INDUCTIVE BIAS, HYPOTHESIS, HYPOTHESIS SPACE, VARIANCE

(SESSION- 2018-19)

WHAT IS THIS ?

THIS IS :

CHOOSE A MODEL

X	Y
2	3.4
3	5.9
5	7.8
7.8	6.5
9.2	11.7
10.4	15.3
11.8	17.6

MODELS:

CHOOSE A MODEL (ASSUMPTIONS)

X	Y
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MODEL (**Assumptions**)

1. Y= bx + a
2. Y = $e^{-(bx)}$
3. Y = Sin(bx)
4. Y = bx^2
5. Y = $\sqrt{a + bx}$

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Chose a model from assumptions

Inductive Bias

INDUCTIVE BIAS

The **inductive bias** (also known as learning **bias**) of a learning algorithm is the set of assumptions that the learner uses to predict outputs.

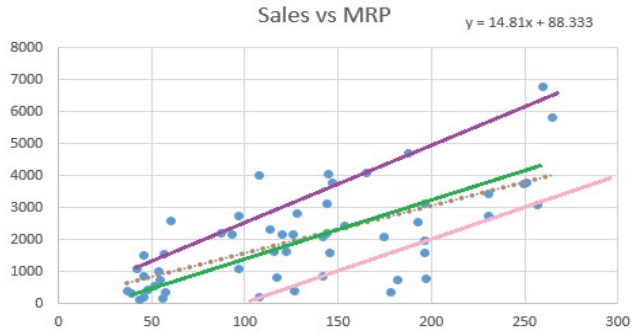
In machine learning, one aim to construct algorithms that are able to learn to predict a certain target output.

Inductive Bias = Y=a+bx (Linear Model)

HYPOTHESIS SPACE

Inductive bias = a +bx

Infinite Infinite

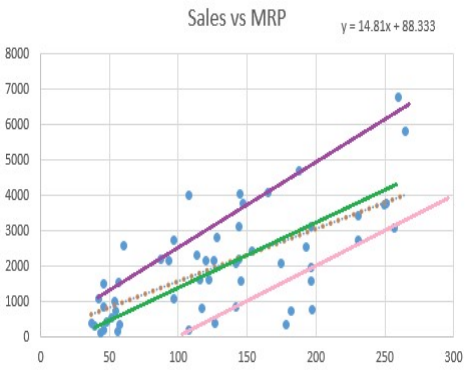


HYPOTHESIS SPACE

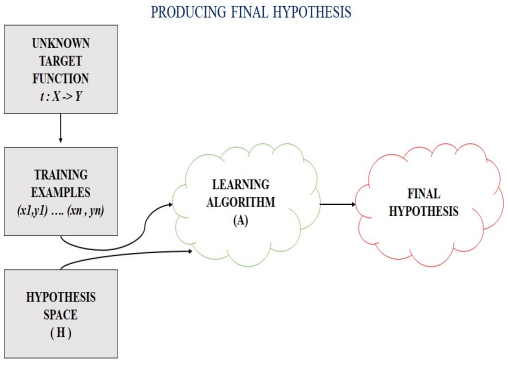
Hypothesis space is the set of all the possible legal hypothesis.

This is the set from which the machine learning algorithm would determine the best possible (only one) which would best describe the target function or the outputs.

Best Solution = Hypothesis



HYPOTHESIS

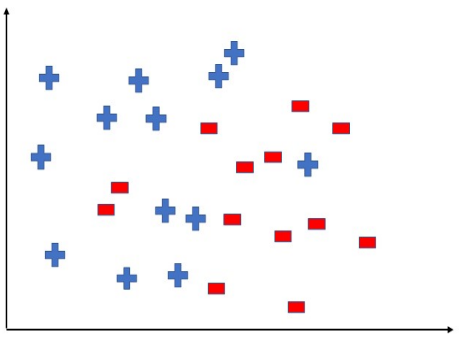


A hypothesis is a function that best describes the target in supervised machine learning.

The hypothesis that an algorithm would come up depends upon the data and also depends upon the restrictions and bias that we have imposed on the data.

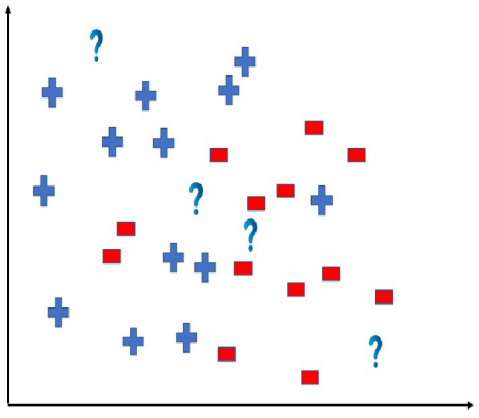
CLASSIFICATION EXAMPLE

To better understand the Hypothesis Space and Hypothesis consider the following coordinate that shows the distribution of some data:



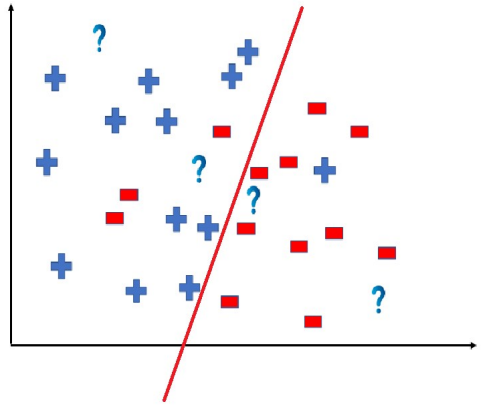
HYPOTHESIS

Say suppose we have test data for which we have to determine the outputs or results. The test data is as shown:



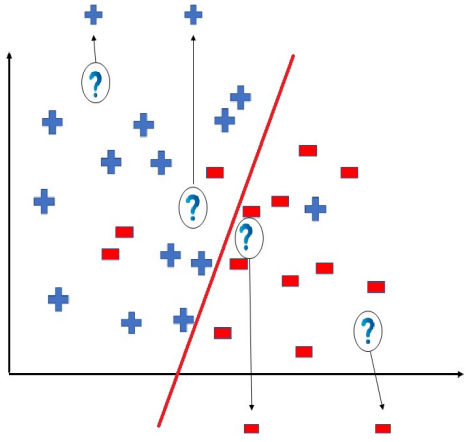
HYPOTHESIS

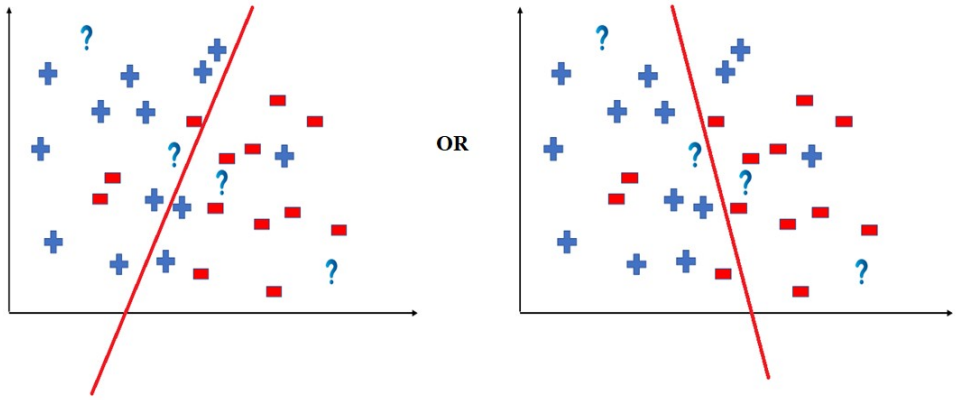
We can predict the outcomes by dividing the coordinate as shown below



HYPOTHESIS

So the test data would yield the following result:



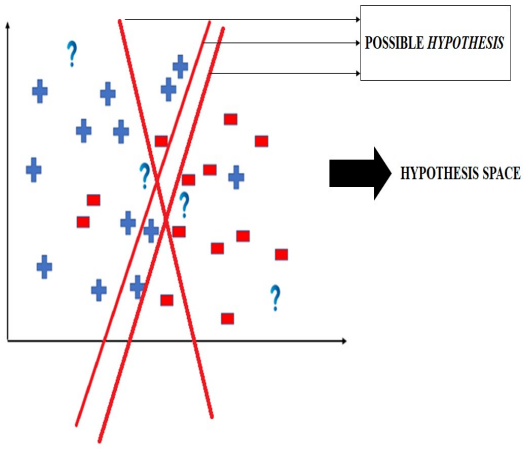


HYPOTHESIS

The way in which the coordinate would be divided depends on the data, algorithm and constraints.

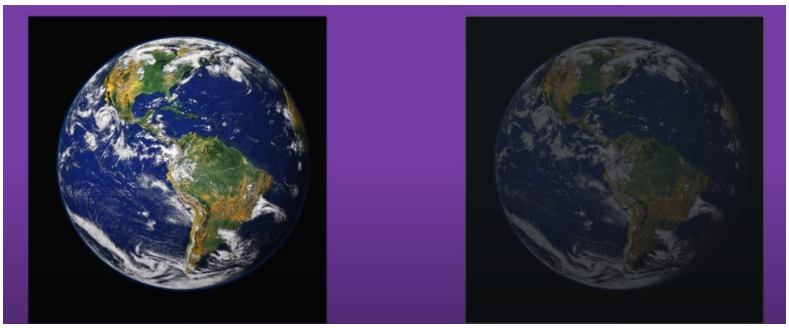
All these legal possible ways in which we can divide the coordinate plane to predict the outcome of the test data composes of the Hypothesis Space (H).

Each individual possible way is known as the hypothesis (h).

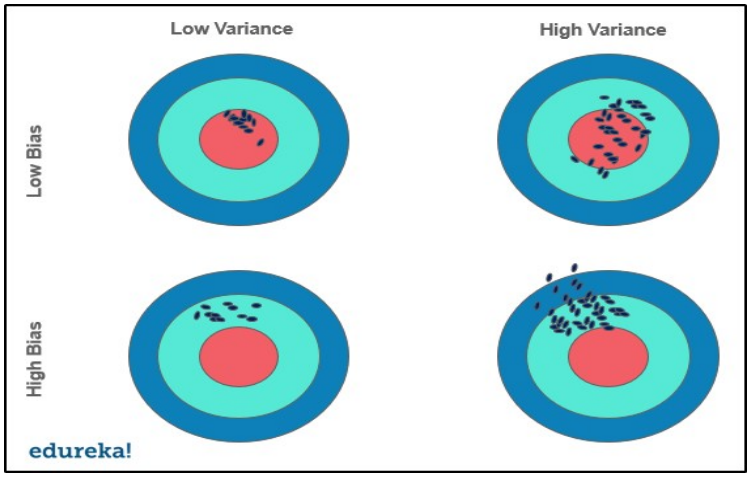


VARIANCE

- When a model does not perform as well as it does with the trained data set, there is a possibility that the model has a variance.
- It basically tells how scattered the predicted values are from the actual values.



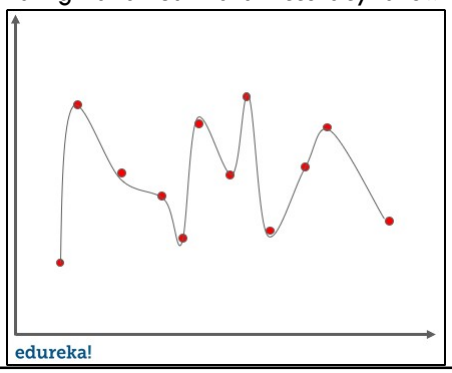
BIAS-VARIANCE TRADE-OFF



- Bias: Error in training data
- Variance: Error in test data

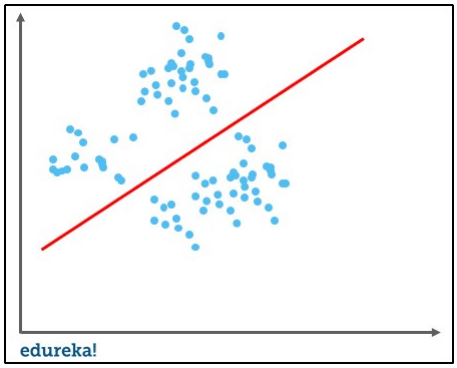
OVERFITTING

- A statistical model is said to be overfitted when we feed it a lot more data than necessary.
- Training Data Accuracy is high and Test Data Accuracy is low.

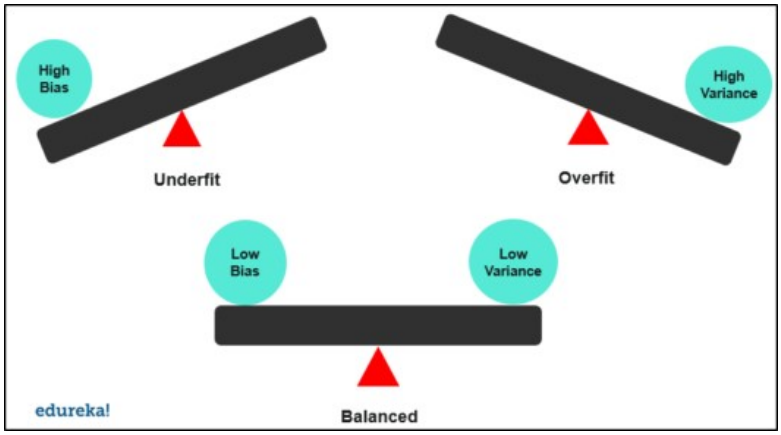


UNDERFITTING

- In order to avoid overfitting, we could stop the training at an earlier stage.
- Training Data Acc is low and Test Data Acc is low

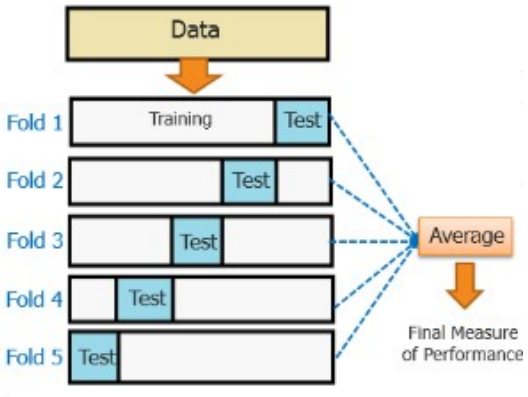


IDEAL SCENARIO



AVOID OVERFITTING

- Cross-Validation
- Training With More Data
- Removing Features
- Early Stopping
- Regularization
- Ensembling



Thank You…