

Deep learning

- Linear Algebra 3B, one brown 5 videos.

What is Deep Learning?

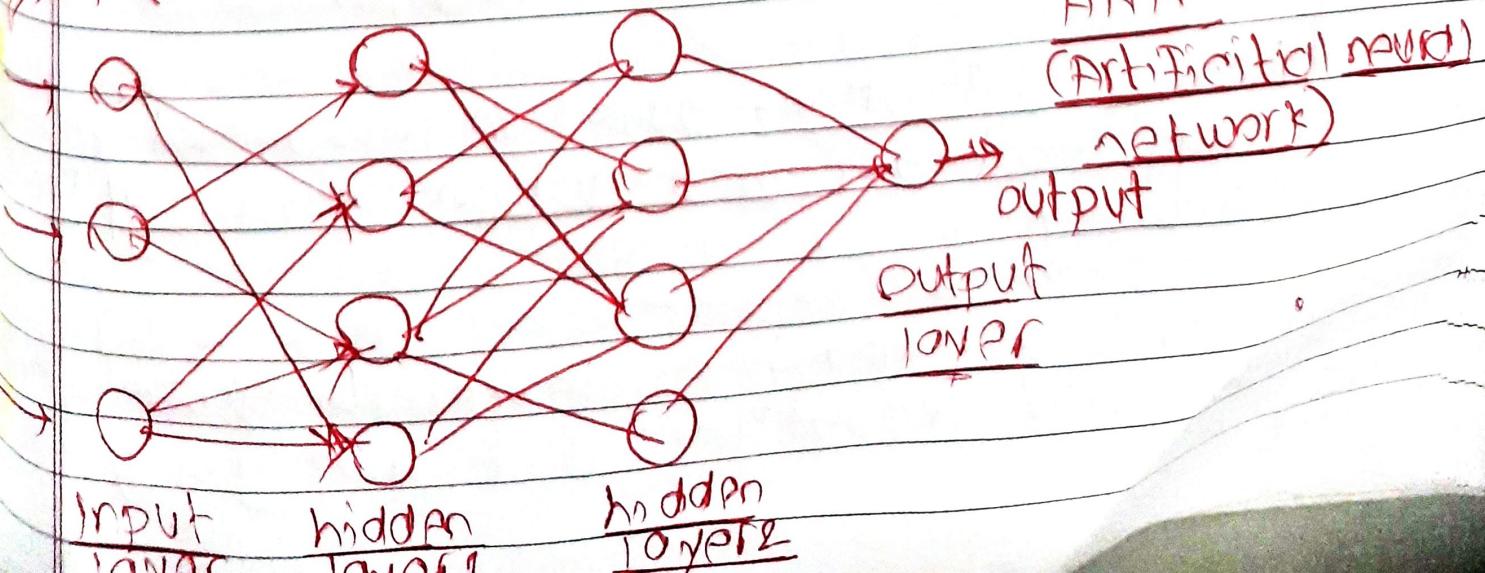
Deep learning is a subfield of artificial intelligence and machine learning that is inspired by the structure of human brains.

Deep learning algorithms attempt to draw a similar conclusion as humans would by continually analyzing data with a given logical structure called neural network.

Deep learning vs machine learning

- Most of machine learning algorithm rely on simple technique.
- While deep learning depends on logical structure known as neural network.

Input



- ANN basically logical structure where fundamental unit is 'perceptron'.
- Perceptron connected to each other with arrows and this arrows is known as weight.
- We can add many hidden layers as i want, deep learning name comes from how many hidden layers we have.

Types of neural networks

- 1) ANN \Rightarrow Artificial neural net
- 2) CNN \Rightarrow convolution neural net (image data)
- 3) RNN \Rightarrow recurrent neural net (text data)
- 4) GAN \Rightarrow Used generate's things

Why is deep learning getting famous?

- 1) Applicability \Rightarrow Used in various domain, speech recognition, NLP, machine translation etc.
- 2) Performance \Rightarrow Best performance.

- General definition, Based on representation learning, what is representation learning / feature learning?
 - Example in machine learning if we want to build classifiers that are going to

classify dog / cat classes or how to feed some feature to machine learning model, \rightarrow this feature are manual feature,
i) size we have to give to our algorithm,
ii) color

• But in deep learning this process is automated, we don't give's a features to deep learning algorithm, those's this feature extracted by deep learning algorithm.

• This process is known as representation learning.

• Deep-learning algorithm progressively extract high-level feature by using multiple hidden layers from raw input (right formatte dog's and cat's images).

Layer's purpose

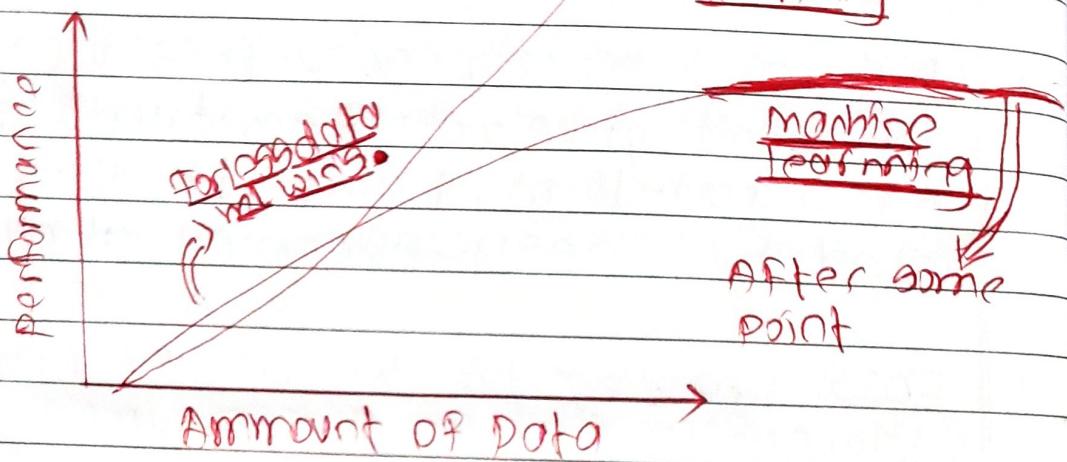
1) Input layer \Rightarrow We feed data pixel by pixel to input layer (dog's / cat's images).

2) Output layer \Rightarrow We get output from here.

3) Hidden layer \Rightarrow Hidden layers will extract primitive structures from data (e.g. edges detection), Hidden layer 2 will extract (e.g. shape), Hidden layer 3 will extract (e.g. face & something else).

Deep learning vs Machine learning

- 1) Deep learning needs vast amount of data, (performance reliable on large number of data).



- 2) In Deep learning, in hardware it's matrix multiplication and dealing of large numbers, To handle this we need Graphics processing unit (GPU) with more memory.
- 3) Training time is high because app learning model are complex.
- 4) Prediction time very fast in Deep learning.
- 5) Interpretability is equal none because it's like black box model, how this dog that we can't tell.

Q In machine learning interpretability is very high, because most of time prediction depends on weightage of parameters algorithms or decision trees, Here we have some interpretability so we can explain to our client why you are bad.

Machine learning की वजह से काफी कम अकली deep learning व्यवहार की वजह से इसकी interpretability.

Why not AI?

- i) Datasets
- ii) Frameworks
- iii) Model architecture
- iv) Hardware
- v) Community

After 2010 Deep learning are booming because of smartphone increasing and internet pricing revolution (price of internet decreasing), because of this we generate's lots of data on daily basis.

To train model we need labelled data, but we generate that is ~~is~~ unlabeled data. So we need someone to creates labels, यहाँ से कई companies जैसी microsoft, google, एंड्रोइड इत्यादि करके unlabeled data का

- Labeled data exist.
- ~~exist~~ exist datasets of public datasets
to convert them for research purposes.
- Example of public datasets, Image,
Microsoft coco, video → youtube 8 min.
on videos data, Text → squad (data
set from wikipedia), audio → Google,
Audio set 20 lakh sound clip they extr-
acted (from youtube) under 600 categories.
- That's why research related deep learning im-
easing vastly.
- Second factor would be hardware, that's
pretty explained by Moore's law,
Moore's is co-founder of intel, "Number
of transistor in microchip doubles every
two years, cost of computation is half
every two years."
- Someone release instead of instead of
training model on CPU why we not imple-
ment it parallelly on GPU, that's where NVI-
ded launches its first GPU CUDA.
- ~~exist~~ exist deep learning AI revolution ~~exist~~,
That's why NVIDIA stock becomes crazy,
now gamer's not only buy graphics card,

some deep learning researcher also uses graph neural network

~~आपके~~ concept of FPGAs Field programmable gate array से जुड़ी कठिन things they are fast and they are working on low power too, also they are reprogrammable, custom solution possible applied only problem, with FPGA they are very expensive.

• 'Xilinx' & lead manufacturer 'FPGA' etc,
deep learning model are used on deep learning
microsoft Bing search engine AI uses
FPGA

- ASIC (Application specific integrated circuits),
this are custom chips too, very expensive
to design firstly

ASIC type

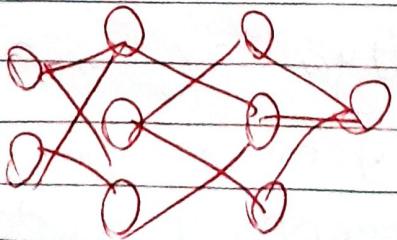
TPU (Tensor processing unit) Google
manufactured it, every google
collab code run on TPU.

→ Edge TPU (For edge devices e.g. drones, watch) If we want to run deep learning model on watch or drones that's where edge TPU used.

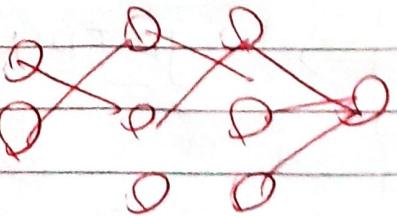
ENPV (Neural processing unit) for smart-

phone (these work is accelerate machine learning / deep learning task on mobile phone)

- Frameworks
 - ① TensorFlow (Google) Difficult to use
 - ② PyTorch (Facebook) Researcher use करते हैं क्षमा.
 - ③ Keras (Top of TensorFlow) Easy to use.
 - (Industry में ज्यादा use होता है)
- If we want we can convert pytorch code to TensorFlow this problem solved dropdown UI based application
- Deep learning Architecture,



one-way ANN



second-order ANN

- By reducing or increasing no. of weight

- But remember AI figures out which dataset is best for which neural network, this process is known as Transfer learning.
- So this boosting deep learning up too.
- last factor is people/community which are obsessive to their craft.

Theory of Neural Network.

→ 1) Multi-layer Perceptron

(Simplest type of artificial neural network)

It can be applied to simplest machine learning scenario (especially unsupervised machine learning), also in linear relationship captured if we add hidden layers in it.)

→ 2) Convolutional Neural Network

(मत्ता किसी भी layer convolutional

layer होता है, CNN जहाँ से होता

है image processing and video pro-
cessing के लिए)

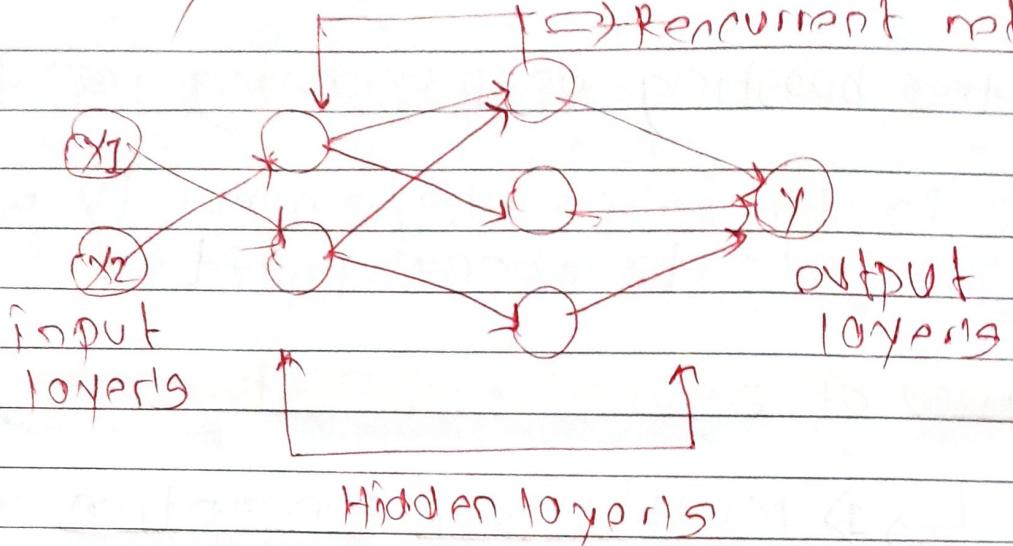
→ 3) Recurrent Neural Network

(Other neural network & data,

linearly forward pass होता है,

through input's output लोग
takar output through output layer's)

But in RNN data was again feeding by hidden layer to back layers, maybe backward hidden layer.



- ~~for~~ ~~in~~ variation of term ~~in~~ ~~for~~ use ~~in~~ ~~in~~ natural language processing, e.g. chatbot, google search.

4) Autoencoder

Work of autoencoder is to compress image/video to smaller size without losing quality. Here input and output layer has same no. nodes, but hidden layer has low nodes.

