

# Hypothesis Space and Inductive Bias

BCSE0105: MACHINE LEARNING

What is this ?



This is :



# Data

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

# MODEL (Assumptions)

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

1.  $Y = bx + a$

2.  $Y = e^{-(bx)}$

3.  $Y = \sin(bx)$

4.  $Y = bx^2$

5.  $Y = \sqrt{a + bx}$

# MODEL (Assumptions)

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

1.  $Y = bx + a$

2.  $Y = e^{-(bx)}$

3.  $Y = \sin(bx)$

4.  $Y = bx^2$

5.  $Y = \sqrt{a + bx}$

Chose a model  
from assumptions

Inductive  
Bias

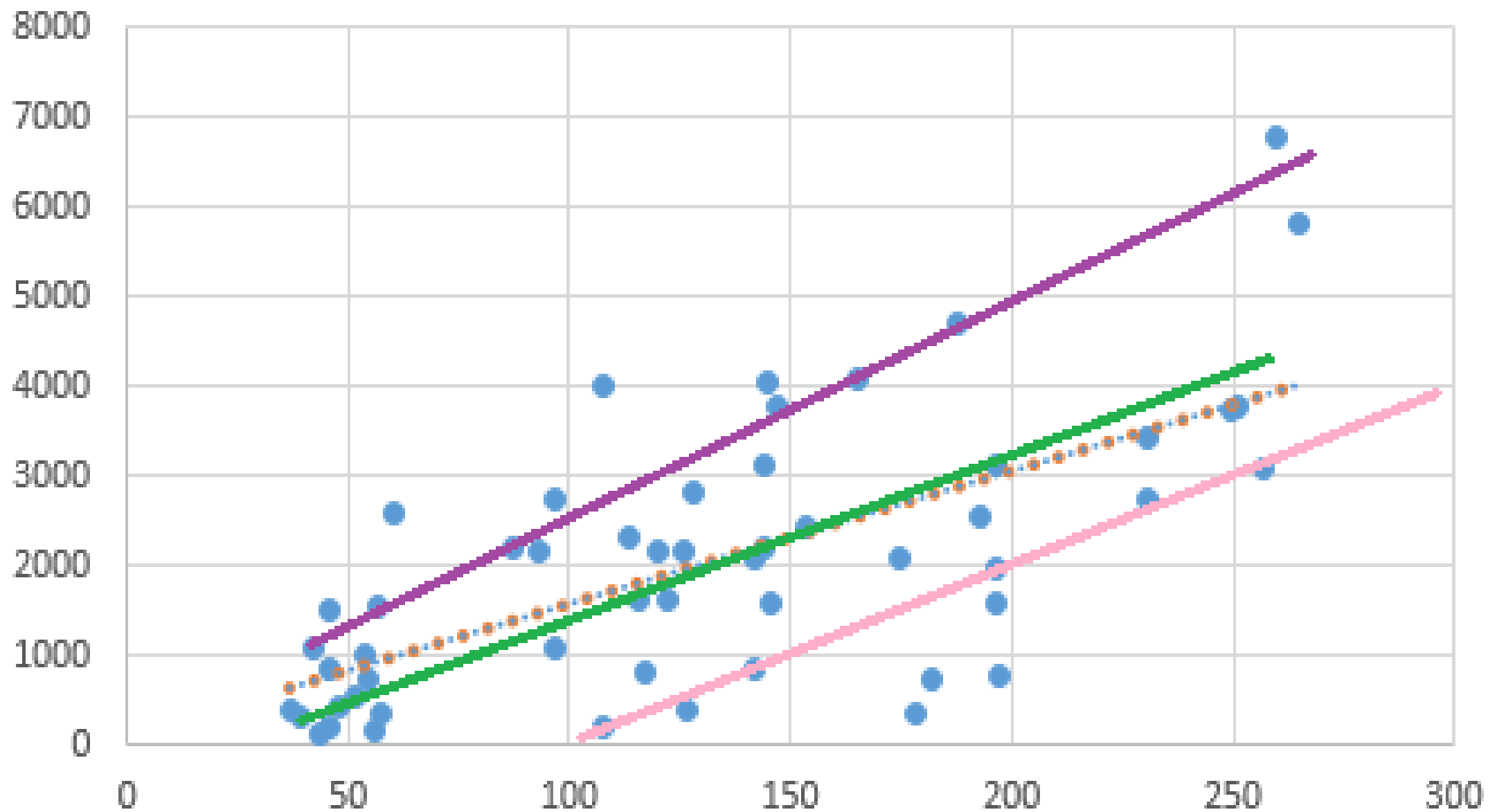
# Inductive bias

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

Inductive Bias  $\Rightarrow Y = bx + a$  (Linear Model)

# Sales vs MRP

$$y = 14.81x + 88.333$$



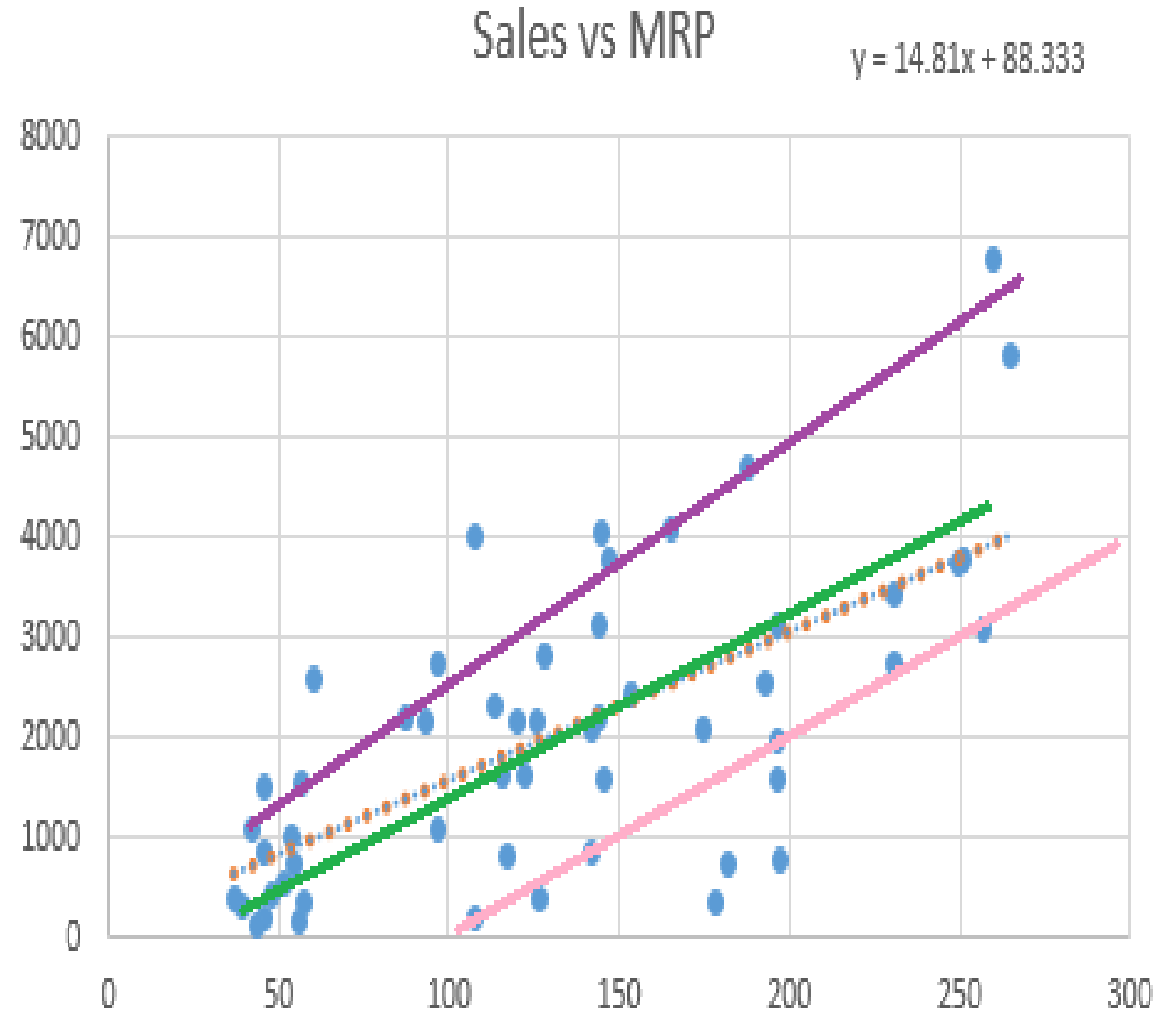


# Hypothesis

- A hypothesis is a tentative statement about the relationship between two or more variables
- An idea that is suggested as the possible explanation for something but has not yet been found to be true or correct

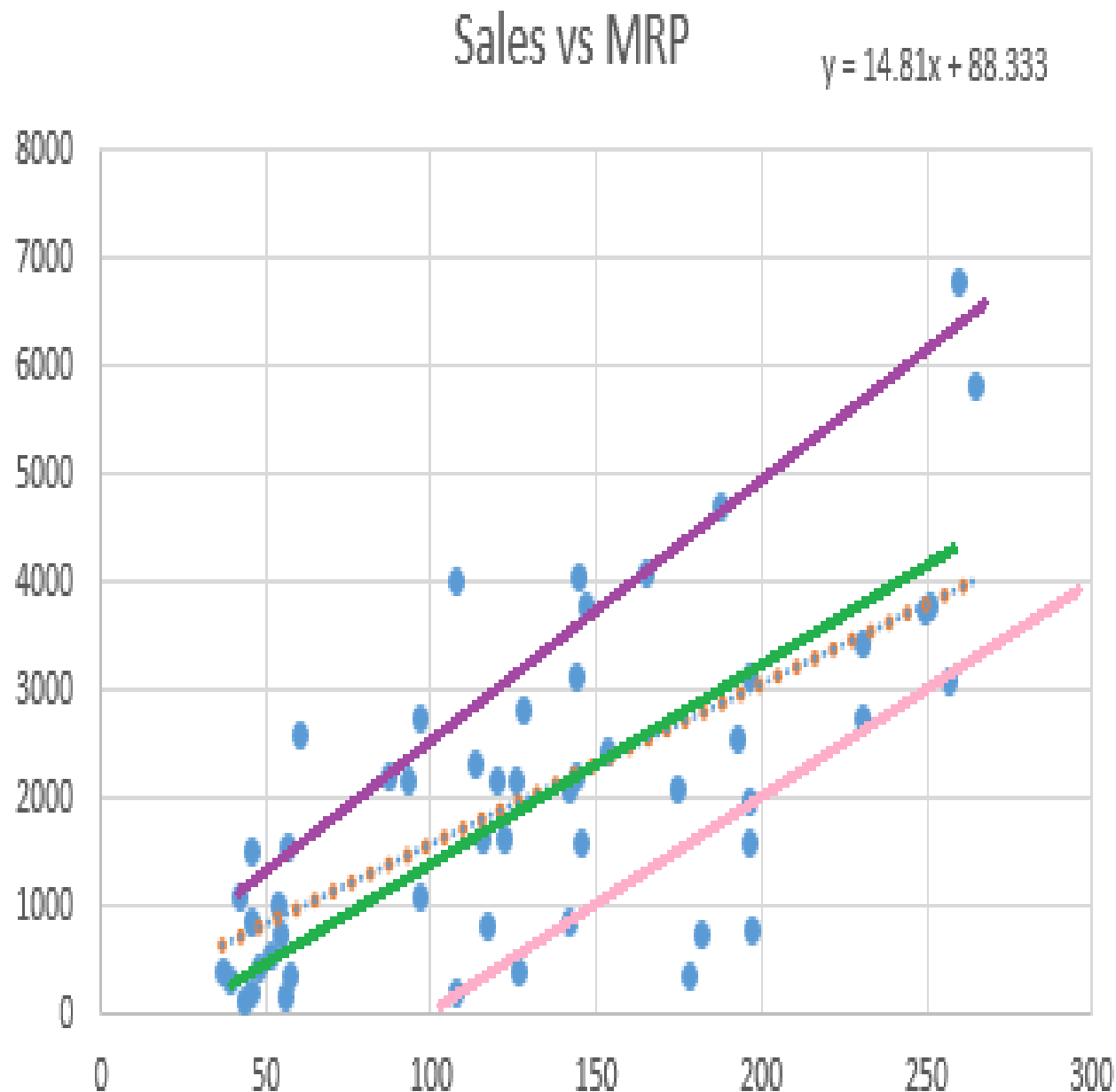
# Hypothesis

- Hypothesis in Machine Learning is used when in a Supervised Machine Learning, we need to find the function that **best maps input to output**.
- Eg.  $y = 14.81x + 88.333$



# Hypothesis space

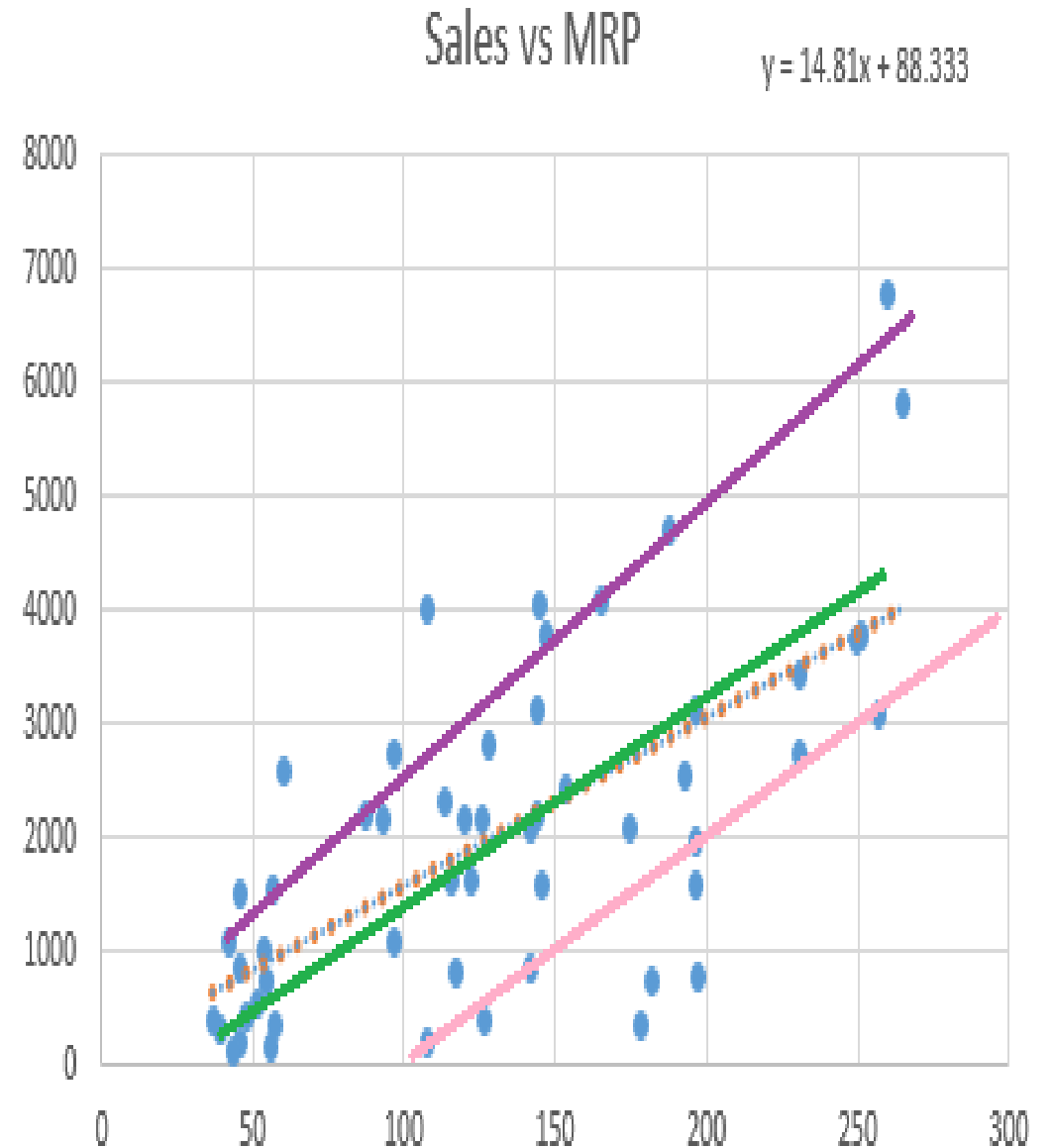
- Inductive bias =  $a + bx$
- For particular values of  $a$  and  $b$ , it becomes hypothesis
- But  $a$  and  $b$  can take **infinite values**
- The linear model is **hypothesis space** collectively for all values of  $a$  and  $b$ .



# Hypothesis space

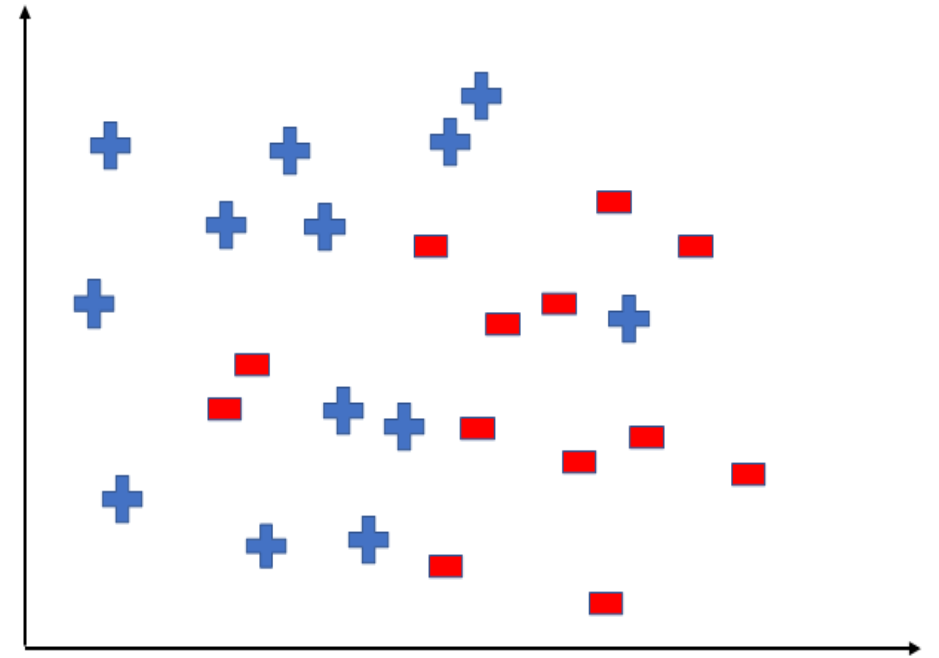
- Hypothesis space is the set of all the **possible legal hypothesis**.
- This is the set from which the machine learning algorithm would determine the best possible **(only one)** which would best describe the target function or the outputs.

Best Solution = Hypothesis



# Classification example

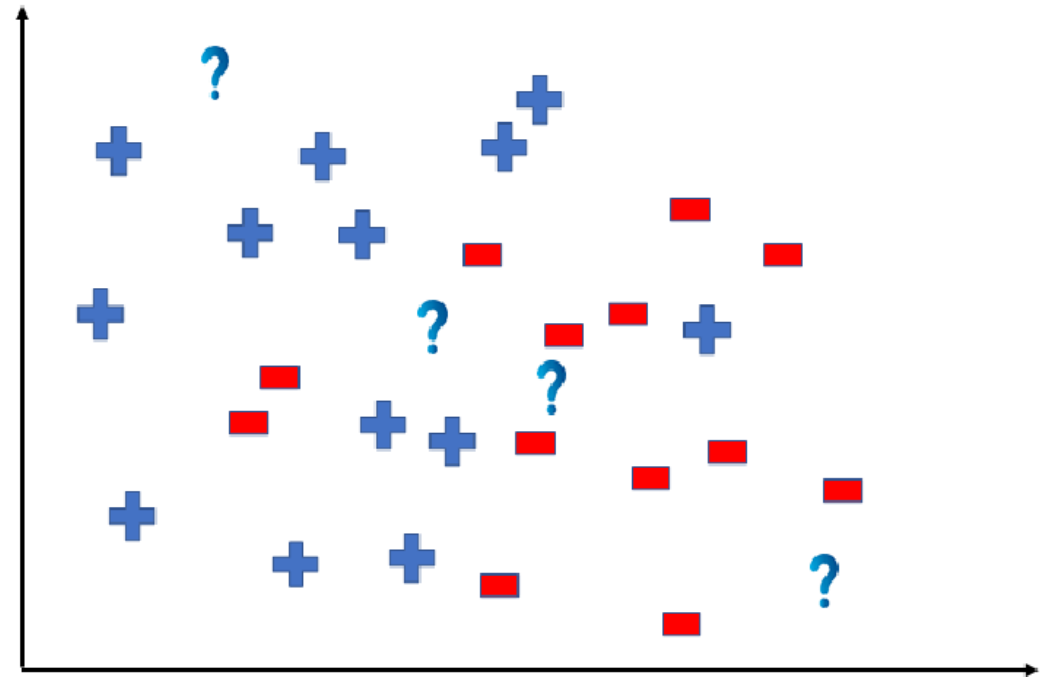
To better understand the Hypothesis Space and Hypothesis consider the following coordinate that shows the distribution of some data.



# Classification example

## Hypothesis

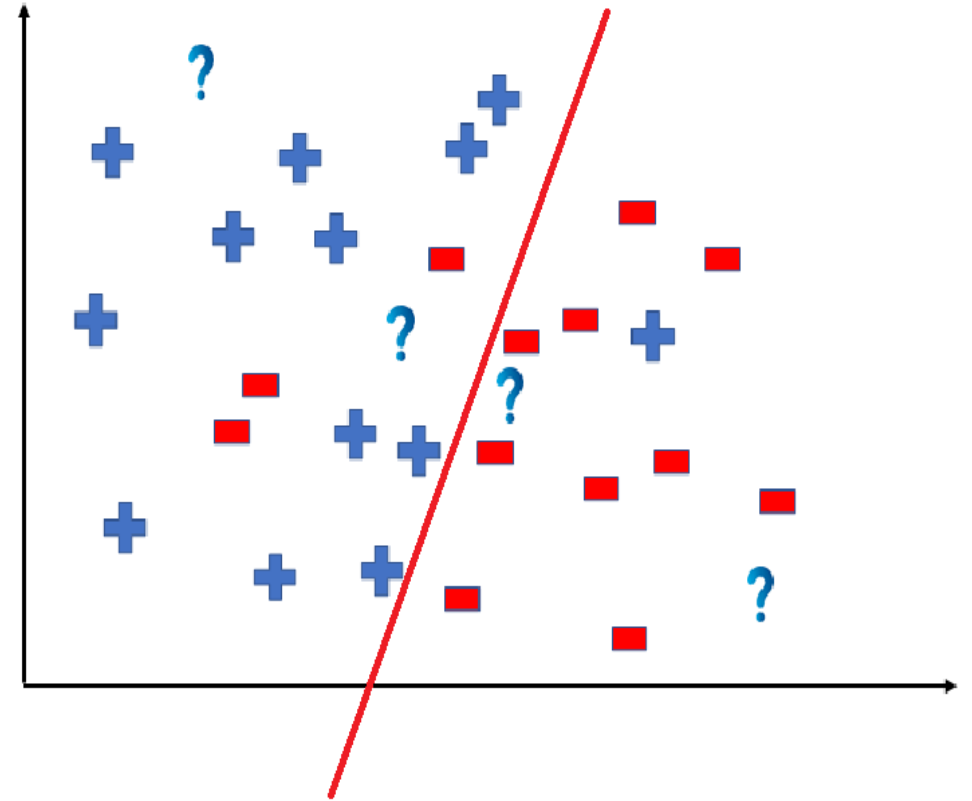
Suppose we have test data for which we have to determine the outputs or results. The test data is shown as ‘?’



# Classification example

## Hypothesis

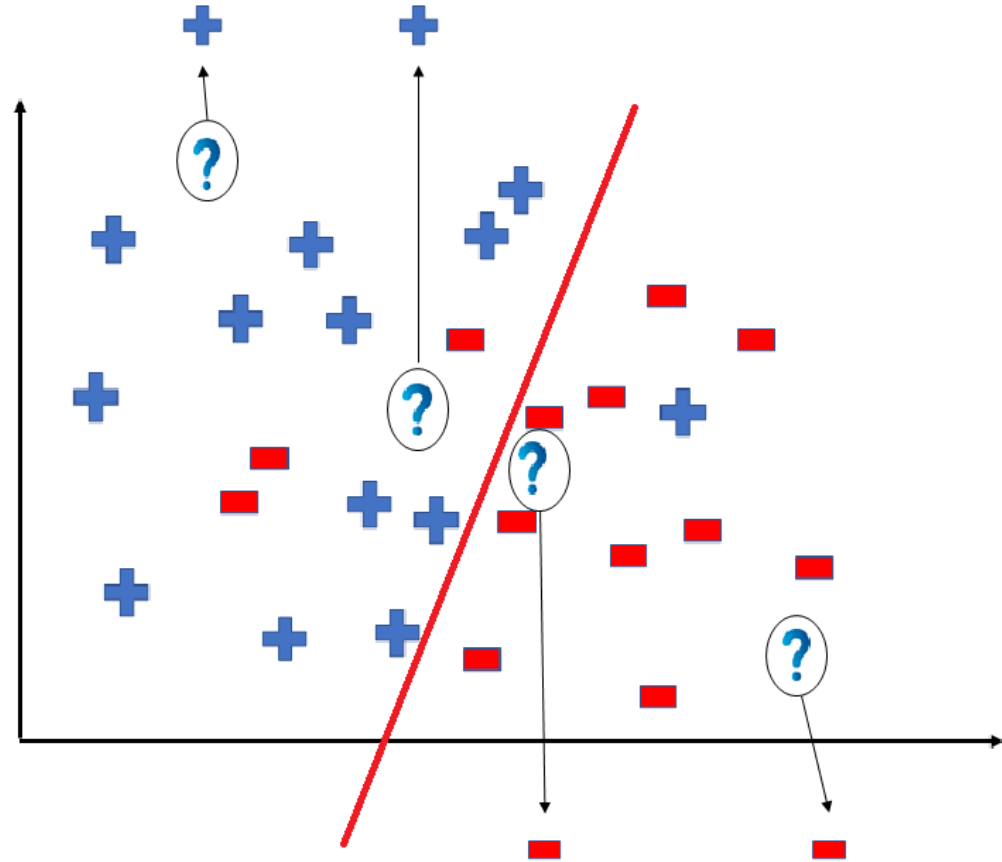
We can predict the outcomes by dividing the coordinate as shown below



# Classification example

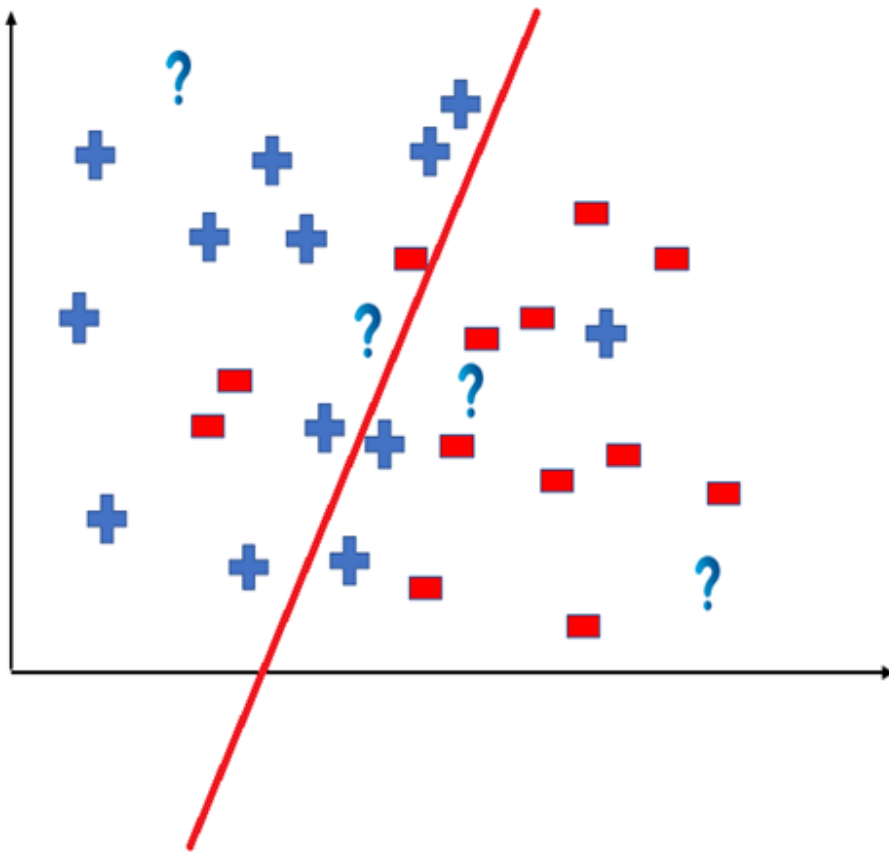
## Hypothesis

So the test data would yield the following result

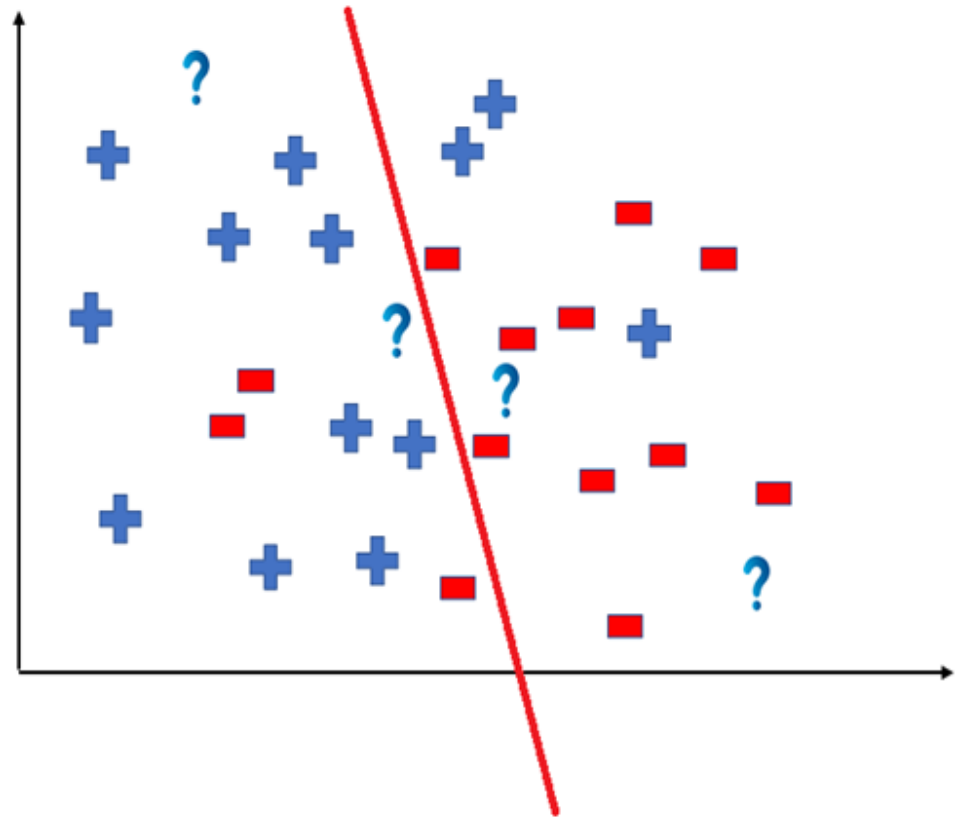




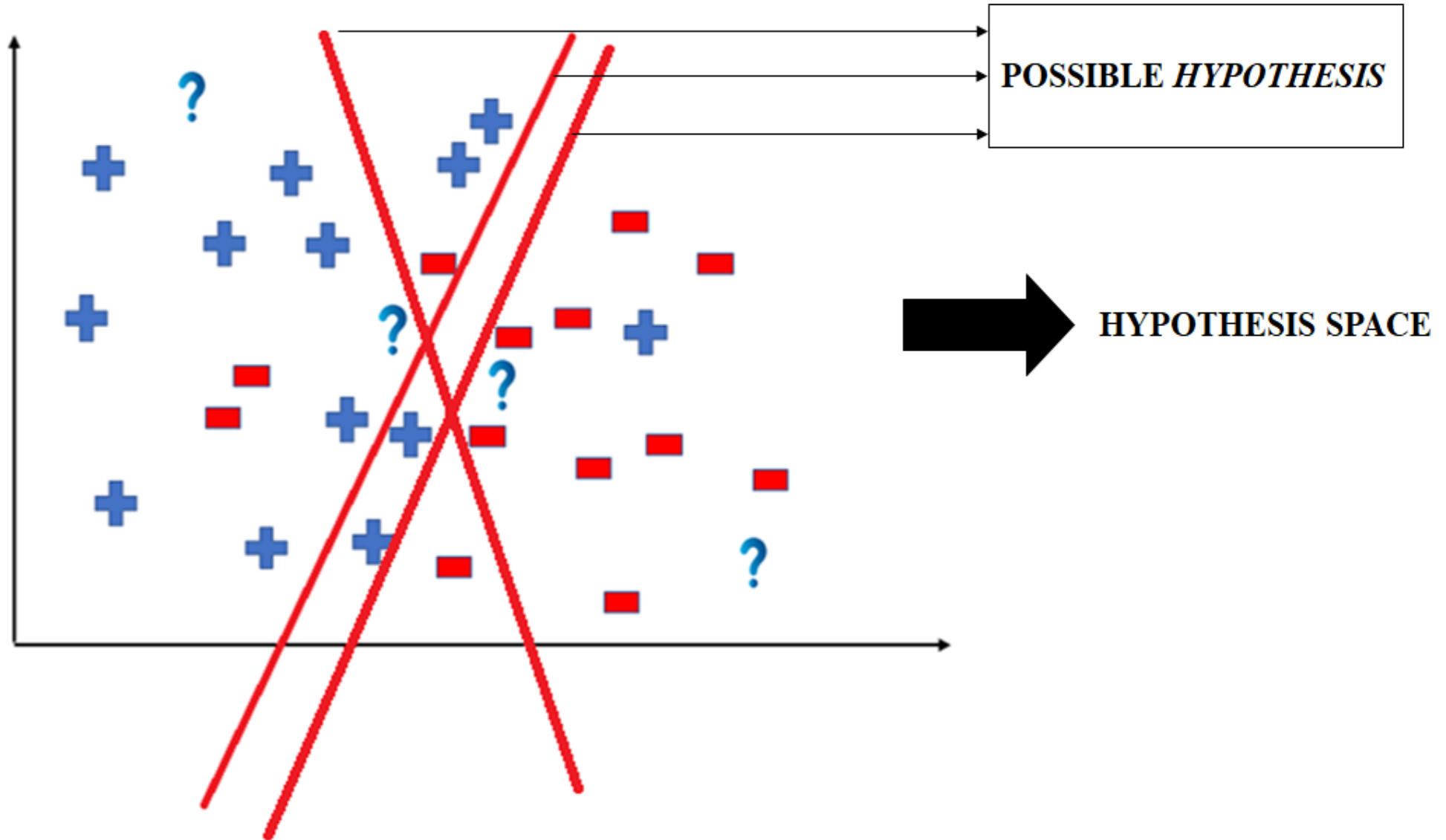
# Hypotheses (More than one possible solution)



OR



# Hypothesis Space



# Hypothesis Space

- 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 ( $h$ ).