https://www.youtube.com/watch?v=PJPFLHw8lKI

https://aayushmnit.com/posts/2024-12-15-MLInterviewPrep/MLInterviewPrep.html

Key components in software engineering:

1. Reading code is harder than writing code
2. Debugging is more important key
    a. Feature development
    b. Improving a feature
    c. Debugging is quite challenging
3. How can you become a debugger?
4. Data structure and algorithms: Deep on a lee code.

Behaviour Interview Section:

1. Much more important input to figure out how will this be engineer operate in a company
2. How they will evaluate the company
3. Targeted in communication, what does the story level spend a lot of thinking
4. Involve :
    a. How much you care about software engineering
    b. Talking about the company : answering the problem space is very interesting to me.
    c. Team

STAR : Situation, Task, Action and Result related in the behaviour interview

Finally : System design

1. Example System design : Twitter, Uber designs
2. Data infrastructure
3. System design interview is about:
    a. How are you communicating the different options available to you?
    b. What assumptions are you making about how the system might scale or break?
4. Focus on the actual problem being asked

The secret to grow fast:

1. Be a feedback vaccum.

Choosing the right company:

1. To be delibrate
2. Want to go to the big tech companies

How can you become a successful engineer in a company?
Another thing is documentation.

Promotion is not about hard work, it is about relationships within a team.

Salary Negotiation: Make more money, be more valued

1. Don’t share a number first
2. Make a negotiation with multidimensional.
3. I want you to negotiate with writing in an email rather than a call/meeting.
4. Closing the deal: I am willing to sign my contract.

Work life balance:

Most important skill in Software:

1.

My computer vision:
C:\Users\MYCOM\Desktop\tts_cv_collection\TTS_USB\Hand_Detection_In_Yolov8\yolov8_hand_detection

Behavioral Interview: Use the S.T.A.R technique ….

1. It is recognized by all hiring managers.
2. It allows you to easily remember your answers.
3. It will help you to get the highest scores possible for each behavioural interview question.
    a. S: Tell the interviewer the Situation you were faced with.
    b. T: Briefly explain the Task you had to complete.
    c. A: Given in-depth details about the ACTION you took to achieve the task.
    d. R: Finish off with the RESULT following your actions.

Q : ⇒ Tell me about a time when you received criticism that you thought was unfair.
Manner : ⇒ When answering this tough behavioural interview question, demonstrate to the interviewer you are a mature and professional employee who is willing to take on board feedback to improve, despite it being unfair.

Example
Situation : ⇒ In a previous role, my manager spoke to me about how long I was speaking to customers on the telephone.

I was trying to build a positive rapport with our customers to help improve sales. However, my manager said I was taking too long.

Task : ⇒ Although I felt the criticism was unfair, simply because I was trying to help the company, it was my task to take onboard his feedback to improve.

Action: ⇒ I explained to my manager that I was trying to improve customer relations but that I fully understood there was a need to act with speed because other customers were waiting on the line that needed my assistance.

Result: ⇒ After reflecting on my performance, I made changes as per my manager's instructions, and this improved the speed of my call handling rates meaning I could help and assist more customers.

Q2: ⇒ Tell me about a time when you had to do something differently and what was the outcome?

Tip: ⇒ This behavioural interview question is assessing how adaptable you are when difficult situations arise.

Give an answer that shows you managed to successfully overcome a difficult challenge in the workplace.

Situation: ⇒ I was working in a previous role as part of a team project.

Task: ⇒ It was our task to build a website for an important client. However, part way through the project, we lost an important team member due to illness.

He was our graphic designer and there was still plenty of graphic design work still to be done on the project.

Action: ⇒ Not being deterred by this setback, I decided to use my initiative and think of alternative ways of working to still get the website project completed on time.

After assessing the options, I decided to place an advert on the website UpWork.com for a graphic designer who could work remotely to create the artwork we needed.

Ten high-quality graphic designers responded to the advert, and after I had chosen the most suitable one, I gave him a detailed and concise brief, and he then set to work.

Result: ⇒ By using a different method of working, I was able to overcome a challenge that had the potential to detail the project and get the website finished on time and to the clients specification.

********** Touch Behavioral Interview Question # 3 **********
Q: Tell me about a time when you worked in a team.
Tip : This tough behavioural interview question is designed to assess whether you can collaborate with other people in an unselfish manner.
In your answer, demonstrate you understand the importance of always putting the needs of the team first in everything you do.

Situation:In a previous role, I was part of a team whose responsibility it was to come up with innovative ways to promote a new company product that had just launched.

Task: I suggested we should hold a team meeting to brainstorm different ideas.
By doing so, we would have many different options at the end of the session, and at least one of them would help us to achieve our objectives.

Action: During the team meeting there was no hierarchy, I encouraged everyone to put forward ideas, and no suggestion was off limits.

Team members who were normally shy, were given plenty of opportunity to contribute.

Result: At the end of the meeting we had five outstanding ideas for promoting the product. These included online advertising through social media running a contest for our loyal customers to win one of the new products, and a targeted radio advertising campaign.

######## Tough Behavioural Interview Question 4 ######
Q. Tell me about a time when you made a mistake.
Tip: Do not say you have never made a mistake when answering this tough behavioural interview question.
Instead, show you are the type of person who takes ownership of their mistakes,and takes positive action to improve.

Situation: ⇒ I am the type of person who tries to learn from every mistake.
When I started work in my last role, I was eager to impress but I took on too many tasks and responsibilities without first considering how long each one would take.

Task: ⇒ Although it was my job to make sure everything was completed on time, I ended up missing an important deadline due to the workload I had committed to, which was entirely my mistake.

Action: ⇒ After I had apologized to my manager for missing the deadline, I started putting systems in place to make sure the same situation never happened again.

I kept a priority list of tasks I was responsible for, and the time it would take to complete each one.

Result: ⇒ By using a more methodical and considered approach to task completion, I could safely take on additional responsibilities knowing everything would be successfully completed on time and as requested.

Tough Behavioural Interview Question 5
Q: Tell me about a time when you multitasked.
Tip: Being able to successfully complete multiple tasks is a key workplace skill required in virtually all job roles.
Give a specific answer that demonstrates you have the ability to prioritize and finish multiple tasks on time and to the expected standard.

Situation : ⇒ My manager asked for a volunteer to cover the work of a co-worker who was off sick for several weeks. I volunteered to be that person.

Task: It was my task to make sure my one work and the work of my co-worker was completed on time.

Action: ⇒ I started out by writing a priority list of the tasks that needed my attention. Any tasks that were not urgent, I would leave until the end of the day.
There were several of my co-workers' tasks that I was unsure how to complete, so I carried out some research and found out the most efficient way to tackle them.
Result: ⇒ By prioritising tasks correctly, by remaining calm, and by taking the initiative to learn the tasks I was unsure of, I was able to successfully complete two people's work on time and to the required standard.

######## Tough behavioural Interview Question 6 #######
Q. Tell me about a time when you failed to meet a deadline.
Tip: This is a tough behavioral interview question to answer correctly!
However, in your response, give a situation where you missed a deadline due to challenging circumstances but explain what you did to improve and learn from the experience.

Situation: ⇒ In my last role, I was working as part of a team on a difficult time sensitive project.

Task: ⇒ It was our task to get the project completed on time despite the many challenges that were present.

Action: ⇒ 7 days before the project deadline, two members of staff went off sick with Covid. We tried our hardest to get the project finished. I, and several other team members, put in extra hours and we outsourced several tasks to online contractors.
However, despite the team's best efforts we missed the deadline by 24 hours.

Result: ⇒ I learned a lot from that situation. Now, whenever I am a part of a team project or task, I always put contingency plans in place before starting work to compensate for problems whenever they occur.

This includes making sure we have back up from other departments in the organization if needed at short notice.

Machine Learning Interview Questions

⇒ Machine Learning Core Interview Question

⇒ Machine Learning using Python Interview Question

⇒ Machine Learning scenario based interview Question

Machine Learning Core Interview Question: Theoretical Questions

Q: How will you explain Machine Learning to a school going kid?

⇒ Suppose your friend invites you to his party where you meet totally strangers
⇒ Since you have no idea about them you will classify them on the basis of gender, age

Group, dressing or whatever way you would like using unsupervised learning (no prior knowledge)

⇒ How is learning different from supervised learning?

1. Since you didn't use any past/prior knowledge about people and classification them "on-the-go".

Q: What are various types of machine learning?

1. Supervised learning
    a. Is like with a teacher
    b. Training dataset is like a teacher which is used to train the machine
    c. Model is trained on a predefined dataset before it starts making decisions when given new data.
2. Unsupervised learning
    a. Is like learning without a teacher
    b. Model learns through observation and find structures in data
    c. Model is given a dataset, and are left to automatically find patterns and relationships in that dataset by creating clusters
3. Reinforcement learning
    a. Modern learns with hit and trial method
    b. Learns on the basis of reward or penalty given for every action it performs

Q: How deep learning differs from machine learning?

Deep learning is a form of machine learning that is inspired by the structure of the human brain and is particularly effective in feature detection	Machine learning is all about algorithms that parse data, learn from that data, and then apply what they've learned to make informed decisions.

Q: What do you understand y Precision and Recall?

⇒ To extend your life, you need to recall all 10 surprising events from your memory

⇒ Recall is the ratio of a number of events you can correctly recall to a number of all correct events.

⇒ If you can recall all 10 events correctly, then, your recall ratio is 1.0 (100%)

⇒ If you can recall 7 events correctly, your recall ratio is 0.7 (70%)

However, you might be wrong in some answers.

For example, you answered 15 times, 10 events are correct and 5 events are wrong. This means you can recall all events but it is not so precise.

So, precise is the ratio of a number of events you can correctly recall to a number of all events you recall.

From the last example (10 real events, 15 answers: 10 correct, 5 wrong), you get 100% recall but your precision is only 66.66% (10/15)

Q: What do you understand by precision and recall?

Number of events you can correctly recall = True Positive (they're correct and you recall them)

Number of all correct events = True positive (they're correct and you recall them) + False negative (they're correct but you don't recall them)

Number of all events you recall = True positive (they're correct and you recall them)+ False positive (they're not correct but you recall them)

recall = True positive / (True positive + False negative)

precision = True positive/(True positive+False positive)

True Positive: if the alarm goes on in case of a fire
⇒ Fire is positive and prediction made by the system is true

False Positive: If alarm goes on, and there is no fire
⇒ System predicted fire to be positive which is a wrong prediction, hence the prediction is false

False Negative: if alarm does not go on but there was a fire
⇒ System predicted fire to be negative which was false since there was fire,

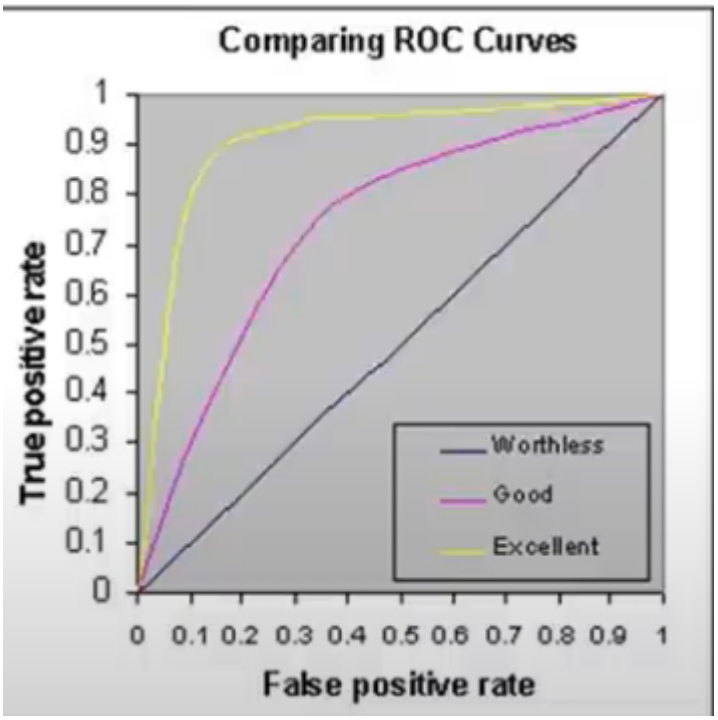
True Negative: if alarm does not go on and there was no fire,
⇒ The fire is negative and this prediction was true.

Q: What is a confusion matrix?
⇒ A confusion matrix or a error matrix is a table which is used for summarizing the performance of a classification algorithm

Q: How is KNN different from k-means clustering?

K Nearest Neighbors	K Means Clustering
Supervised Technique	Unsupervised Technique
Used for classification or regression	Used for clustering
'K' in KNN represents the number of nearest neighbours used to classify or predict in case of continuous variable/regression	'K' in K-Means represents the number of clusters the algorithm is trying to identify or learn from the data

Q: Can you explain to me what ROC curve is and what it represents?
⇒ Receiver Operating Characteristic curve (or ROC curve) is a fundamental tool for diagnostic test evaluation and is a plot of the true positive rate (Sensitivity) against the false positive rate (Specificity) for the different possible cut-off points of a diagnostic test.



⇒ It shows the tradeoff between sensitivity and specificity (any increase in sensitivity will be accompanied by a decrease in specificity).
⇒ The closer the curve follows the left-hand border and then the top border of the ROC space, the more accurate the test.
⇒ The closer the curve comes to the 45-degree diagonal of the ROC space, the less accurate the test.
⇒ The slope of the tangent line at a cut point gives me the likelihood ratio (LR) for that value of the test.
⇒ The area under the curve is a measure of text accuracy.

Q: What's the difference between Type I and Type II error?

⇒ Type I error is a false positive, while type II error is a false negative.
⇒ Type I error is claiming something has happened when it hasn't, while Type II error is claiming nothing when in fact something has happened.

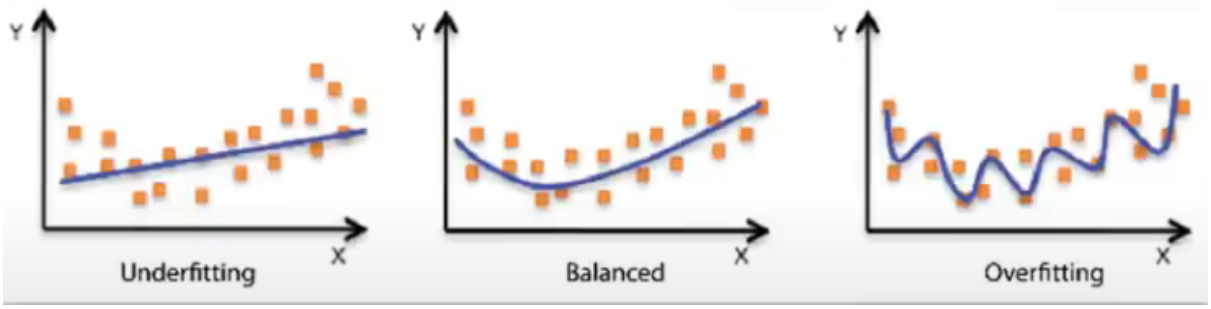
Q: What is the difference between Gini Impurity and Entropy in a Decision Tree?

⇒ These two are the metrics for deciding how to split a tree
⇒ Gini measurement is the probability of a random sample being classified correctly if you randomly pick a label according to the distribution in the branch

⇒ Entropy is a measurement of lack of information.You calculate the information gain by making a split, which is the difference in entropies. These measures tell how you reduce the uncertainty about the label.

Q: What is the difference between Entropy and Information Gain?
⇒ Entropy is an indicator of how messy your data is. It keeps on decreasing as you reach closer to the leaf node.
⇒ The information gain is based on the decrease in entropy after a dataset is split on an attribute. It keeps on increasing as you reach closer to the leaf node.

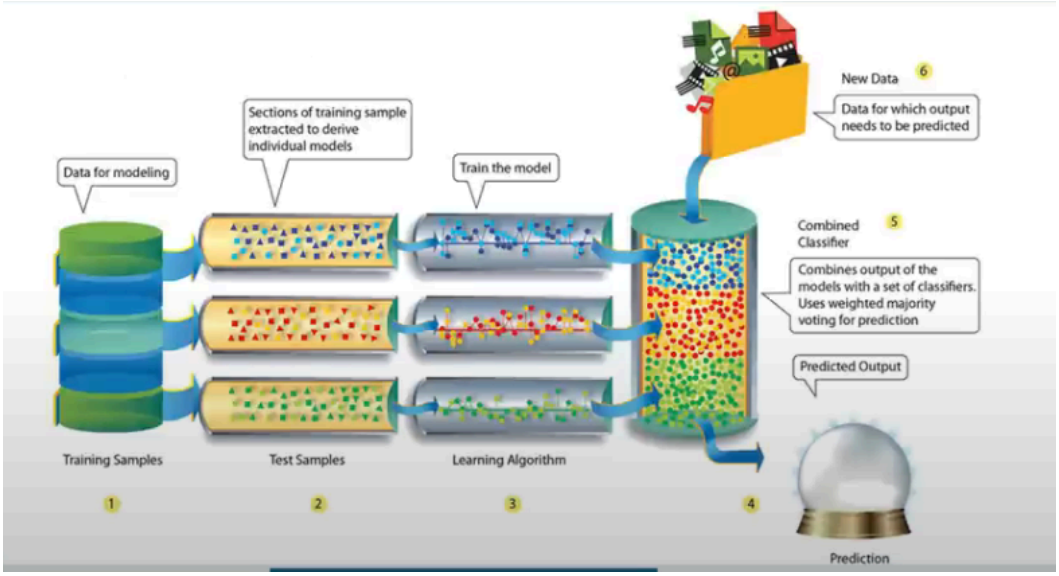
Q: What is overfitting? And how do you ensure you're not overfitting with a model?



Overfitting : a modelling performance,

Q: What is overfitting? And how do you ensure you're not overfitting with a model?
Three main methods to avoid overfitting:
⇒ Collect more data
⇒ Use ensembling methods that "average" models
⇒ Choose simper models

Q: Explain ensemble learning technique in Machine Learning



Q: What is bagging and boosting in machine learning?

Similarities	Difference
Both are ensemble methods to get N learns from 1 learner	While they are built independently for bagging, boosting tries to add new models that do well where previous models fall.
Both generate several training data sets by random sampling	Only boosting determines weight for the data to tip the scales in favour of the most difficult cases
Both make the final decision by taking the average of N learners	Is an equally average for bagging and a weighted average for boosting more weight in those with better performance on training data
Both are good at reducing variance and proving higher scalability	On

Meta MLE interview preparation guide
:https://aayushmnit.com/posts/2024-12-15-MLInterviewPrep/MLInterviewPrep.html

Python Error: `TypeError: 'method' object is not subscriptable`

ML for Nerds:

1. Video 1: Neural Networks From Scratch – Course Intro and Curriculum
    a. Basics of neuron
    b. Neural Network Components – Layers, Weights, Biases
    c. Neural Network Operations – Vector Dot Products
    d. Activation Functions – Sigmoid, Softmax, Relu, etc.,
    e. Loss functions – MSE, cross entropy etc.,
    f. Backpropagation – Gradient Descent
    g. Optimizers – SGD, ADAM, RMSPROP etc.,
    h. Training of NN – training loop, saving the model etc.,
    i. Evaluation – Accuracy Metrics

Prerequisites

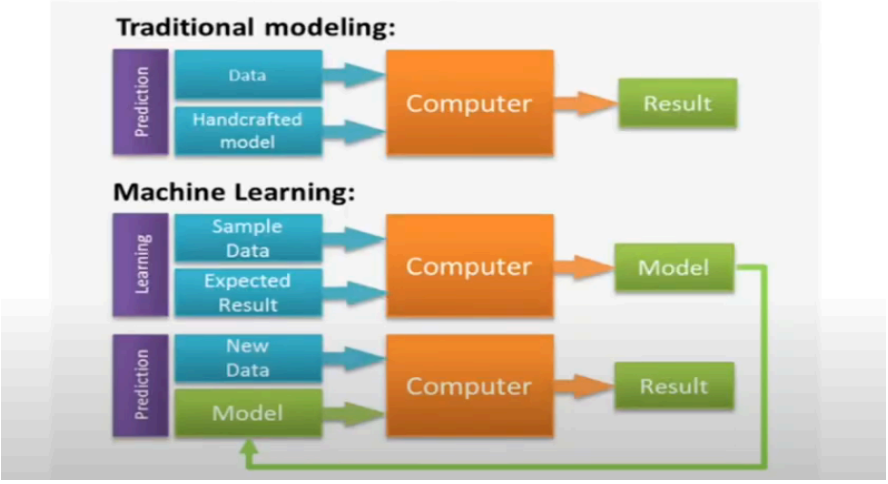
1. Python
2. Basics of linear algebra
3. Partial derivatives

Tools

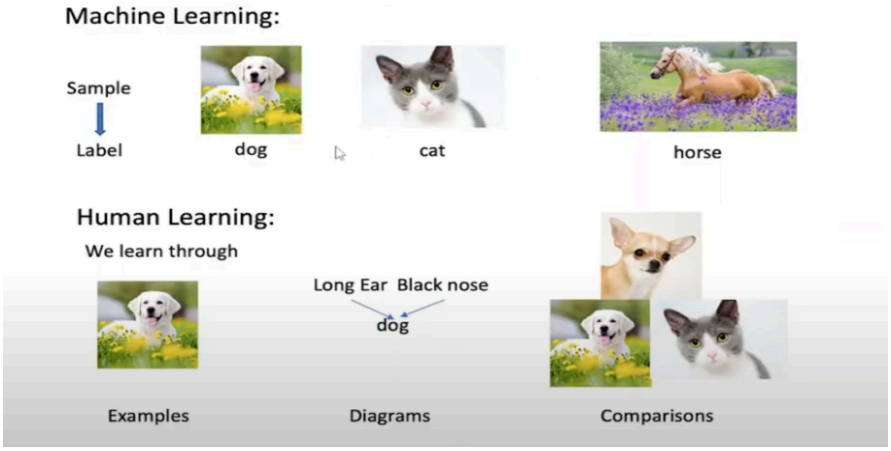
1. Python
2. Numpy

2. Video2 : Neural Networks from Scratch

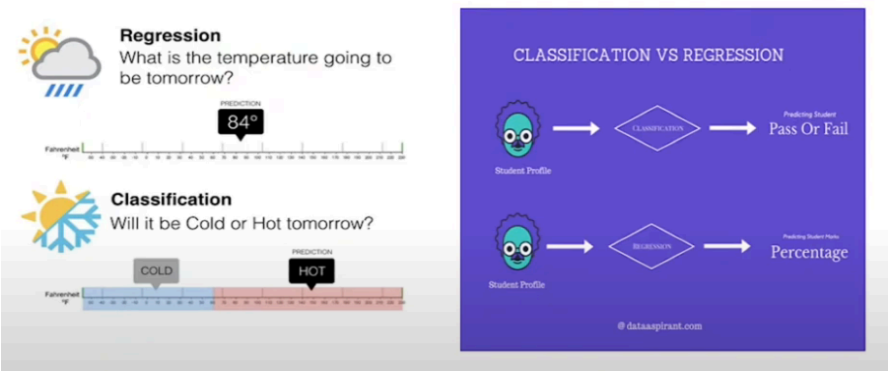
Introduction



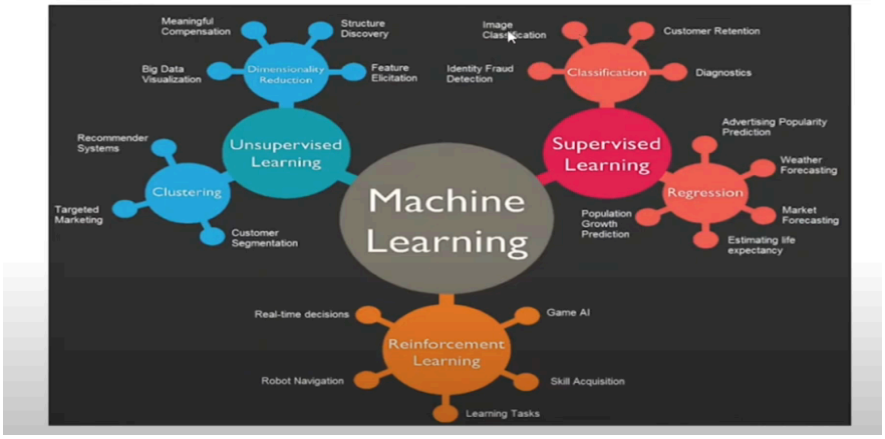
Example



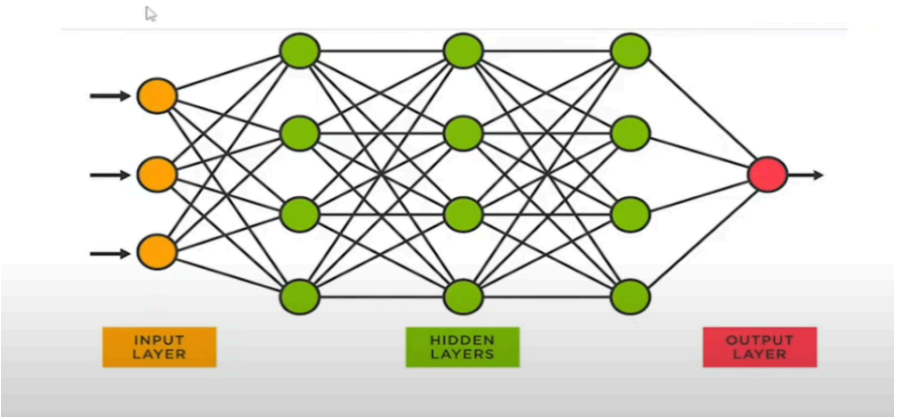
Common Tasks



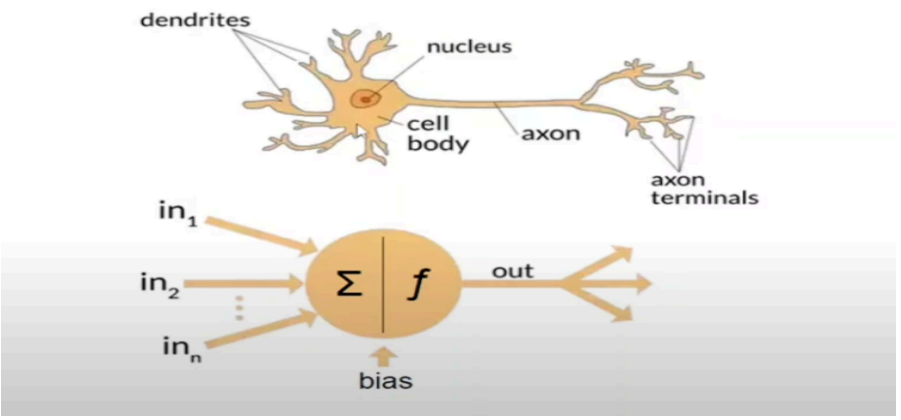
Machine Learning

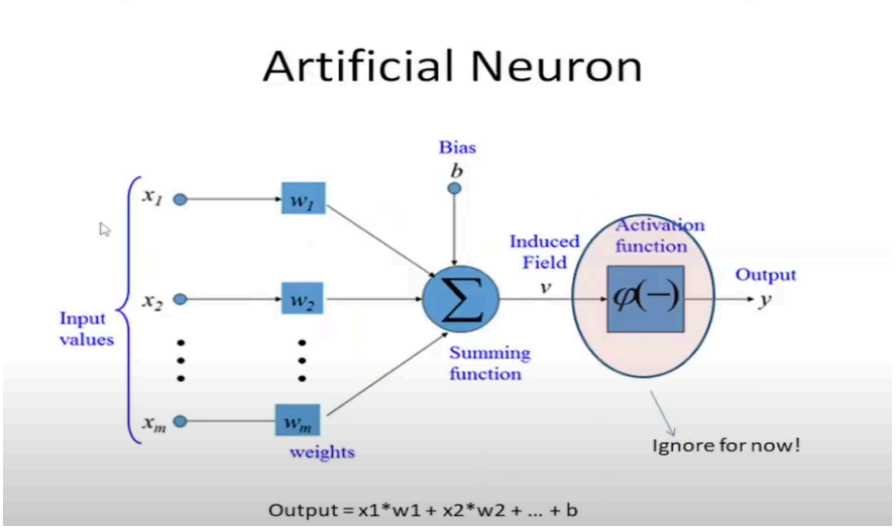


Neural Networks



Neuron





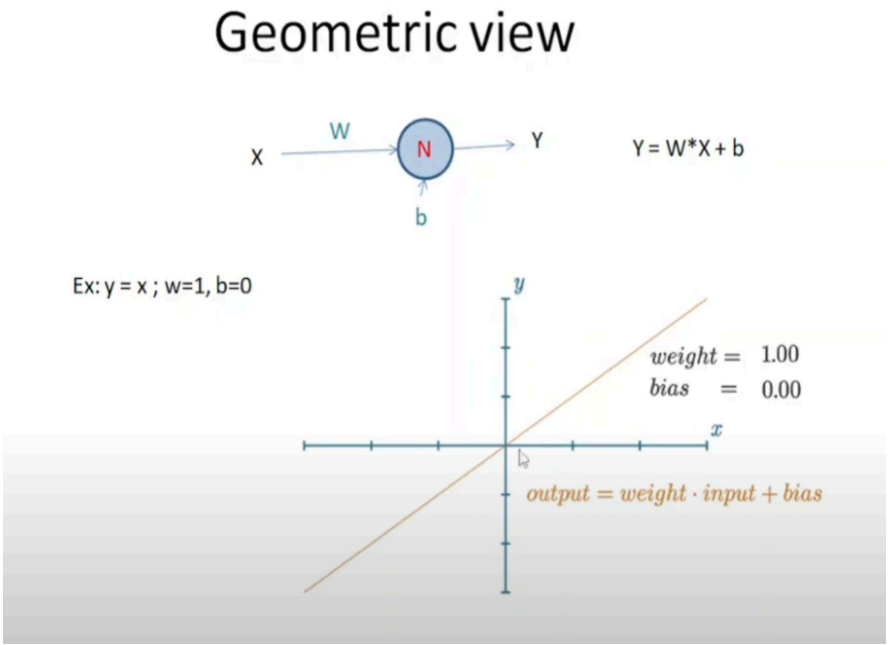
Examples:

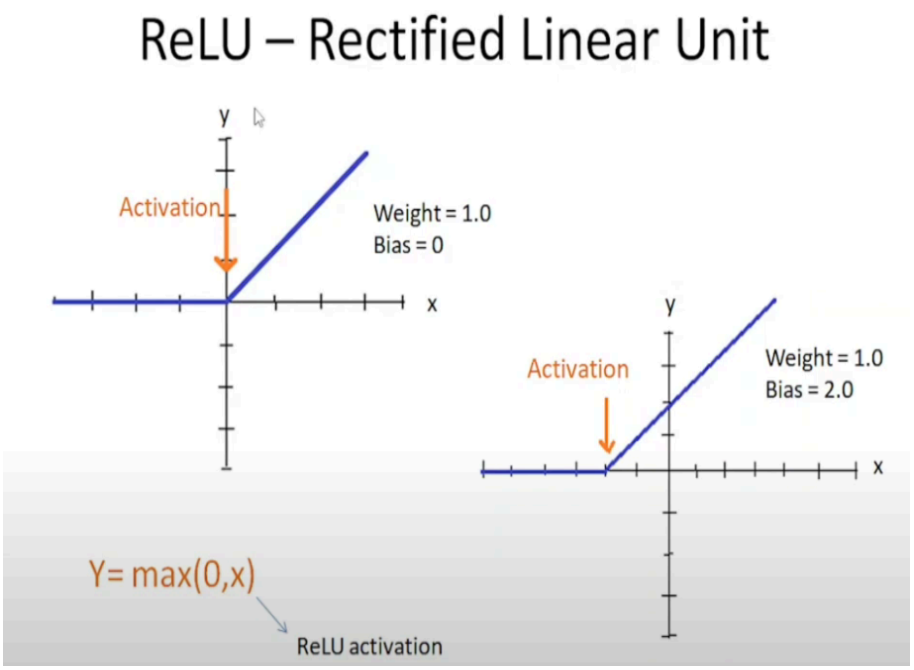
Weight =1.00
Bias =2.00
Output = Weight. Input + bias

System of linear equations

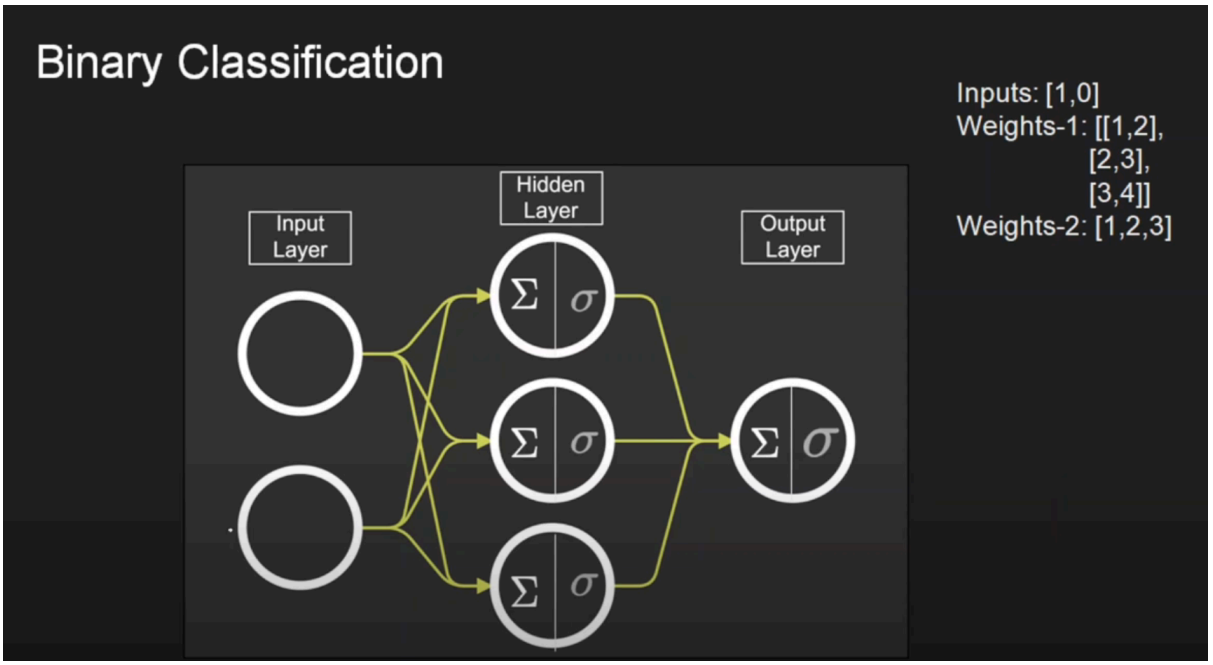
A1x + b1y = c1
A2x + b2y = c2 → bias

(a1,a2, b1,b2) = Weights





Neural Networks from Scratch - Activation Function



1x1 + 0x2 → 1

1x2 + 0x3 → 2

1x3 + 0x4 → 3

Binary Step

f(x) = 0 for x < 0

f(x) = 1 for x>=0

Drawbacks

1. Derivative is 0
2. Hard Threshold
3. Only for binary classification

Sigmoid Activation Function

→ S(x) = 1/(1+e^-x)

Drawback

→ Vanishing gradient
→ Not-Zero Centered

Sig(-1) → 0.3

Sig(-0.6) → 0.4

Sig(10) → 0.999

Python code:

→ import numpy as np
→ def sigmoid_function(x):
    Z =(1/(1+ np.exp(-x)))
    Return z

→ f'(x) = sigmoid(x)* (1- sigmoid(x))

Tanh Activation Function

Drawbacks of Sigmoid

→ Vanishing Gradient
→ Not zero-centered
→ Only for binary classification problems

⇒ Neural Networks from Scratch - Lec 10 - Relu and its variants

Variants of ReLU

→ Leaky ReLU
→ Randomized Leaky ReLU
→ Parametric ReLU
→ Exponential Linear Unit
→ Scaled Exponential Linear Unit

Solution:

→ f(x) = x for x <0
→ f(x) = x for x>0

ReLU vs Leaky ReLU

Randomized Leaky ReLU

→ ‘a’ - Random sample from Uniform Distribution [0,1]

Maxout Activation Function

⇒ Implementation

```
→ import numpy as np
→ x = np.random.random((2,5))
# 12 hidden neurons

→ W = np.random.random((12,5))
→  b = np.random.random((12))
→ print(W.shape, b.shape)
→ z = np.dot(x, W.T) + b
→ print(z.shape)
→ z_ = z.reshape((2,4,3))
→ o = np.max(z_, axis = 2)
→ print(o.shape)
```

Drawbacks in Maxout

→ Prone to overfitting
→ Used along with dropout regularization
→ Doubles the number of parameters compared to other activations

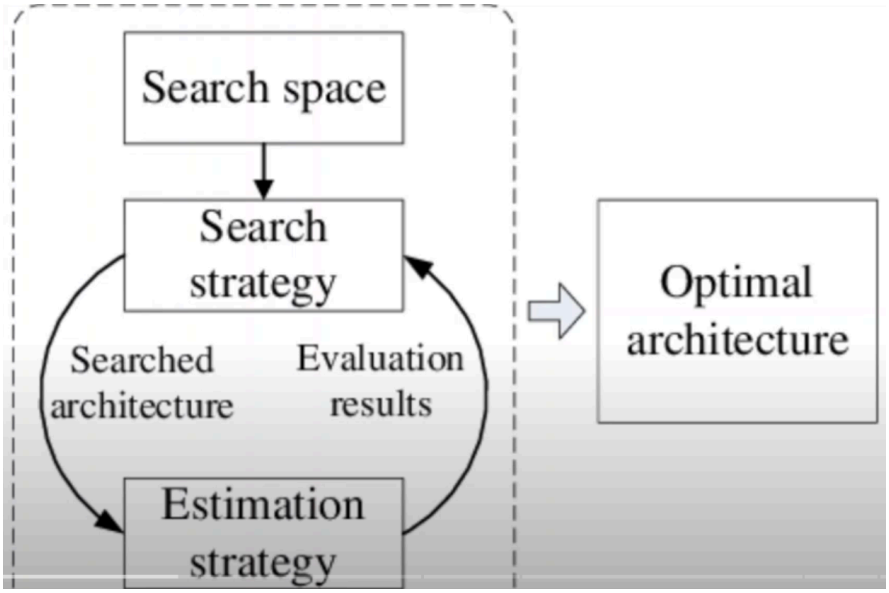
Softplus activation function ⇒ Don’t use in general

→ Derivative f(x) = ln(1+e^x)

Softplus
→ Range - (0,inf)
→ Smooth Gradient
→ NO Vanishing Gradient
→ Computationally Expensive

Swish Activation Function

⇒ Neural Architecture Search



Evaluated on
Datasets:
→ CIFAR-10
→ CIFAR-100

Networks:
→ ResNet (RN)
→ Wide ResNet (WRN)
→ DenseNet (DN)

Activation:
→ ReLU

General Form of activation function:

f(x) = x.sigma (beta of x)

Beta is a constant or trainable parameter

Derivative
⇒ f(x) = x.asapolon of x

Properties of Swish

⇒ Unboundedness
⇒ Non-monotonic
⇒ Smoothness

Mish Activation Function

→ f(x) = x. sigmoid(x) ← Swish Activation Function

→ f(x) = x. tanh(x) ← Mish Activation Function

Properties of Mish Activation Function

→ Continuous
→ Non-monotonicity
→ Zero-centered
→ Unbounded

GeLU Activation Function ←

Motivation
→ Combine ReLU and Dropout
→ ReLU - multiplies the input by 1 or 0
→ Dropout - Randomly drops neurons

Gaussian Error Linear Unit

→ Weighted Sum - x
→ g(x) = GeLU(x) = x*m

Intuition

Zero-to-Identify Mapping = (0 for negative inputs, x for positive inputs)

10 Activation functions in Neural Networks
→ Step
→ Sigmoid
→ Tanh
→ ReLU

→ Softplus
→ Maxout
→ GeLU
→ Swish
→ Mish
→ Softmax

*** Step Activation Function
→ Motivation : Neurons firing in human brain
→ Definition 👍
f(x) = 0 for x<0
f(x) = 1 for x>=0
→ Derivative 👍
f(x) =0, for all x
→ Properties:
1. Not continuous
2. Bounded
3. Not 0 centered
→ Poor Performance
→ Use case: Hidden and output layers

**** Sigmoid Activation Function

→ Motivation : Smooth curve and probabilistic output
→ Definition :
S(x) = 1/(1+e^-x)
→ Derivative:
→ Properties:
1. Continuous
2. Non-linear
3. Monotonic
4. Bounded
5. Not 0 centered
→ Performance : Avg
→ Use Case: HIdden and output layers

***** ReLU Activation Function

→ Motivation : Solve vanishing gradient problem, linear-like function
→ Definition :
ReLU = f(x) = max(0,x)

→ Derivative: f'(x) =1 for x > 0
=0 for x < 0
= NA for x =0

→ Properities:
1. Continuous
2. Piecewise linear
3. Monotonic
4. Unbounded
5. Not 0-centered

→ Performance : Better than sigmoid, tanh
→ Use cases: hidden layers

**** Softplus Activation Function
→ Motivation: ReLU-like function but smooth curve
→ Definition:
f(x) = ln(1+ e^x)
→ Derivative:
dy/dx = 1/(1+e^-x)
→ Properties:
1. Continuous
2. Non-Linear
3. Monotonic
4. Unbounded
5. Not 0-centered

→ Performance: Same as relu, but unstable
→ Use case: Hidden layers

**** Maxout Activation Function
→ Motivation: Solve dead neurons issue
→ Definition :
hi(x) =
→ Derivative: 1 or -1
→ Properties:
1. Non-continuous
2. Piecewise-linear
3. Unbounded
4. 0-centered

→ Performance: Better than relu, but complex
→ Use case: hidden layers

***** GeLU Activation Function
→ Motivation: Combine ReLU and Dropout
→ Definition:
→ Derivative :
→ Properties:
1. Continuous
2. Non-linear
3. Unbounded
4. 0-Centered
5. Non-monotonic

→ Performance: Better than relu, complex

→ Use Case: hidden layers

**** Swish Activation Function

→ Motivation: Search for better activation using NAS
→ Definition:
→ Derivative: f(x) +a(x) (1-f(x))
→ Properties:
1. Continuous
2. Non-Linear
3. Unbounded
4. 0-Centered

→ Performance: Better than relu
→ Use Case: Hidden Layers

***** Mish Activation Function
→ Motivation: Inspired by Swish
→ Definition : f(x) = x.tanh(ln(1+e^x))
→ Derivative:
→ Properties:
1. Continuous
2. Non-linear
3. Non-monotonic
4. Unbounded
5. 0-centered

→ Performance: Better than relu and swish
→ Use case: Hidden layers

****** Softmax
→ Motivation: Multiclass classification, probabilistic output
→ Definition:
→ Derivative:
→ Properties:
1. Non-linear
2. Bounded
3. Not 0-centered

→ Performance: NA
→ Use case: Output layers

Loss function vs Cost function vs Objective Function

⇒ Loss function : Error for a single data point (one sample in training set)
: Calculated many times for each cycle(for every data point)
: has only error terms
⇒ Cost function : Average error of group of data (for the whole training set)
: Calculated once for each training cycle

: Can have other terms like regularisation etc.,

*** Learning the parameters for optimizing the objective function
*** Learning the parameters for minimizing the cost function
*** Learning the parameters for maximizing the accuracy