ANALYTICS – 4

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HOCHSCHULE HEIDELBERG
SRH
Intelligence in Learning

DAS CORE PRINZIP

WHO ARE WE?

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EXAM STRUCTURE

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- Individual presentation for a selected NN architecture topic.
- By 27th Nov. Submit (**1 Pager of the Neural Network architecture going to present in Final examination**)
- 20 mins presentation each (15 for Presentation and 5 for Q&A)
- Explain how the architecture functions (elaborative explanation)
- A working implementation on cloud infrastructure (using docker and Kubernetes) of the code is expected of the architecture.
- **11th February 2021, 12th February 2021: Final Examination**

EXAM STRUCTURE

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- **Plan for the module:**
- Final Examination : 75%
- Assignment: 25%
- For final exam expectations are - Novelty (MLOps Pipeline + Neural Network Architecture)

COURSE STRUCTURE

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- Introduction to ML
- Introduction to RNN
- Introduction to LSTM
- Introduction to CNN
- GANS and DAE
- All classes will be virtual given the current situation.

BEFORE WE START, WHAT IS MACHINE LEARNING?

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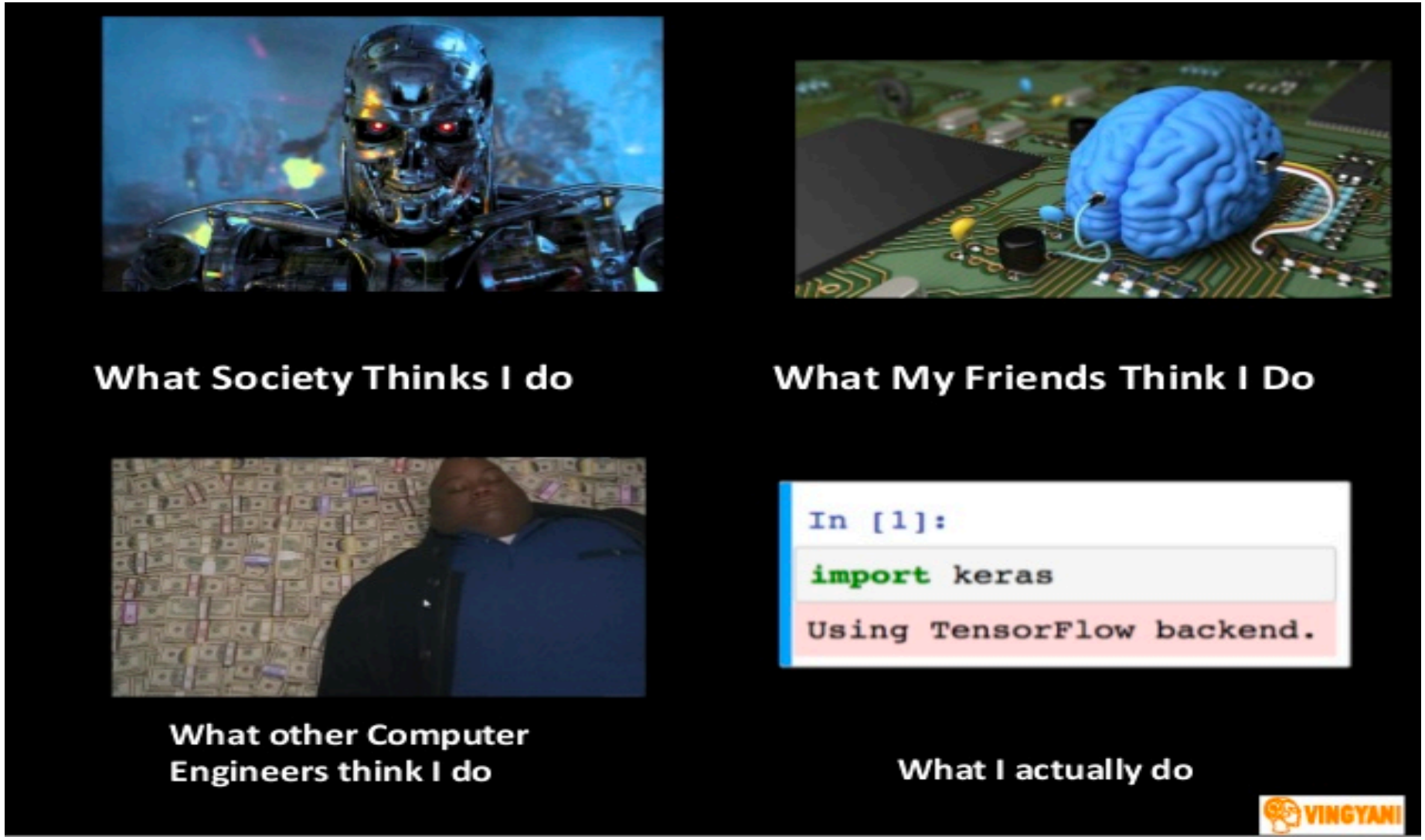
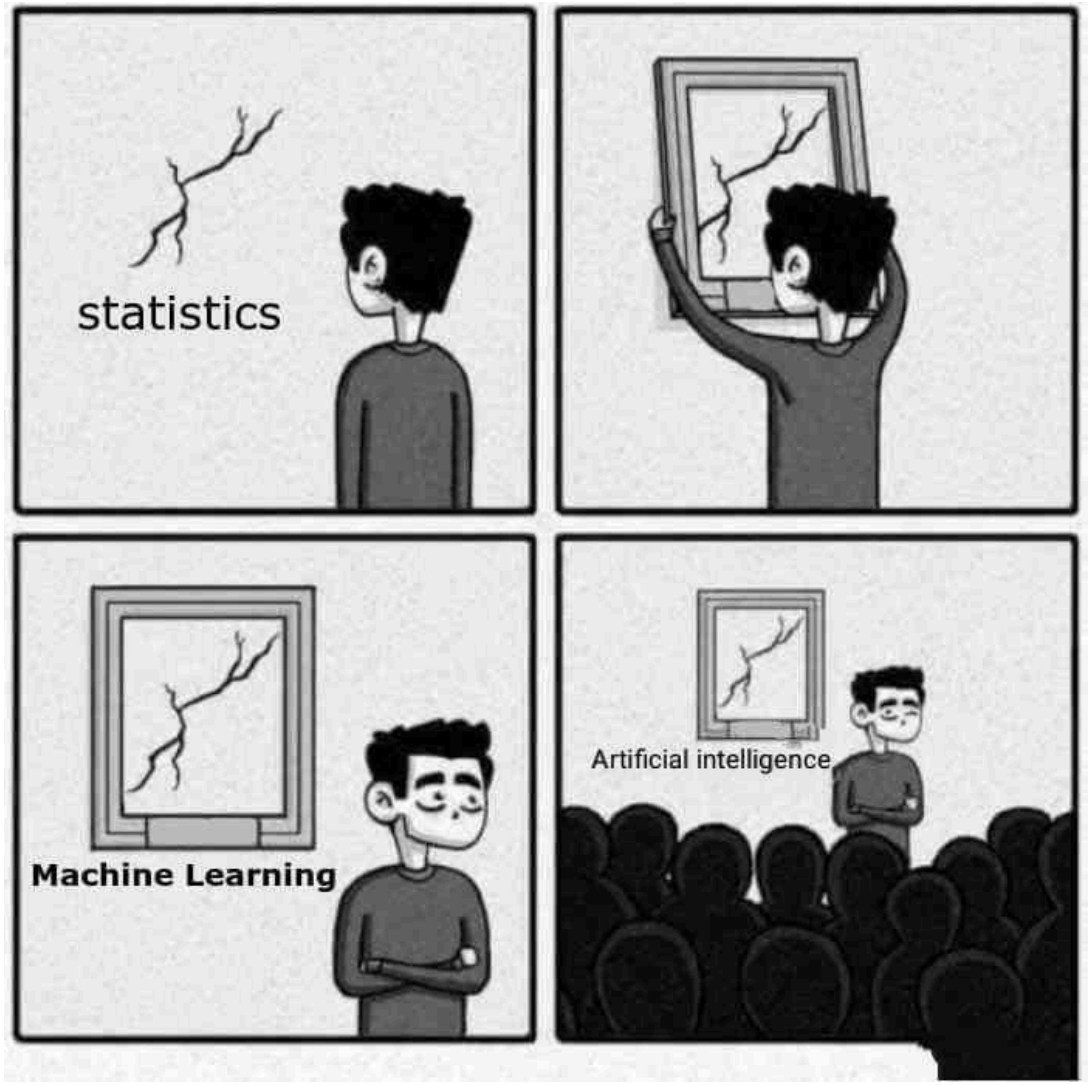


WHAT IS AI? BASICALLY !



MACHINE LEARNING

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- Generally speaking, Machine Learning is the science of getting computers to learn and act like humans do, and improve their learning.

- Specifically, Machine learning (ML) is the study of algorithms and mathematical models that computer systems use to progressively improve their performance on a specific task.

- Algorithms build a mathematical model of sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to perform the task.

SUPERVISED LEARNING

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- Supervised learning is the machine learning task of learning a function that maps an input to an output based on example input-output pairs.

- In supervised learning, each example is a *pair* consisting of an input object (typically a vector) and a desired output value (also called the *supervisory signal*).

SUPERVISED LEARNING APPLICATIONS

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- Predicting Prices (Regression)
- Fraud Detection (Classification)
- Collaborative Filtering (Product Recommendation)

UNSUPERVISED LEARNING

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- Unsupervised learning is a branch of machine learning that learns from test data that has not been labeled, classified or categorized.

- Rather than learning from feedback, unsupervised learning identifies commonalities in the data and reacts based on the presence or absence of such commonalities in each new piece of data.

UNSUPERVISED LEARNING APPLICATIONS

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- Clustering (Grouping Customer by Purchasing behaviors)
- Association (People who bought this also bought this.)
- Understanding patterns and important data features in IoT Applications.
- Clustering websites based on particular words count on each webpage

BIOLOGICAL NEURON

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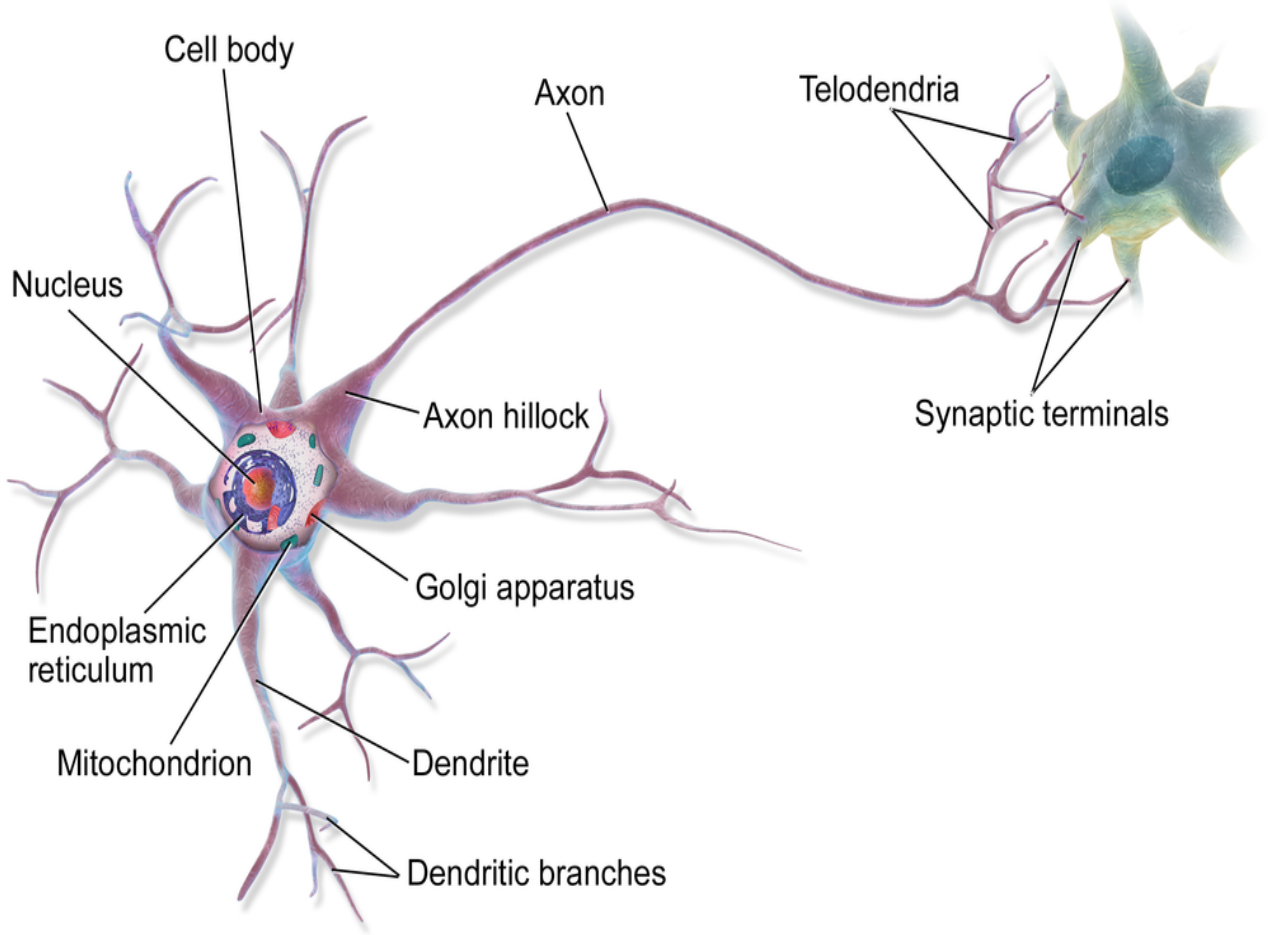
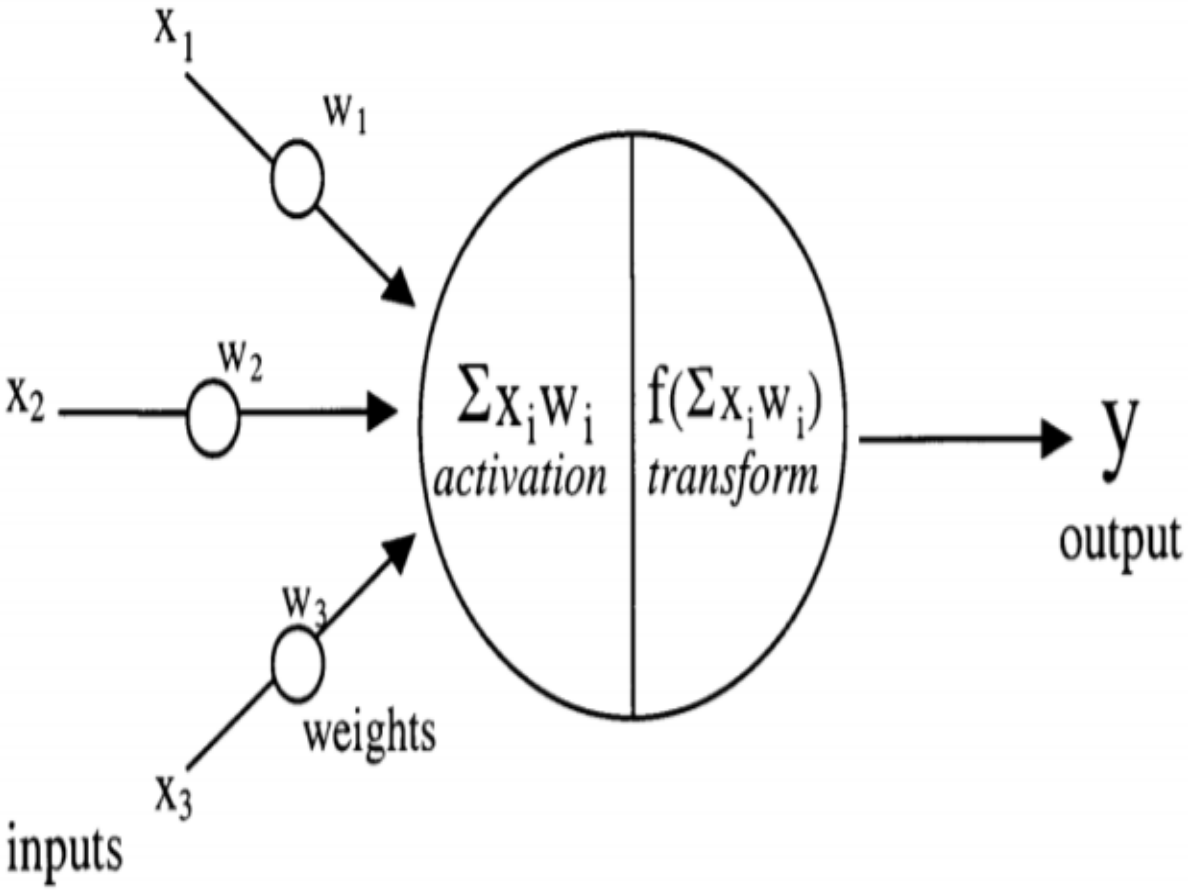
- Input comes from Dendrite
- Nucleus of a neuron creates a message/ Does some operation on input.
- Synapses, Either gives an output or connects to new neurons.



ARTIFICIAL NEURON

- Input : Features/ Weights (Numbers).
- Functions do some operation on the input data.
- Output of Neuron connect to new neurons or gives final output.
- Formula = $w_1x_1+w_2x_2+w_3x_3....w_nx_n$

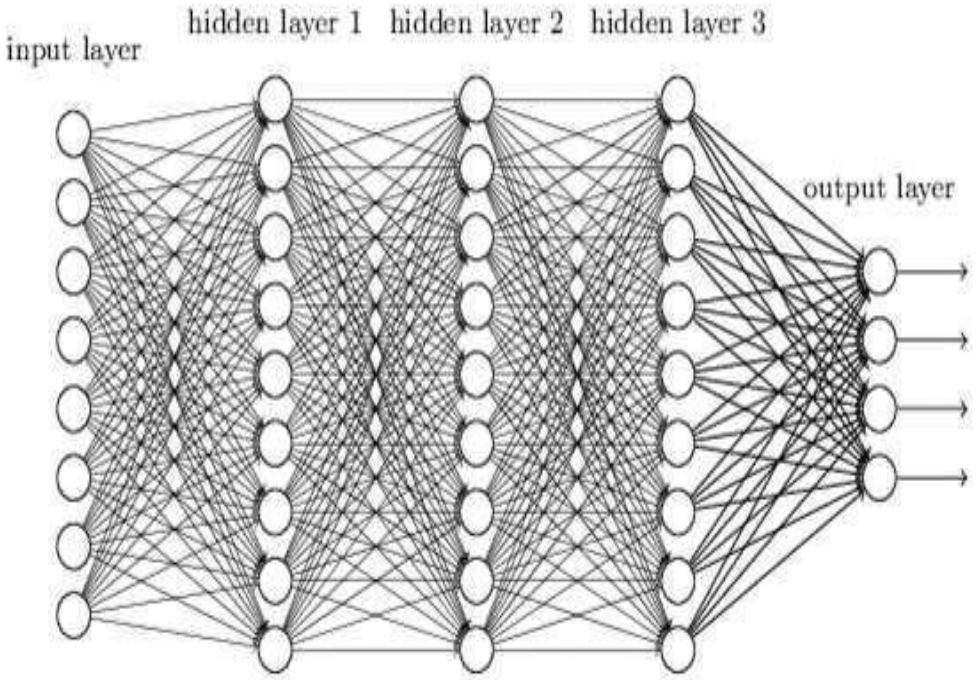


BIOLOGICAL NEURAL NETWORK

- Billions of Neurons Interconnected to each other processing different data manifests into a Brain.
- The Brain knows things from experiences which it has stored from previous encounters.

ARTIFICIAL NEURAL NETWORK

- Billions of Artificial Neurons Interconnected to each other processing different data manifests into a Artificial Neural Network.
- The Artificial Brain knows things from experiences /Examples which it has stored from previous encounters/Training/learnings.



TYPES OF NN

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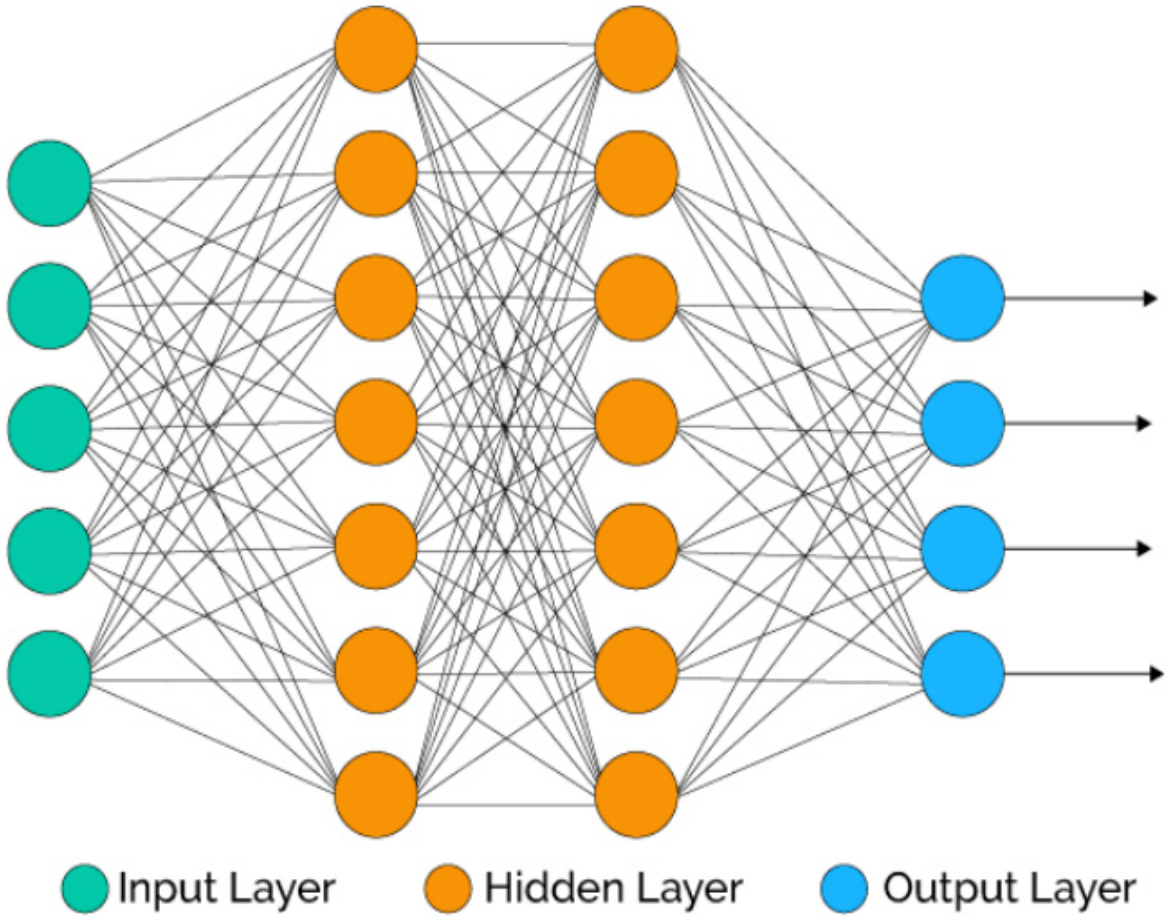
- Multilayer Perceptron Neural Network (Deep Neural Network)
- Recurrent Neural Networks
- Convolutional Neural Networks
- Generative Adversarial Networks
- Deep Autoencoders

DEEP NEURAL NETWORK

- Contains more than 1 hidden layer.
- One Input and One Output Layer.
- Input Layers will take data from the outside world and pattern recognition will be done in hidden layers.
- Patterns are studied in a feed forward manner and error is calculated using back propagation.
- https://playground.tensorflow.org



APPLICATIONS OF DNN

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- Anomaly Detection
- Fraud Detection
- Predicting numbers (Prices of houses)
- Classification.

RECURRENT NEURAL NETWORKS

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- Learns from sequential data and contexts, used mostly in NLP or Time Series Analysis.

- One Input and One Output Layer.

- Input Layers will take data from the outside world and pattern recognition will be done in hidden layers.

- Hidden layers have a sort of “memory” to remember context from few steps back.

RECURRENT NEURAL NETWORKS

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- Limitation of Neural Networks is that their API is too constrained: they accept a fixed-sized vector as input (e.g. a frame in a large sequence) and produce a fixed-sized vector as output (e.g. probabilities of different classes).

- They accept an input vector x and give an output vector y. However, crucially this output vector's contents are influenced not only by the input you just fed in, but also on some history of inputs fed in in the past.

APPLICATIONS OF RNN

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- Language Modeling and Prediction
- Speech Recognition
- Time Series Analysis

CONVOLUTIONAL NEURAL NETWORKS

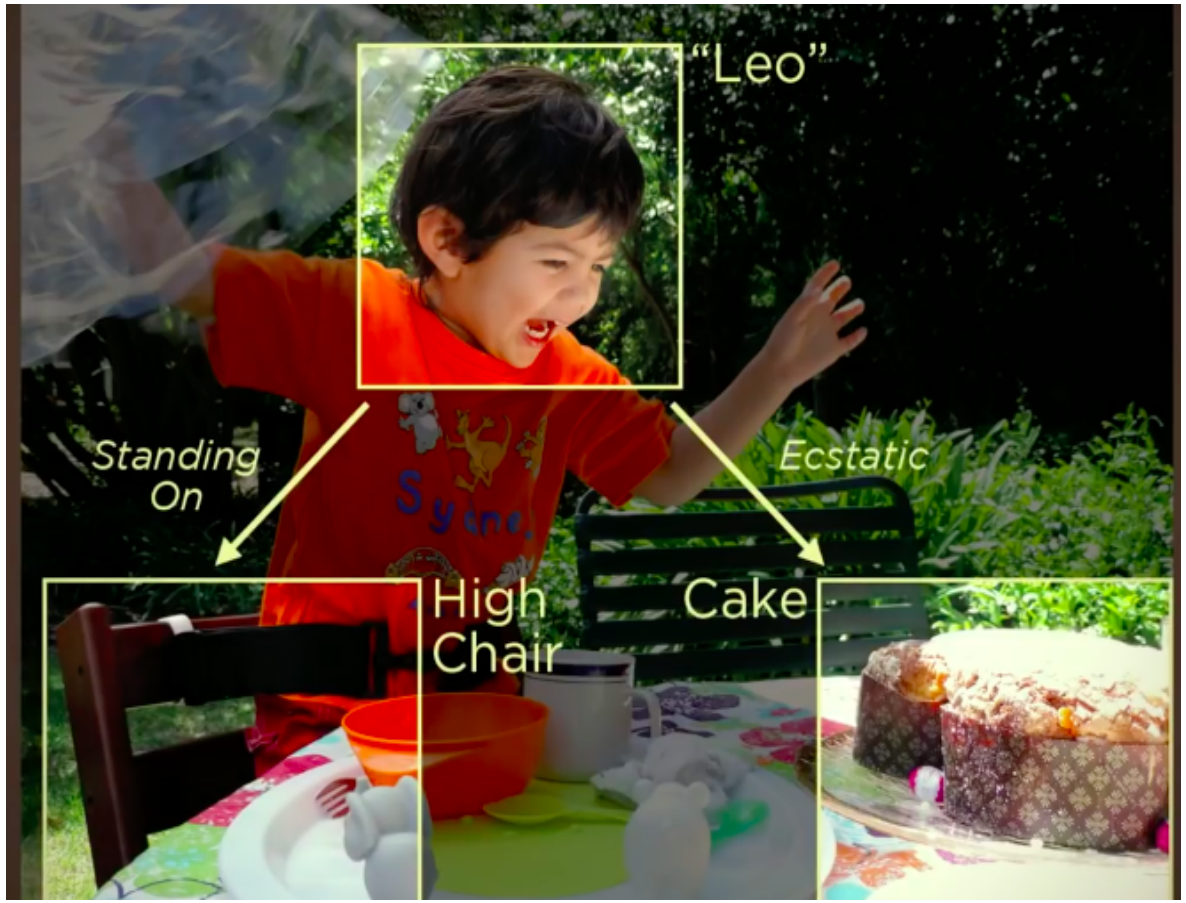
- A common CNN is composed of input layer, multiple hidden layer and an output layer. The hidden layers of a CNN typically consist of convolutional layers (extracts feature from images, detects edges and surfaces), pooling layers (reduces the spatial size of the representation).

- An CNN is well-suited to classify and process Images, Videos.

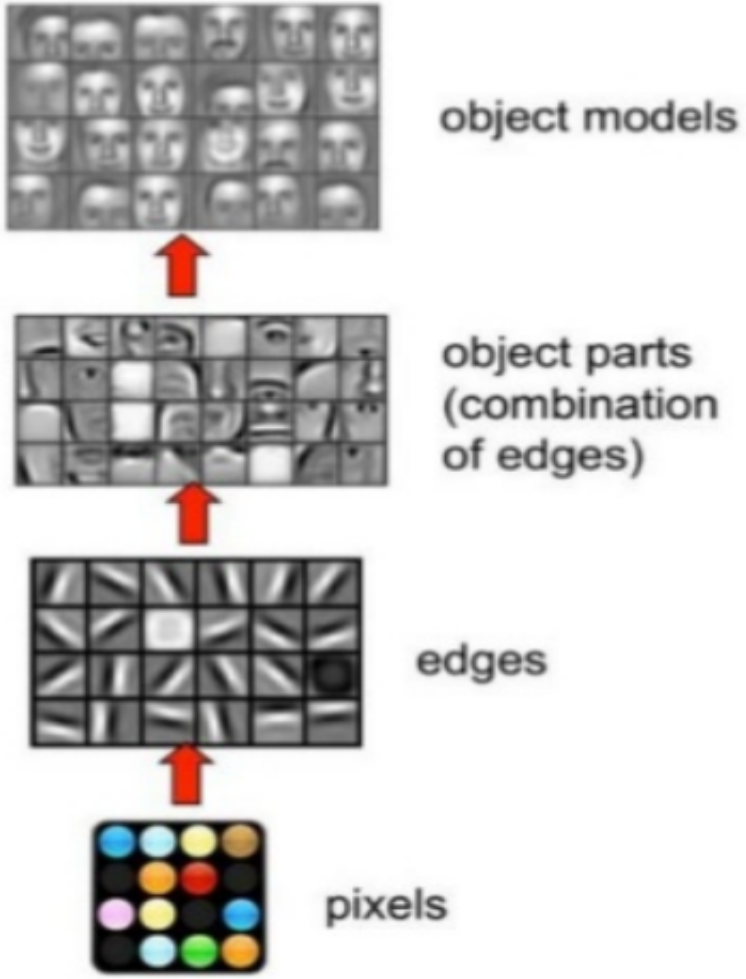
CONVOLUTIONAL NEURAL NETWORKS

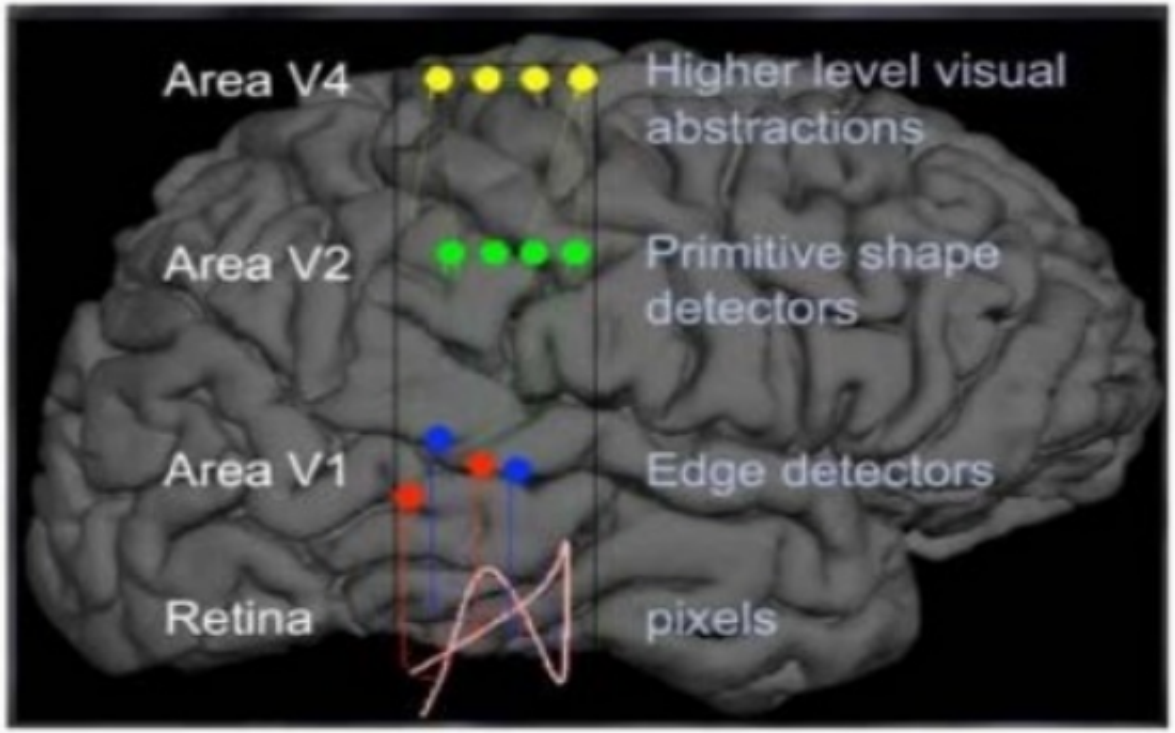
- It took nature over 500 million years to create a system to do this. The collaboration between the eyes and the brain, called the primary visual pathway, is the reason we can make sense of the world around us.

- Similar to how a child learns to recognize objects, we need to show an algorithm millions of pictures before it is be able to generalize the input and make predictions for images it has never seen before.

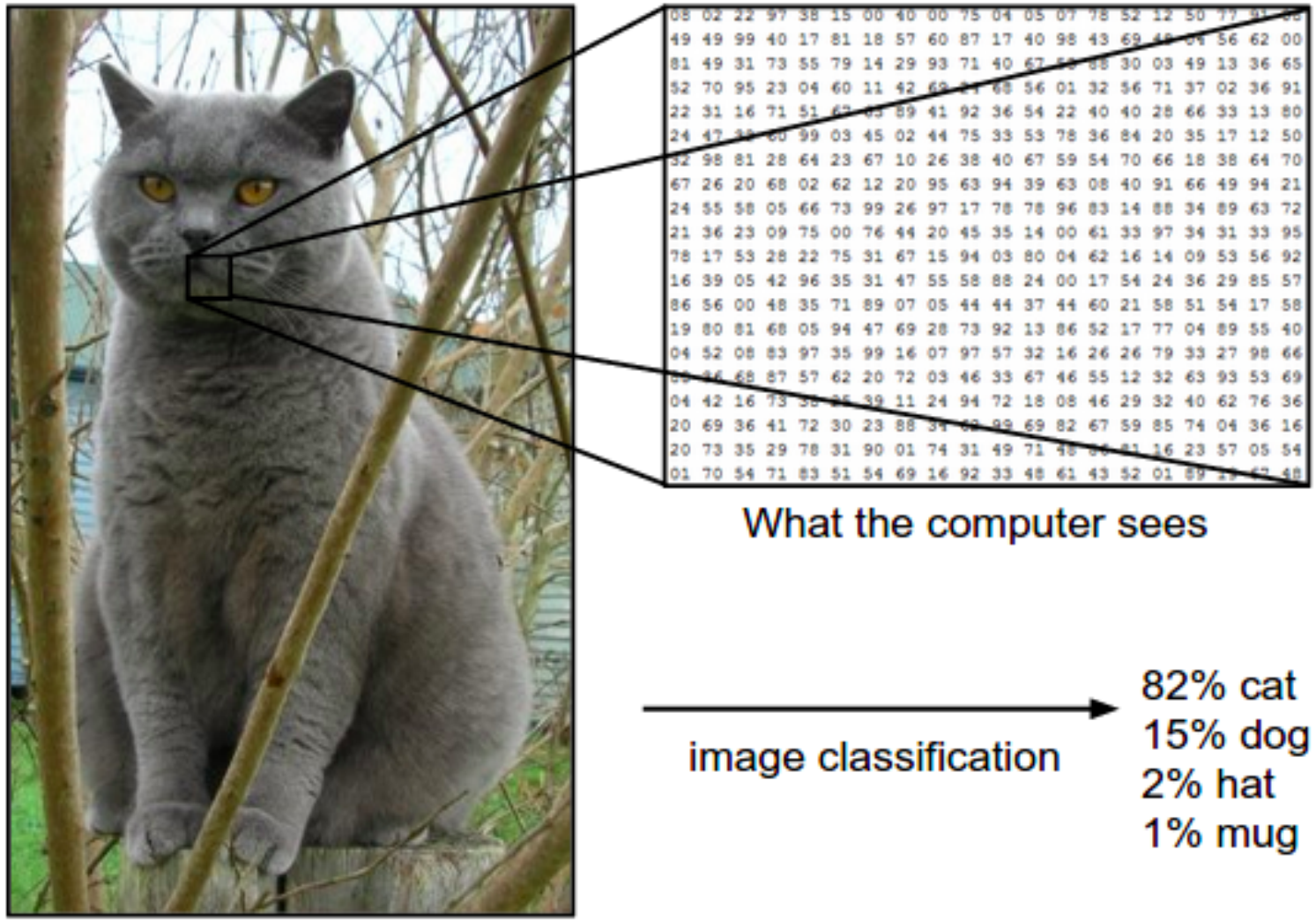


CONVOLUTIONAL NEURAL NETWORKS





CONVOLUTIONAL NEURAL NETWORKS



VISUAL OBJECT RECOGNITION BENCHMARKS (PROJECT AD

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- ImageNet 22k Image Classification

American Foxhound

English Foxhound

APPLICATIONS OF CNN

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- Image Classification
- Face Recognition
- Scene Labeling
- Video Object Detection.
- Live video emotion detection. (https://github.com/omar178/Emotion-recognition#p1)

GENERATIVE ADVERSARIAL NETWORKS (GANS)

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- One network generates candidates (generative) and the other (discriminative) evaluates them.

- A known dataset serves as the initial training data for the discriminator. Training the discriminator involves presenting it with samples from the dataset, until it reaches some level of accuracy.

- Samples synthesized by the generator are evaluated by the discriminator.

- So that the generator produces better images, while the discriminator becomes more skilled at flagging synthetic images.

GENERATIVE ADVERSARIAL NETWORKS (GANS)

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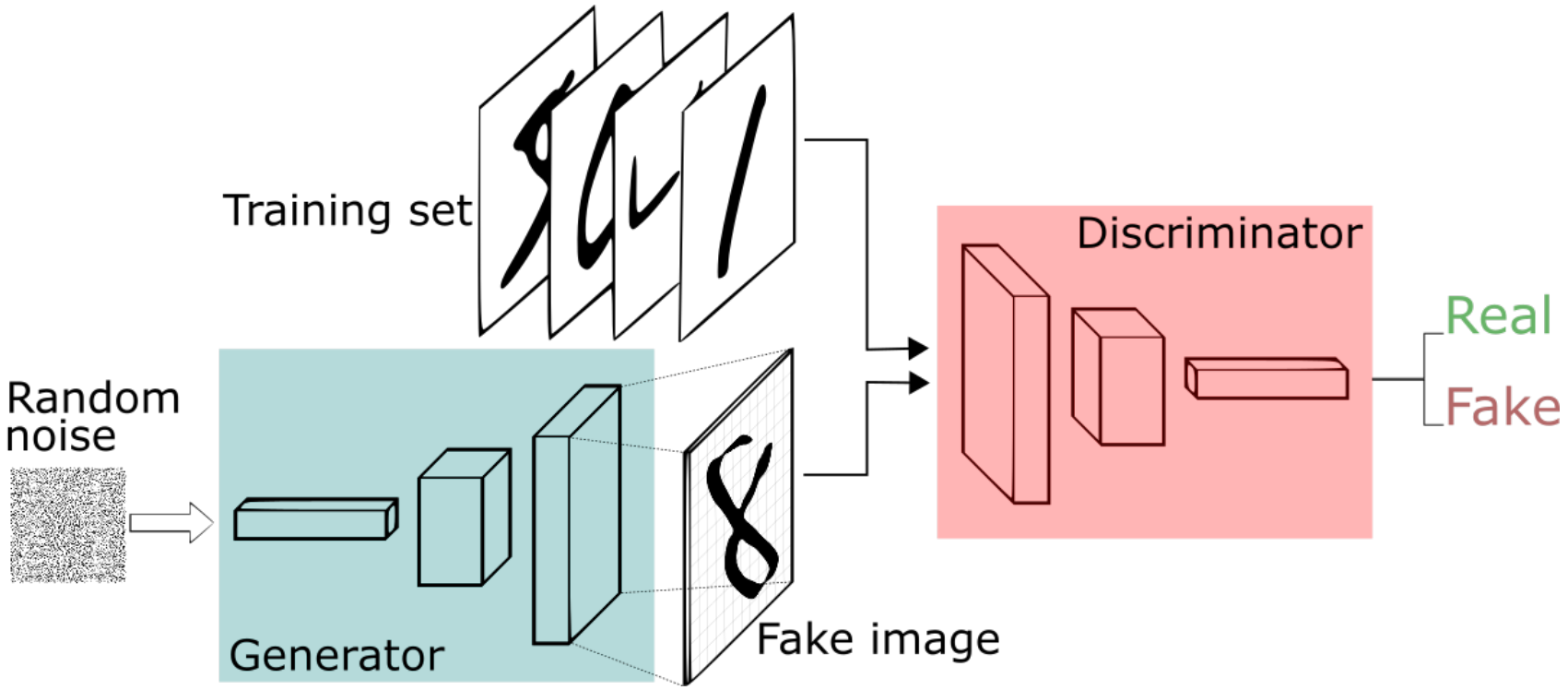

GANS APPLICATIONS

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- Reenacting Videos (https://www.youtube.com/watch?v=MVBe6_o4cMI)
- Artificial Art Creation
- Transferring patterns of Old paintings to new images.
- Map design in Gaming.

DEEP AUTOENCODERS

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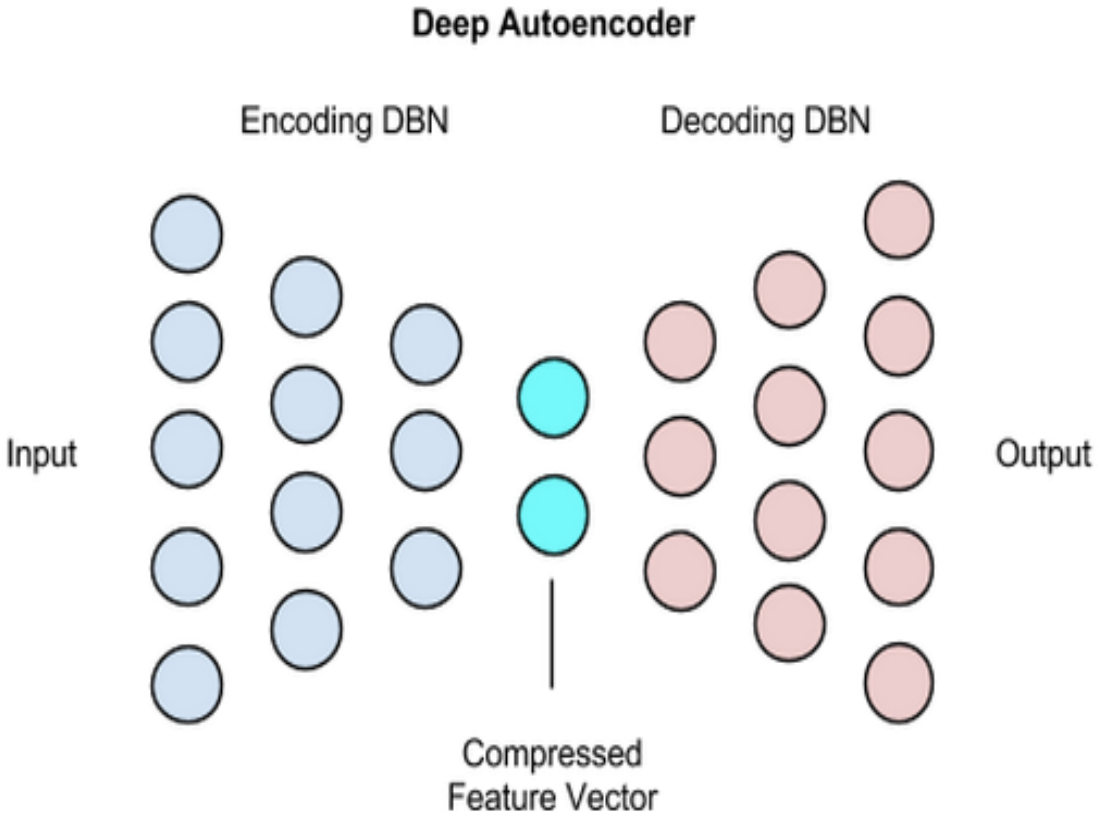
- A deep autoencoder is composed of two networks that typically have four or five shallow layers representing the encoding half of the net, and second set of four or five layers that make up the decoding half.

- Encoding half compresses the input data and decoding tries to decompresses on the output layer.



DEEP AUTOENCODER APPLICATIONS

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- Image Search
- Data Compression
- Image Denoising

REFERENCES FOR ONLINE LEARNING

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- Machine Learning by Stanford University – Coursera, Andrew Ng.
- Deep Learning Specialization – deeplearning.ai
- Enterprise Deep Learning with TensorFlow, Open.sap.com
- Cs231n – Stanford https://www.youtube.com/results?search_query=cs231n
- Cs229 – ML Stanford https://www.youtube.com/results?search_query=cs229
- O'Reilly, Hands on Machine Learning With Scikit-Learn & TensorFlow
- End-to-End Machine Learning with TensorFlow on GCP, Coursera

QUESTIONS?

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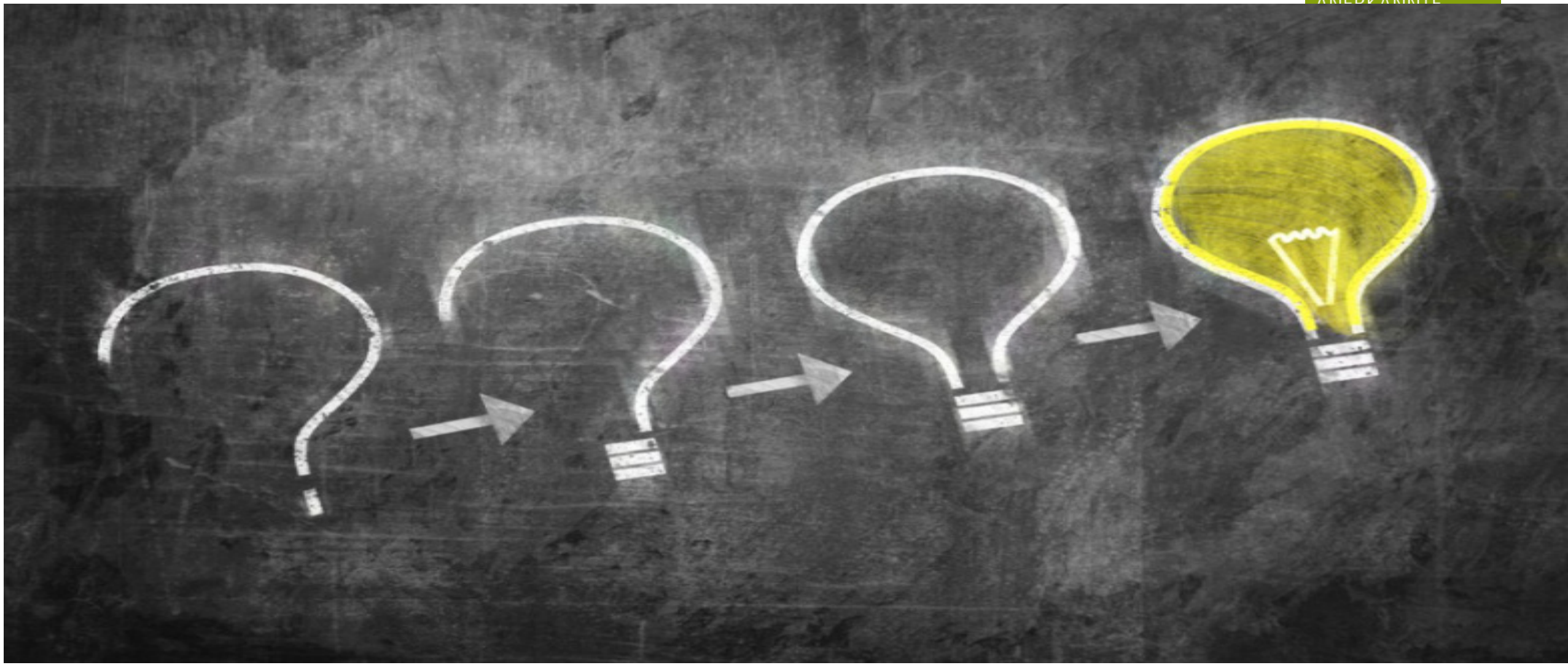

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THANK YOU.