Cognizant

Welcome
to the course

Machine Learning

Fundamentals of Machine Learning

Overview

Data Science involves the concepts of Machine learning, which in turn is the study of algorithms that can learn and modify itself according to the data provided.

Fundamentals of Machine Learning

Objectives

By the end of this module, you will be able to:

- Define Data Science
- Understand the fundamentals of Machine Learning
- Describe the concepts of Supervised and Unsupervised Learning

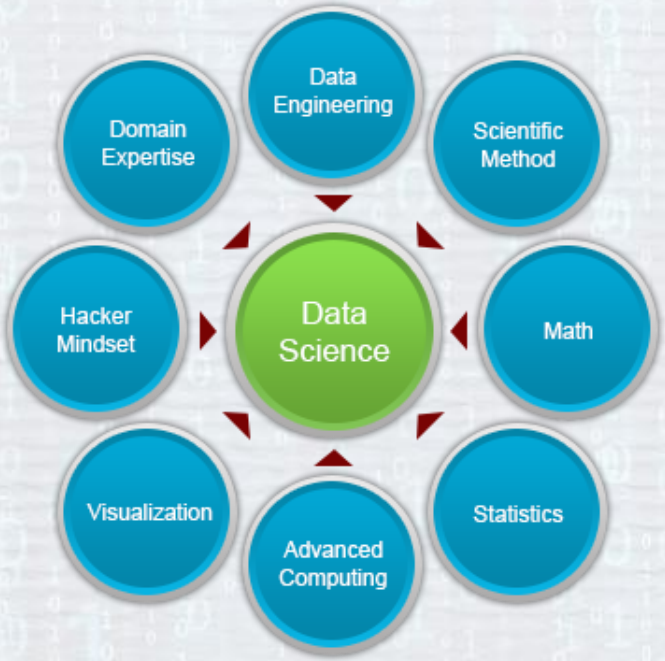
Fundamentals of Machine Learning

Introduction to Data Science

What is Data Science?

Data Science is defined as the process of extracting knowledge from a given set of data.

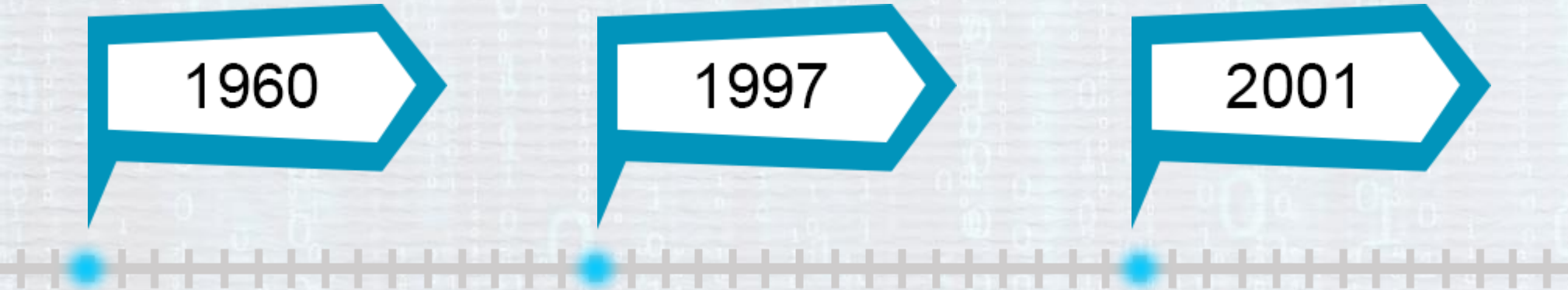
The extraction of data is done by applying techniques and theories of various fields like statistics, signal processing, probability models, data engineering, pattern recognition, predictive analysis, data warehousing and machine learning. The practitioners are called Data Scientists.



Data Science Timeline

Data science has existed ever since the inception of time. For example, in ancient times, before the invention of the sun dial, the time of the day and the time of dusk could be told by looking at the sky. Similarly, a change in the weather pattern could be predicted by the farmers for over centuries.

Data science has been growing perpetually ever since. Now let's take a look at a few pivotal instances in the development of data science as a new field.



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Data Science Timeline

In the year 1960, Peter Naur used the term ‘Data Science’ for the first time as a substitute for Computer Science.

1960

In the year 1997, C.F. Jeff Wu in his lecture, titled, ‘Statistics=Data Science?’ coined the term ‘Data Science’.
He advocated that Statistics should be renamed as Data Science.

1997

In the year 2001, William S. Cleveland introduced Data Science as an independent field in his article titled, ‘Data Science: An Action Plan for Expanding the Technical Areas of the Field of Statistics’

2001

More on Data Science

Vasant Dhar is a Paduano Fellow, Professor, Head of the Information Systems Group, and Director for the Center for Business Analytics at the Stern School of Business at NYU. Dhar teaches courses on Digital Marketing, Trading Strategies and Data Driven Predictive Analysis.

Let's take a look at what Vasant Dhar has to say about data science.

Vasant Dhar

More on Data Science

Vasant Dhar defines data science as being essentially the systematic study of the extraction of knowledge from data. He explains, 'Unlike database querying, which asks what data satisfies this pattern? Discovery asks what patterns satisfy this data?'.

He goes on, 'Specifically, our concern is finding interesting and robust patterns that satisfy the data, where interesting is usually something unexpected and actionable and robust is a pattern expected to occur in the future.'

Data Science in Play

The following are some of the Use Cases of Data Science.

Life Sciences

Travel

Manufacturing

Healthcare

Retail

Insurance

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Data Science in Play

Life Sciences

Life Sciences:

- Drug/chemical discovery & analysis
- Predicting drug demand in different geographies for different products

Travel

Travel:

- Aircraft scheduling
- Dynamic pricing

Manufacturing

Manufacturing:

- Sensor data to look at failures
- Demand forecasting/inventory management

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Data Science in Play

Healthcare:

- Claims review prioritization
- Medicare/medicaid fraud

Retail:

- Market Basket Analysis
- Cannibalization Analysis

Insurance:

- Claims prediction
- Agent & branch performance

Healthcare

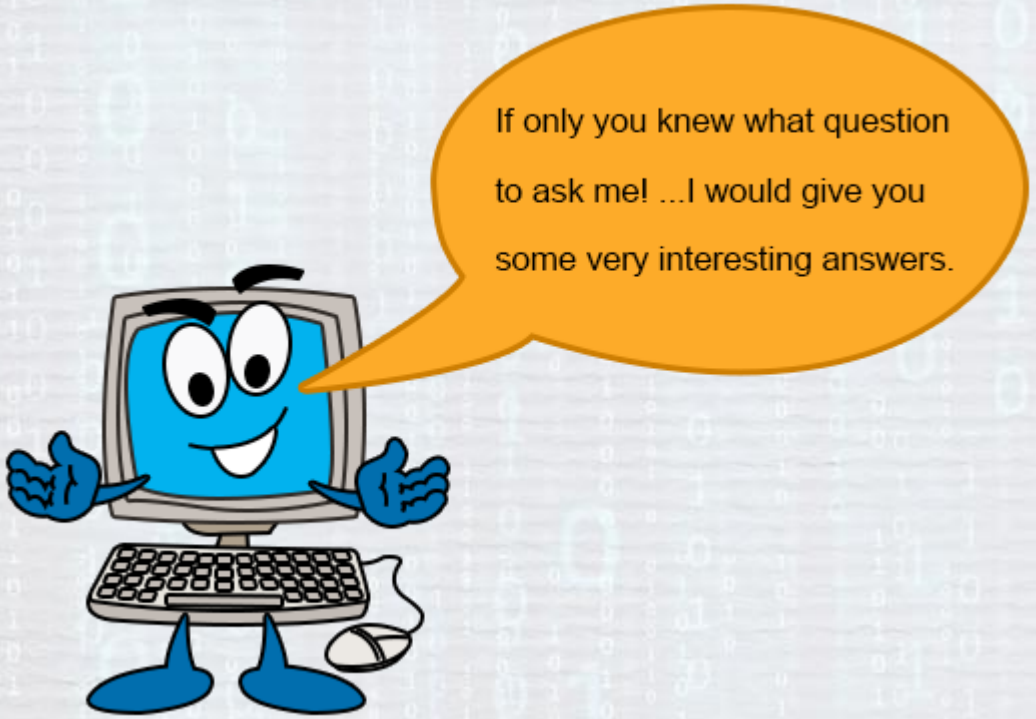
Retail

Insurance

Introduction to Machine Learning Fundamentals

What is Machine Learning?

Given a large trove of data, the computer taunts us by saying, ‘if only you knew what question to ask me, I would give you some very interesting answers based on the data’, says Vasant Dhar on Machine Learning.



Introduction to Machine Learning Fundamentals

What is Machine Learning?

Machine learning is a scientific discipline that explores the construction and study of algorithms which can learn from data.

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In 1959, Arthur Samuel said that, ‘Machine learning is a field of study that gives the computers the ability to learn without being explicitly programmed’.

Moreover, he also believed that the main objective of machine learning is to devise learning algorithms that learns automatically without human intervention.

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Introduction to Machine Learning Fundamentals

What is Machine Learning?

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Vasant Dhar further adds, 'Suitably designed machine learning algorithms help find such patterns for us. To be useful both practically and scientifically, the patterns must be predictive. The emphasis on predictability typically favor's Occam's razor, or succinctness, since simpler models are more likely to hold up on future observations…'

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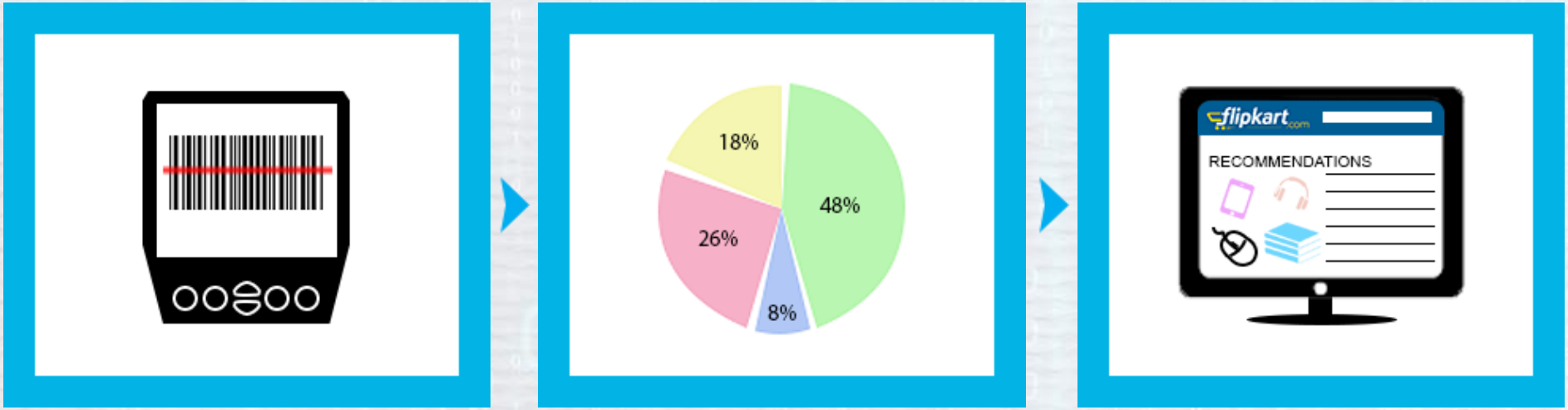
Introduction to Machine Learning Fundamentals

How does machine learning work?

In the year 1998, Tom Mitchell described the working of machine learning through the definition of a Well-Posed Learning Problem. According to the definition, a computer program can learn from experience ‘E’ with respect to some Task ‘T’ and some performance measure ‘P’. If the performance of the computer is measured on ‘T’, as measured by ‘P’, the performance improves with experience ‘E’.

Let’s look at a more relatable example.



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Introduction to Machine Learning Fundamentals

Flipkart scans or tracks the purchase history for a customer.

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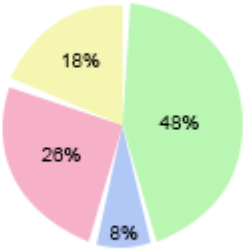
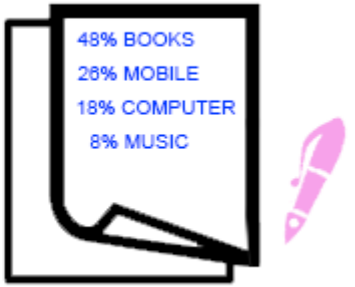
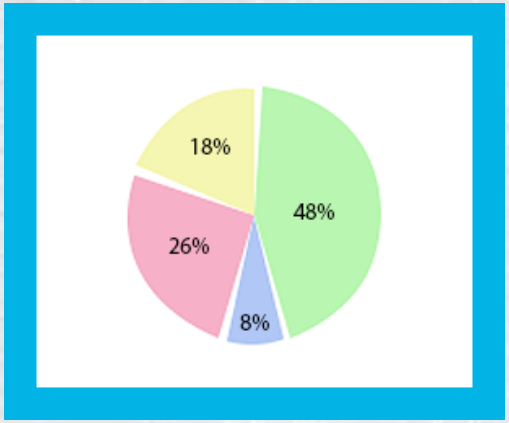
Post the scan, the algorithm will identify those products in which the customer will be particularly interested and will likely make a purchase.







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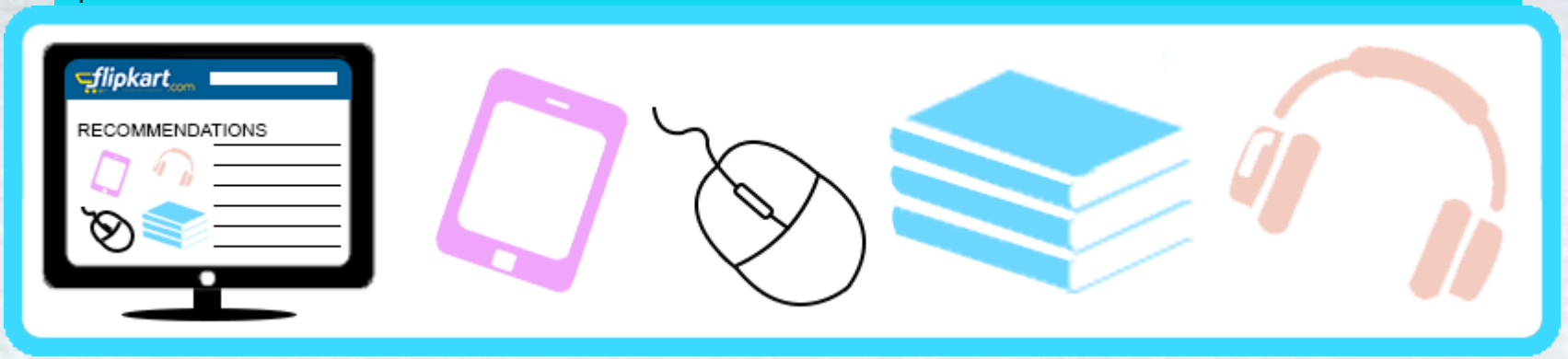
Introduction to Machine Learning Fundamentals

The decision process model allows the program to make future recommendations to the customer and motivate for purchase.

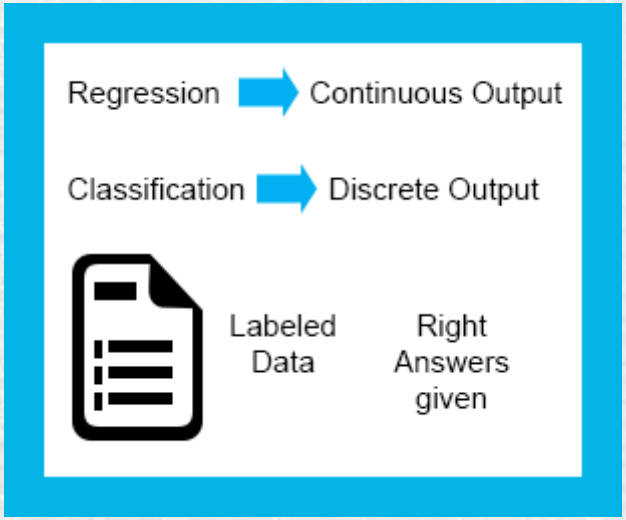


Fundamentals of Machine Learning

Types of Machine Learning

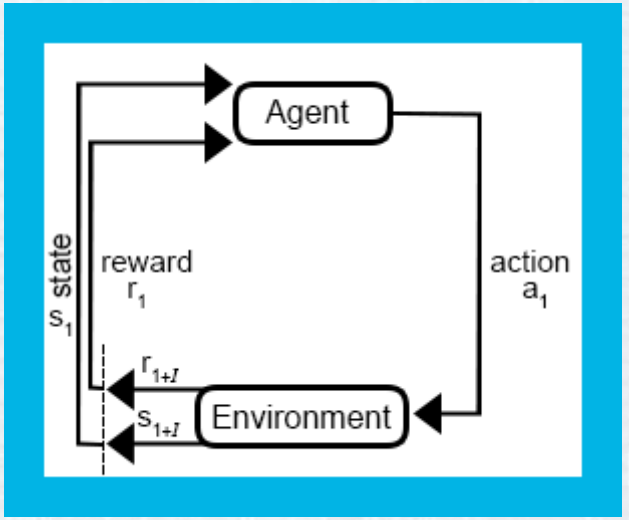
The following are the different types of machine learning.

Supervised Learning



Unsupervised Learning

Others



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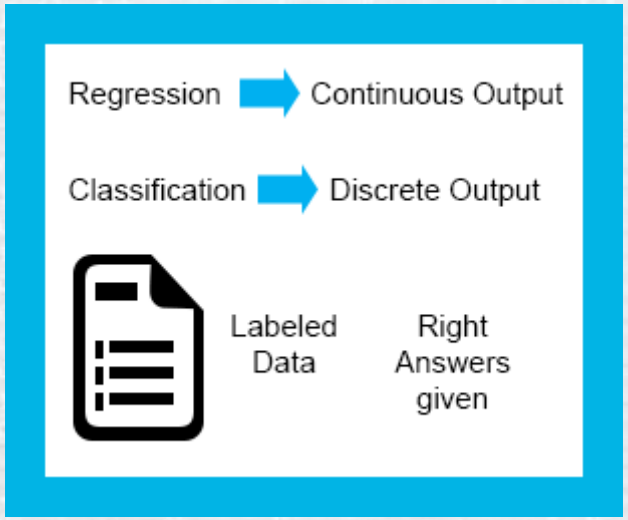
Types of Machine Learning

Supervised Learning



Supervised Learning helps in predicting outputs for new inputs by analyzing the labeled training dataset.

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Types of Machine Learning

Unsupervised Learning

Unsupervised Learning helps in finding the hidden structure in a dataset.

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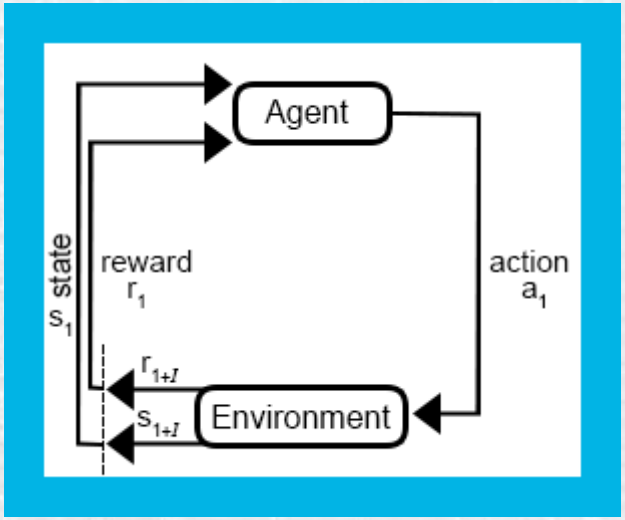
Types of Machine Learning

Others



Reinforce learning and recommender system algorithms also fall under Machine Learning.

Reinforcement learning is an area of machine learning inspired by behaviorist psychology.

Recommender systems are a subclass of information filtering system.

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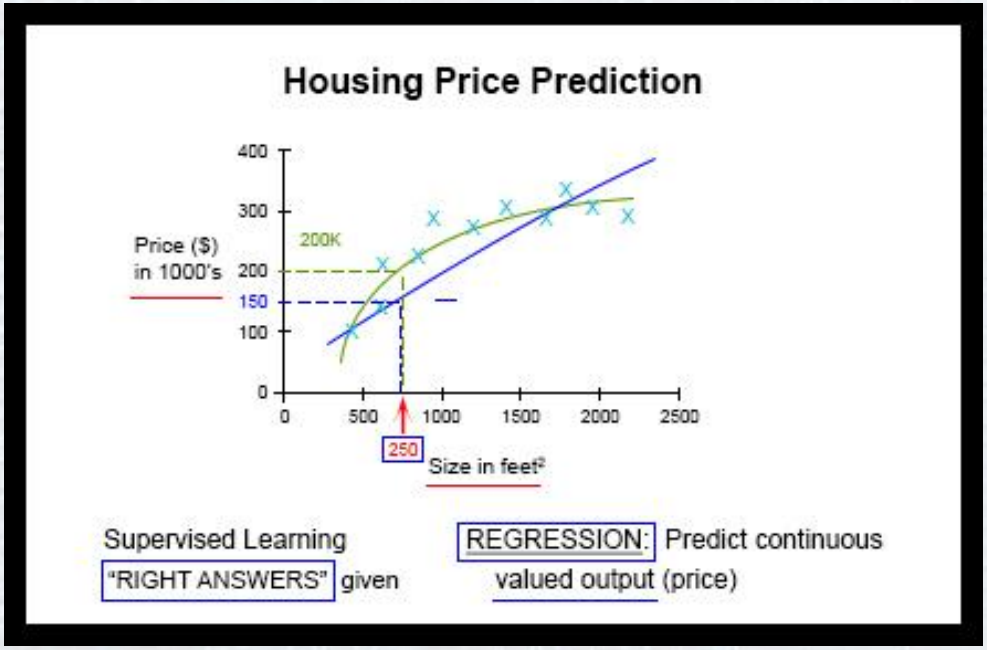
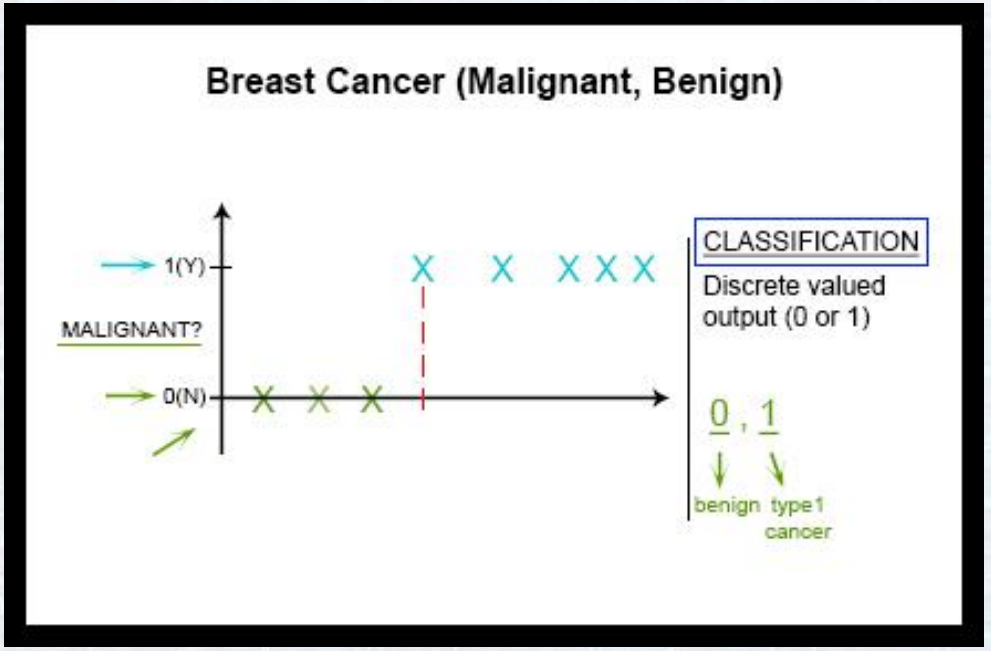
More on Supervised Learning

Supervised learning can be divided into two types - Regression and Classification.

Some examples –

- In housing price prediction, regression is used for predicting continuous valued output.
- In a case of tumor diagnosis, classification is used for predicting if the tumor is benign or malignant





Summary

From this module, you have learned the following:

- Data Science can be defined as the process of extracting knowledge from a given set of data.
- Machine learning is the study of algorithms that can learn and modify itself according to the data provided.

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Thank You