervised Learning is a type of ML that combine few labelled & many unlabelled data.
- Self-supervised Learning is a type of ML that doesn't require human input for data labelling.
- Reinforcement Learning is a feedback-based ML technique where agent learn to act in envt.

VISIT DAY 2/2

Machine Learning in a Real World

Objectives

- What are real life applications of machine learning?
- Which popular companies are using machine learning?
- How are we using machine learning in our daily lives?

Real World Applications of Machine Learning

Face Recognition

One of the most common applications of Machine Learning is Automatic Friend Tagging Suggestions in Facebook or any other social media platform. Facebook uses face detection and Image recognition to automatically find the face of the person which matches it's Database and hence suggests us to tag that person based on DeepFace.

Image Recognition

Can you unlock a phone simply by looking at it? If yes, you are using machine learning. The high-end camera of your phone recognizes 80 nodal points on a human face and machine learning technologies to measure the variable of a person's face and unlock the phone.

Social Media Services

From personalizing your news feed to better ads targeting, social media platforms are utilizing machine learning for their own and user benefits. Machine learning is the core element of Computer Vision, which is a technique to extract useful information from images and videos. Pinterest uses computer vision to identify the objects (or pins) in the images and recommend similar pins accordingly.

Stock market forecasting

Machine learning is widely used in stock market trading. In the stock market, there is always a risk of up and downs in shares, so for this machine learning's long short term memory neural network is used for the prediction of stock market trends.

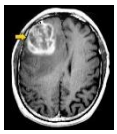
Price prediction

Uber uses a dynamic pricing model, where the price per trip depends on the surge in demand and the number of driver availability. The pricing algorithm normalizes the prices once there is an increase in the availability of the drivers. If you are getting late for a meeting and you need to book an Uber in a crowded area, get ready to pay twice the normal fare.

Web search Engine

Google and other search engines use machine learning to improve the search results for you. Every time you execute a search, the algorithms at the backend keep a watch at how you respond to the results. If you open the top results and stay on the web page for long, the search engine assumes that the results it displayed were in accordance to the query. else, it estimates that the results served did not match requirement. This way, the algorithms working at the backend improve the search results.

Medical Diagnosis



In the field of healthcare, machine learning & deep learning have shown promising results in a variety of fields, namely disease diagnosis with medical imaging, surgical robots, and boosting hospital performance. One such application of deep learning to detect brain tumor from MRI scan images.

A brain tumor is a mass or growth of abnormal cells in your brain.

Online Fraud Detection

Machine learning is making our online transaction safe and secure by detecting fraud transaction. Whenever we perform some online transaction, there may be various ways that a fraudulent transaction can take place such as fake accounts, fake ids, and steal money in the middle of a transaction. So to detect this, Feed Forward Neural network helps us by checking whether it is a genuine transaction or a fraud transaction.

Product Recommendation

Suppose you check an item on Amazon, but you do not buy it then and there. But the next day, you're watching videos on YouTube and suddenly you see an ad for the same item. You switch to Facebook, there also you see the same ad. So how does this happen? Well, this happens because Google tracks your search history, and recommends ads based on your search history.

Self-driving (Autonomous) car

One of the most exciting applications of machine learning is self-driving cars. Machine learning plays a significant role in self-driving cars. Tesla, the most popular car manufacturing company is working on self-driving car. It is using unsupervised learning method to train the car models to detect people and objects while driving.

Virtual Personal Assistant

As the name suggests, Virtual Personal Assistants assist in finding useful information using speech recognition, when asked via text or voice. All you need to do is ask a simple question like "What is my schedule for tomorrow?" or "Show my upcoming Flights". For answering, your personal assistant searches for information or recalls your related queries to collect info.

Online Video Streaming

With over 100 million subscribers, there is no doubt that Netflix is the daddy of the online streaming world. Netflix's speedy rise has all movie industrialists taken aback – forcing them to ask, "How on earth could one single website take on Hollywood?". The answer is Machine Learning. The Netflix algorithm constantly gathers massive amounts of data about users' activities use it properly.

Automatic Language Translation

Traveling to a new place is always thrilling but the only enigma is to understand the common language of that place. To solve this dilemma, Google has launched an app that can help in the easy translation of any language. Google uses 'Google Neural Machine Translation' that has the ability to absorb thousands of languages, words, and dictionaries and transmute any sentence in the desired language.

Traffic prediction

If we want to visit a new place, we take help of Google Maps, which shows us the correct path with the shortest route and predicts the traffic conditions. It predicts the traffic conditions such as whether traffic is cleared, slow-moving, or heavily congested with the help of two ways: (1) Real Time location of the vehicle form Google Map app and sensors. (2) Average time has taken on past days at the same time. Everyone who is using Google Map is helping this app to make it better. It takes information from the user and sends back to its database to improve the performance.

Email Spam and Malware Filtering

Whenever we receive a new email, it is filtered automatically as important, normal, and spam. We always receive an important mail in our inbox with the important symbol and spam emails in our spam box, and the technology behind this is Machine learning.

Online Customer Support Chatbot

A number of websites nowadays offer the option to chat with customer support representative while they are navigating within the site. However, not every website has a live executive to answer your queries. In most of the cases, you talk to a chatbot. These bots tend to extract information from the website and present it to the customers. Meanwhile, the chatbots advances with time. They tend to understand the user queries better and serve them with better answers, which is possible due to its machine learning algorithms.

Video surveillance

With the help of algorithms like behavior analysis, image detection, we can train the machines to detect crime on the basis of their behavior. The cameras track the behavior of people and classify them as usual or unusual. And once some unusual behavior is tracked, the system can then alert the human attendants which could then avoid any mishaps. Thus, this helps to reduce the crime rate and improves the quality of surveillance.

Building an intelligent bot for a game

DeepMinds's AlphaGo program is a good example of game bots: it made the headlines in May 2017 when it beat the world's champion Ke Jie at the Chinese popular board game. It learned its winning policy by analysing millions of games, and then playing many games against itself. Note that the learning was turned off during the game against the champion; AlphaGo was just applying the policy it had learned. After the match between AlphaGo and Ke Jie, The self-taught AlphaGo Zero achieved a 100–0 victory against the early competitive version of AlphaGo, and its successor AlphaZero is currently perceived as the world's top player in Go.

Automatically flagging offensive comments on discussion forums

Hate speech is one of the serious issues we see on social media platforms like Twitter and Facebook daily. Most of the posts containing hate speech can be found in the accounts of people with political views. Twitter's apparently faster at automatically flagging and removing abusive tweets. Twitter is asking users to think twice before sending mean tweets.

Sentiment Analysis

This is an application of natural language processing (NLP) where the words of documents are converted to sentiments like happy, sad, angry which are captured by emotions effectively. Amazon is using sentiment analysis for movie and product reviews. Rating (five stars to one star) are automatically attached as soon as you write your review using sentiment analysis programs.

Text Classification

Every news website classifies the news article before publishing it so that every time visitors visit their website can easily click on the type of news that interests them. For example, I like to read the latest technology updates, so every time I visit a news website, I click on the technology section the read the headlines. Google news is using natural language processing to summarizing long news articles to a headline and classify news articles automatically.

Customer Segmentation

Customer segmentation by means of machine learning is a process of dividing a customer base into particular groups with similar characteristics. There are countless ways to segment customers. It can be done demographically or psychographically (Age, Sex, Highest level of education achieved, Stage of life, Income, Religion, Attitudes towards products/services). Apple is using customer segmentation to provide the best products and services for their customers.

Demand Forecasting

Market demand forecasting is a critical process for any business, but perhaps none more so than those in consumer packaged goods. Inventory, production, storage, shipping, marketing – every retail companies' operations are affected by accurate forecasting. Samsung Electronics Austria forecasts demand with Brightics AI to avoid shortage or overstocking and wasting money in logistics, maximizing sales opportunities.

So these were some of the most popular examples of machine learning applications in the real world. Which of these applications have thrilled you?

Key takeaways

- Companies like Google, facebook, amazon… are applying ML to their product and services.
- ML can be applied in the following areas:
  - Prediction and forecasting
  - Image (face) and Speech (voice) recognition
  - Text filtering and classification [NLP]
  - Recommendation systems
  - AI Gamming