

# Data Mining and Business Intelligence

---

ITA5007

PROF. E.P.EPHZIBAH

# Topic

---

ROLE OF MATHEMATICAL MODEL IN BI,  
BUSINESS INTELLIGENT ARCHITECTURE

# Business Intelligence

---

Business intelligence methodologies are

1. interdisciplinary and broad, spanning several domains of application.
2. concerned with collecting and storing the data intended to facilitate the decision-making process, and thus with data warehousing technologies;
3. with mathematical models for optimization and data mining, and thus with operations research and statistics;
4. with several application domains, such as marketing, logistics, accounting and control, finance, services, and the public administration.

# Business Intelligence

---

A business intelligence environment offers decision-makers information and knowledge derived from data processing, through the application of mathematical models and algorithms.

In some instances, these may merely consist of the calculation of totals and percentages, while more fully developed analyses make use of advanced models for optimization, inductive learning and prediction.

---

Business intelligence methodologies are

- able to express their huge strategic potential based on the systematic adoption of mathematical models
- able to transform data not only into information but also into knowledge

# Role of mathematical models in Business Intelligence

---

A business intelligence system provides decision makers with information and knowledge extracted from data, through the application of mathematical models and algorithms.

In some instances, this activity may reduce to calculations of totals and percentages, graphically represented by simple histograms, whereas more elaborate analyses require the development of advanced optimization and learning models.

In general terms, the adoption of a business intelligence system tends to promote a scientific and rational approach to the management of enterprises and complex organizations.

# Role of mathematical models in Business Intelligence

---

The rational approach typical of a business intelligence analysis can be summarized schematically in the following main characteristics.

- First, the objectives of the analysis are identified and the performance indicators that will be used to evaluate alternative options are defined.
- Mathematical models are then developed by exploiting the relationships among system control variables, parameters and evaluation metrics.
- Finally, what-if analyses are carried out to evaluate the effects on the performance determined by variations in the control variables and changes in the parameters.

# Business Intelligence Architecture components

---

The architecture of a business intelligence system includes three major components.:

**Data sources.** In a first stage, it is necessary to gather and integrate the data stored in the various primary and secondary sources, which are heterogeneous in origin and type.

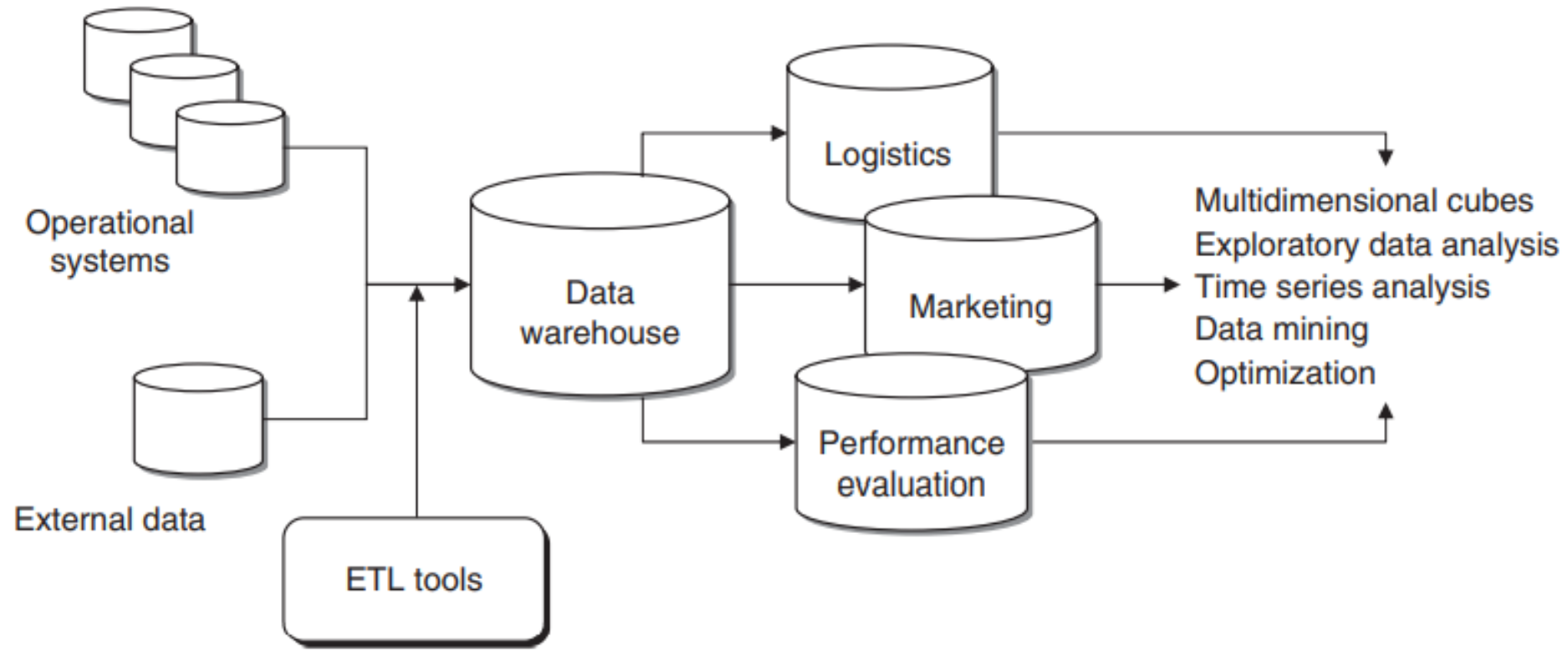
**Data warehouses and data marts.** Using extraction and transformation tools known as extract, transform, load (ETL), the data originating from the different sources are stored in databases intended to support business intelligence analyses.

**Business intelligence methodologies.** Data are finally extracted and used to feed mathematical models and analysis methodologies intended to support decision makers.



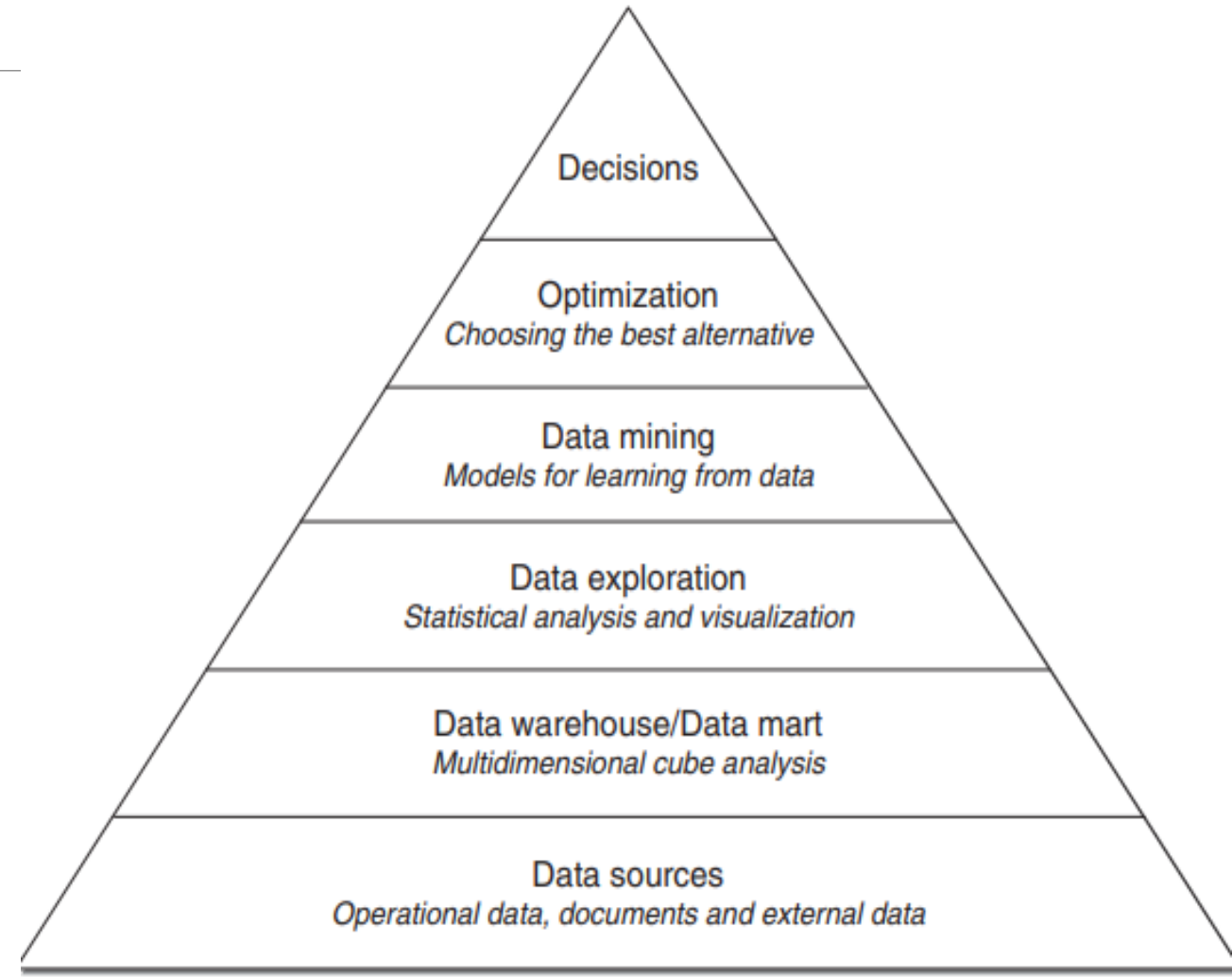
# A typical business intelligence architecture

---



# The main components of a business intelligence system

---



# Business intelligence methodologies- Decision support applications:

---

MULTIDIMENSIONAL CUBE ANALYSIS

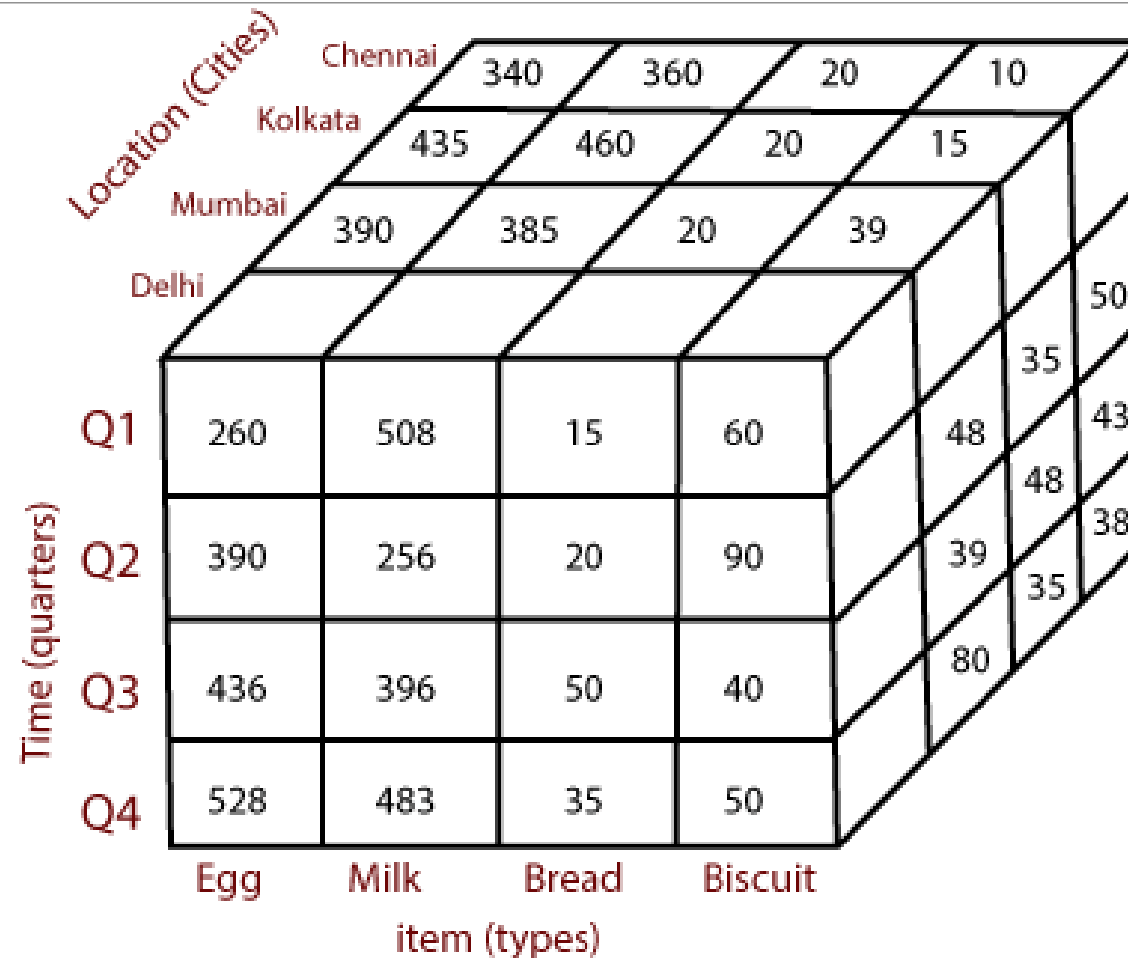
EXPLORATORY DATA ANALYSIS

TIME SERIES ANALYSIS

INDUCTIVE LEARNING MODELS FOR DATA MINING

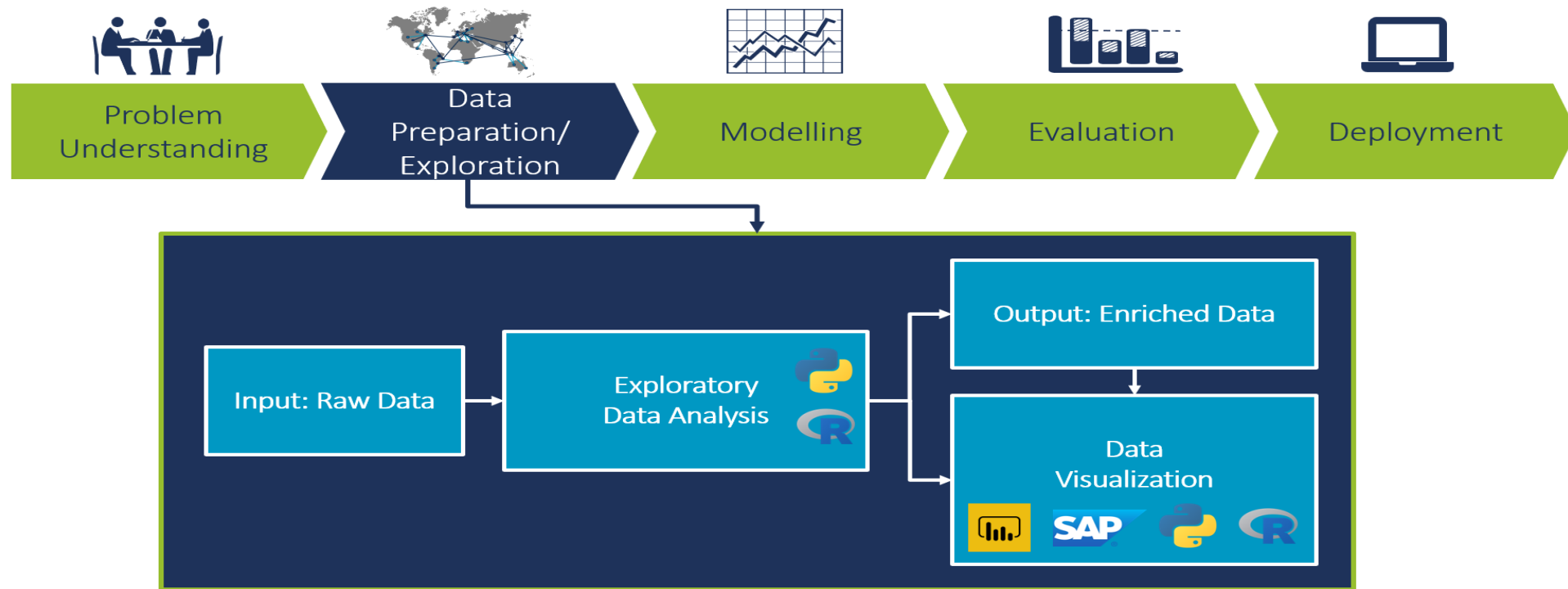
OPTIMIZATION MODELS

# MULTIDIMENSIONAL CUBE ANALYSIS



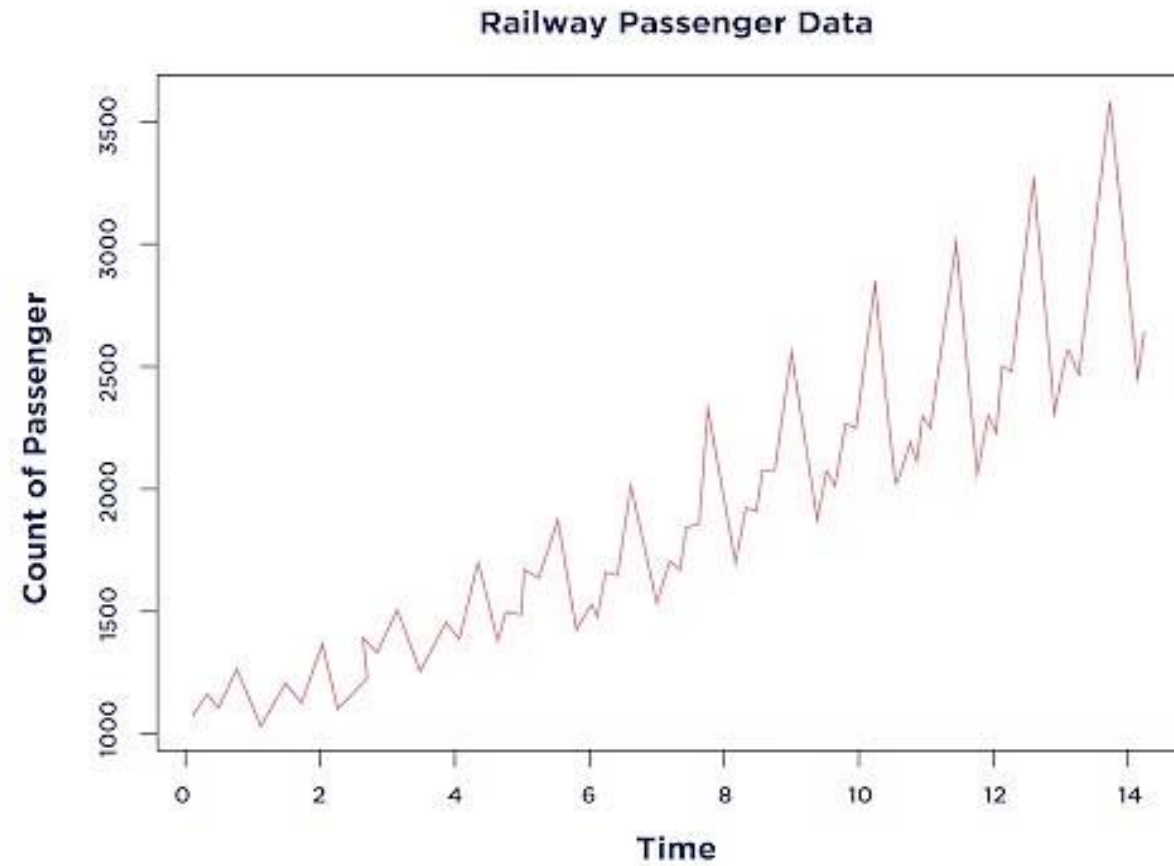
# EXPLORATORY DATA ANALYSIS

---



# TIME SERIES ANALYSIS

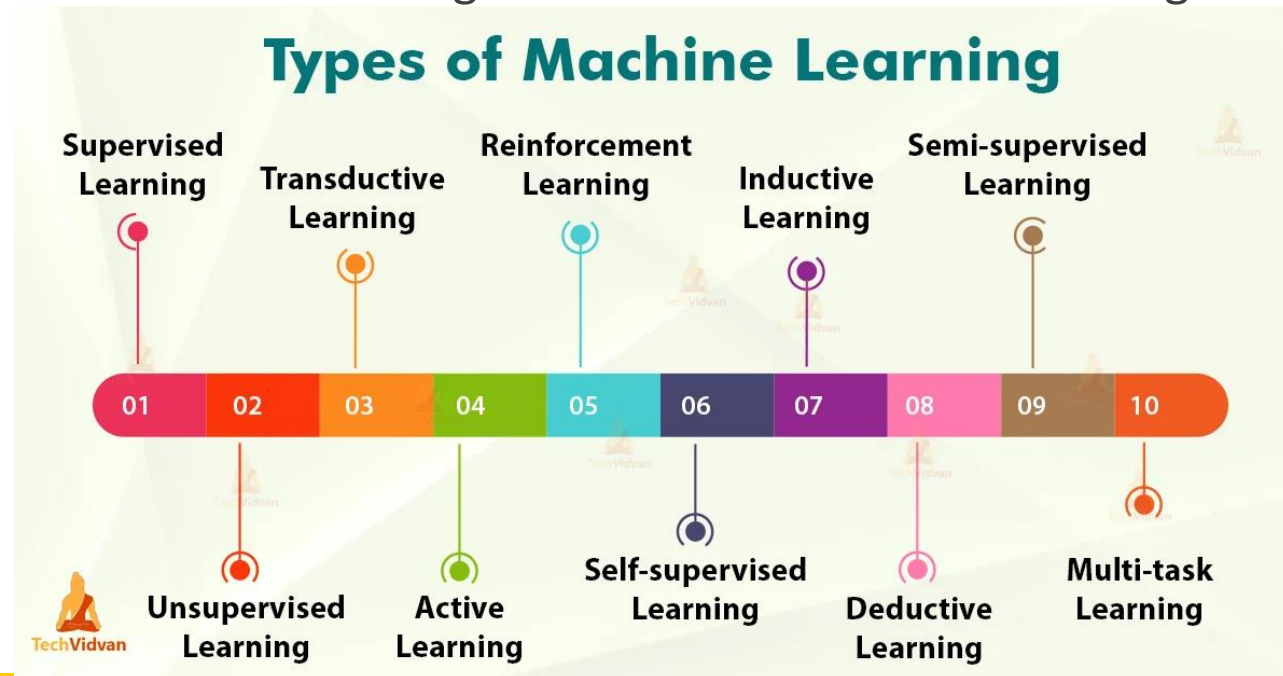
---



# INDUCTIVE LEARNING MODELS FOR DATA MINING

Inductive Learning is where we are given examples of a function in the form of data ( $x$ ) and the output of the function ( $f(x)$ ).

The goal of inductive learning is to learn the function for new data ( $x$ ). Classification: when the function being learned is discrete. Regression: when the function being learned is continuous.



# OPTIMIZATION MODELS

---

An optimization model is a translation of the key characteristics of the business problem you are trying to solve.

The model consists of three elements: the objective function, decision variables and business constraints.

