Types of MachineLearning

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Machine Learning is Inductive

- Deductive Learning

Premise A : Tumor size is >=x

Conclusion B : Person suffers from cancer

$$A \rightarrow B$$

General Information to Specifics

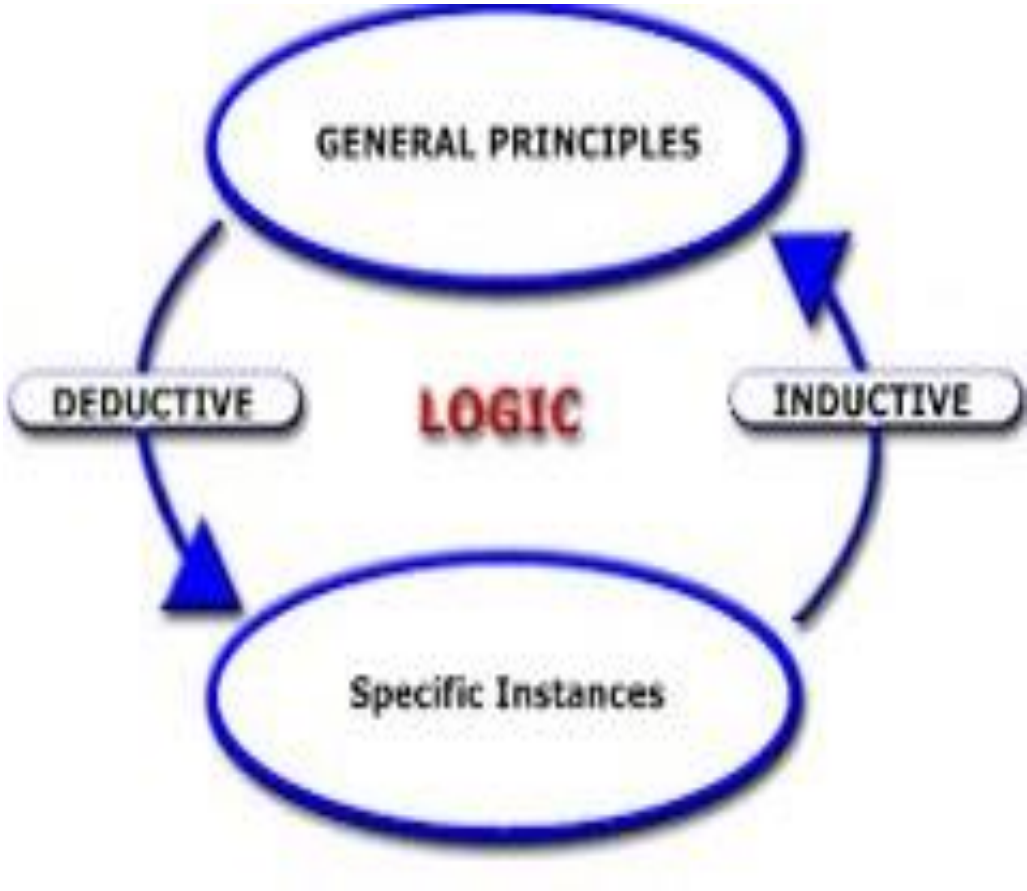
- Inductive (Inference) Learning

Given A: Tumor sizes of various Cancer/Non-Cancer Patients

Infer B : Person suffering from cancer or not

$$B=f(A)$$

Specifics to General Information



Data Representation

	f1	f2	f3	f4	f5	Y
X1						
X2						
X3						
X4						
X5						
X6						
X7						

- Y : Target/Label/outcome/response/dependent variable
- (f1,….,fd) : Features/Attributes/Dimensions
  Independent and Identically Distributed vectors

- (X1,X2,….,Xn) : Samples/Rows/Tuples/Instances/ Observations

- Time series (Dependent vectors)
- Images (Matrices)
- Variable size Non-vector data(Trees, Graphs, Text)
- Objects (Relational Schema)

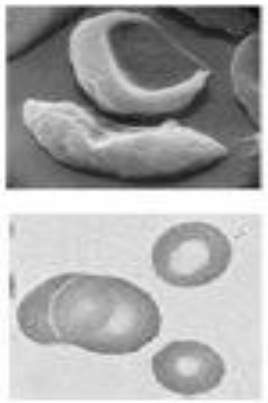
Discrete versus Continuous Labels

Classification

X = Document

Sports
Science
News

Y = Topic



X = Cell Image

Anemic cell
Healthy cell

Y = Diagnosis

Regression

Stock Market Prediction

Approaches for Learning

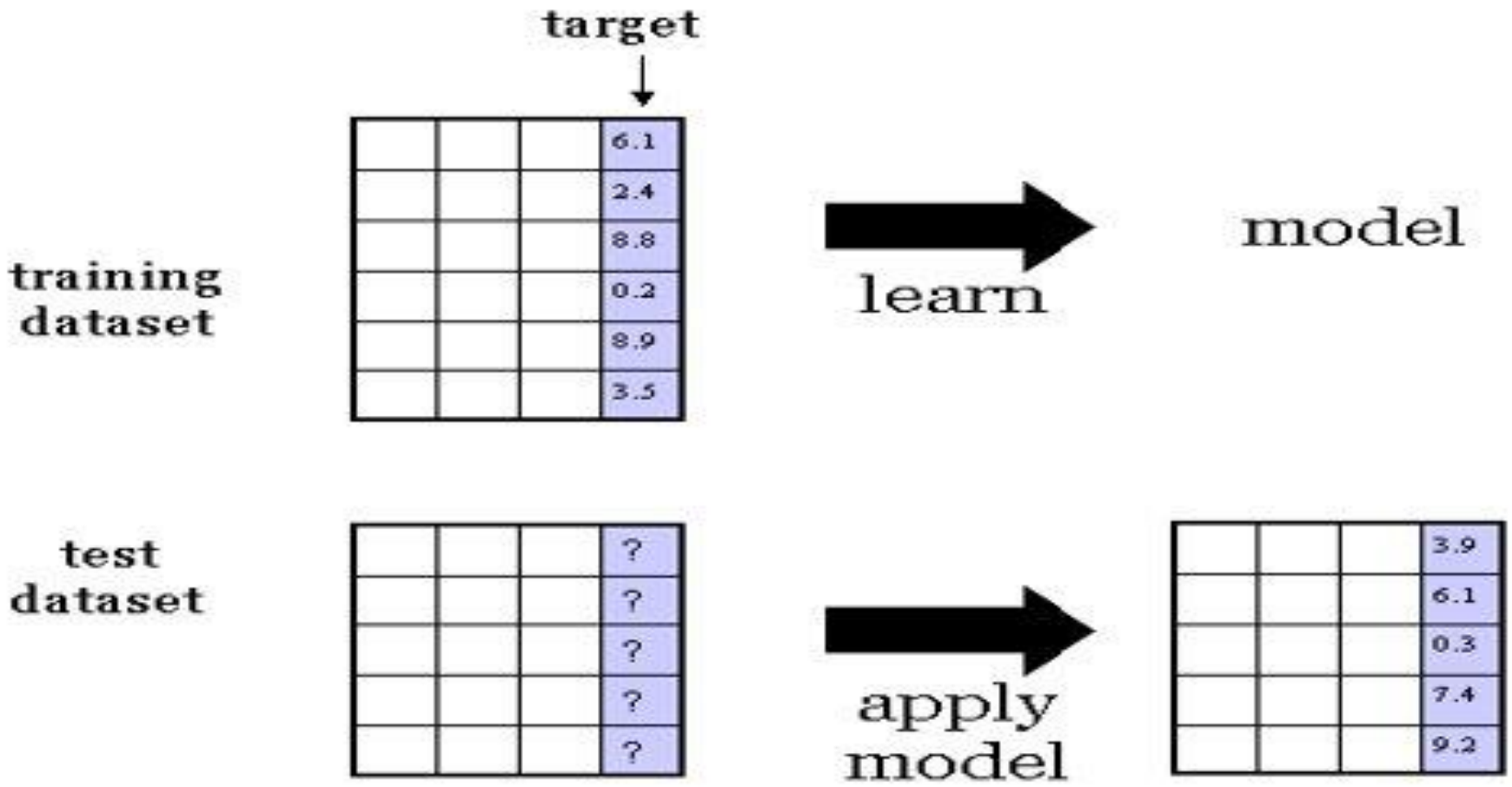
- Supervised

- UnSupervised

- Reinforcement

Supervised Learning from Data

- Predicting continuous target variable



Task : Regression

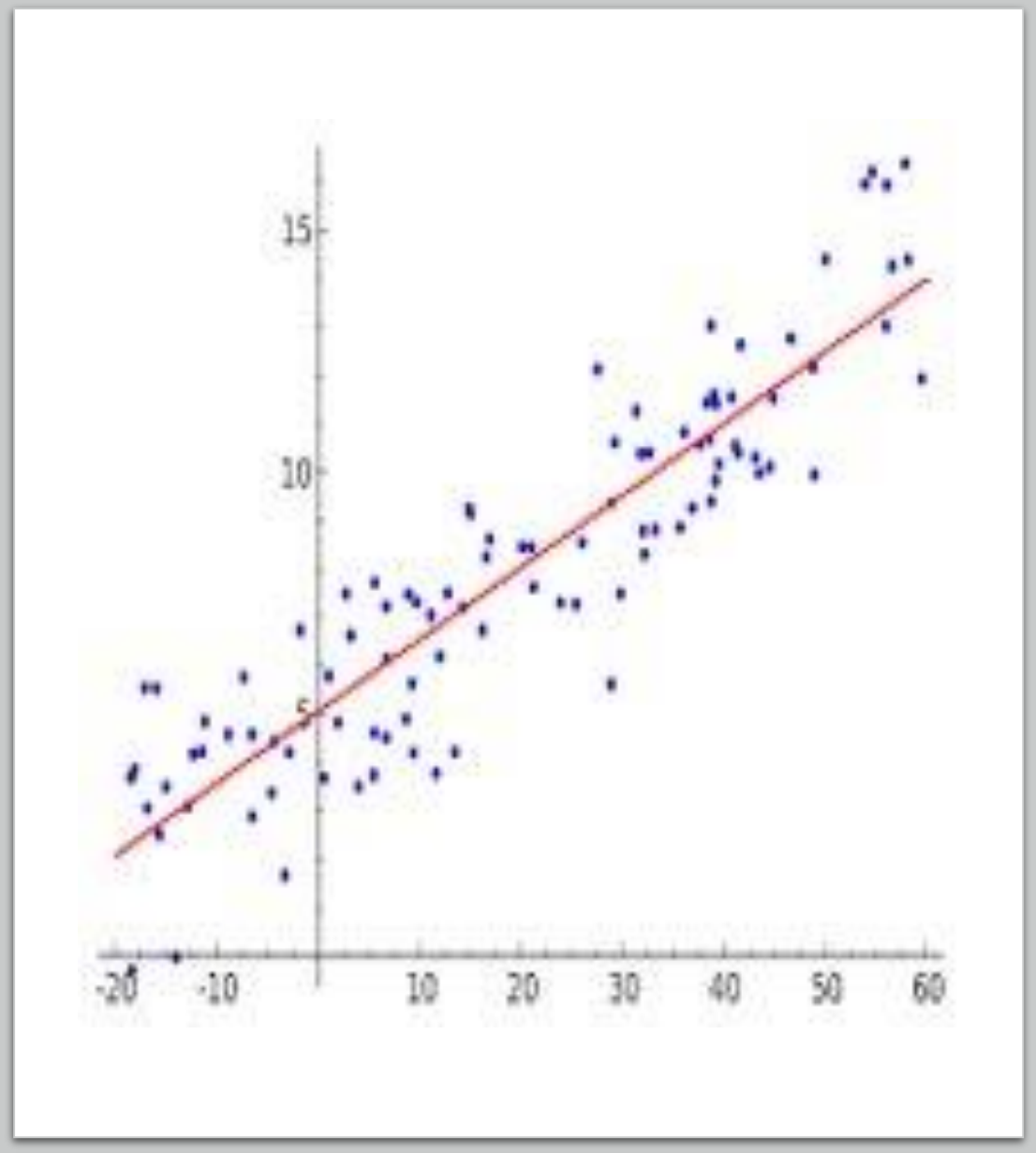
- Example : Stock Price Prediction

- Only one target variable ?

- How to take a combination of the features (linear regression)?

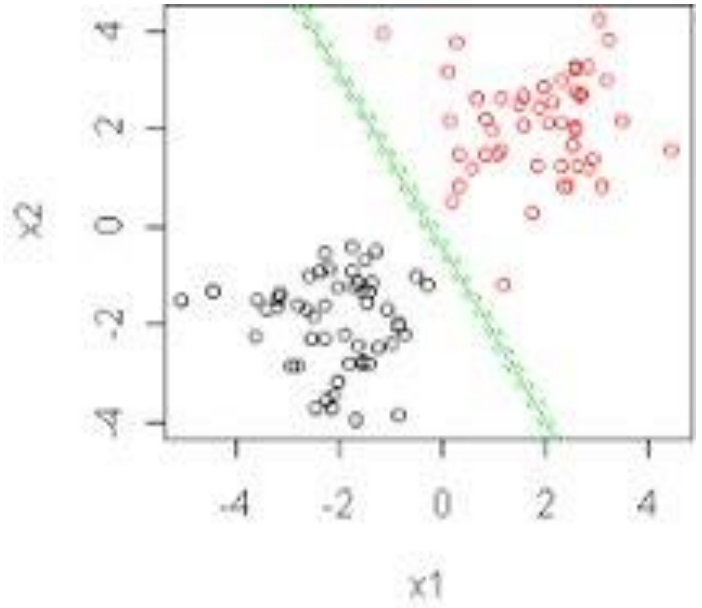
- Anything more general than that?

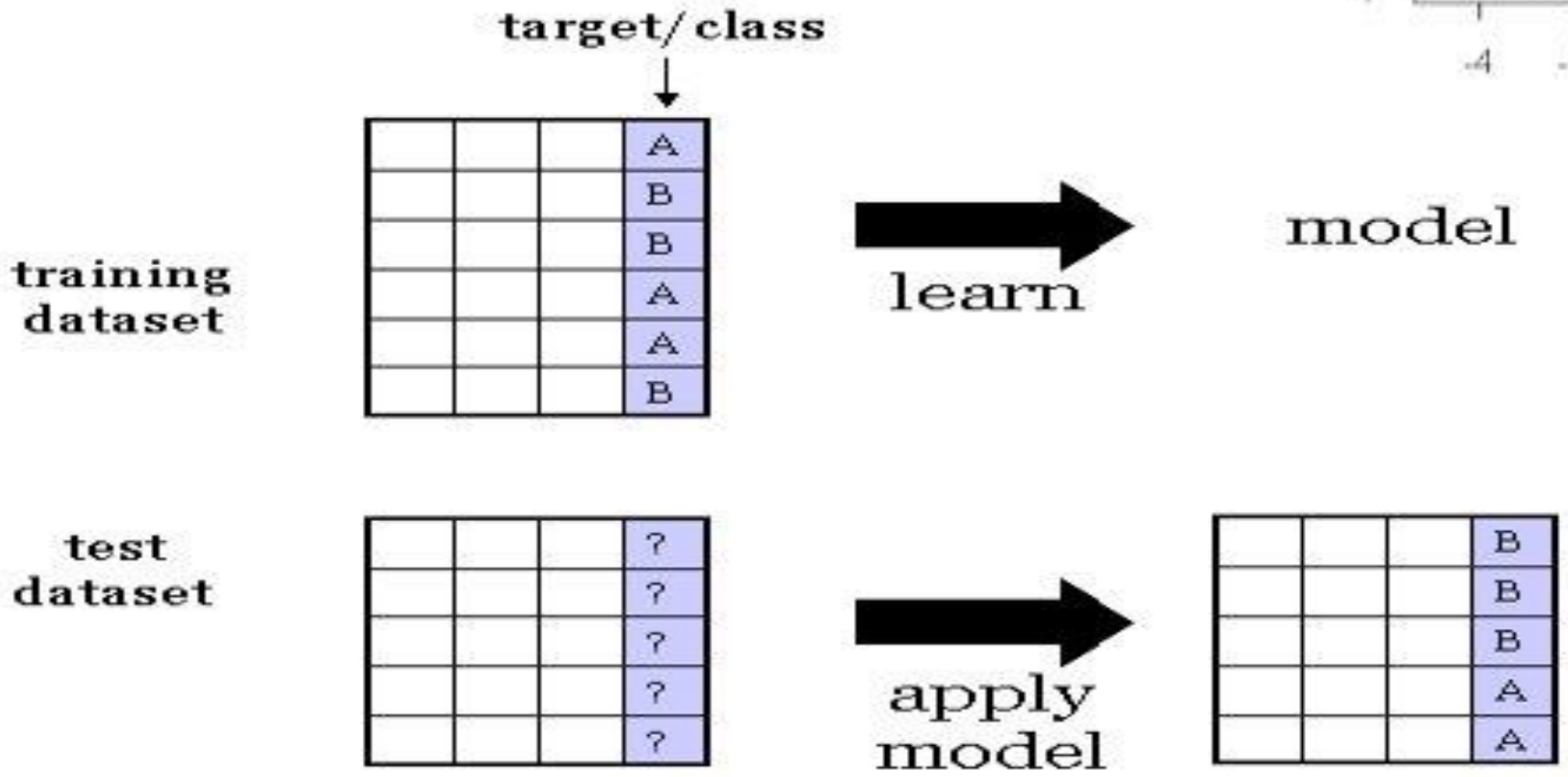
- Is local minimum error the global minimum error ?



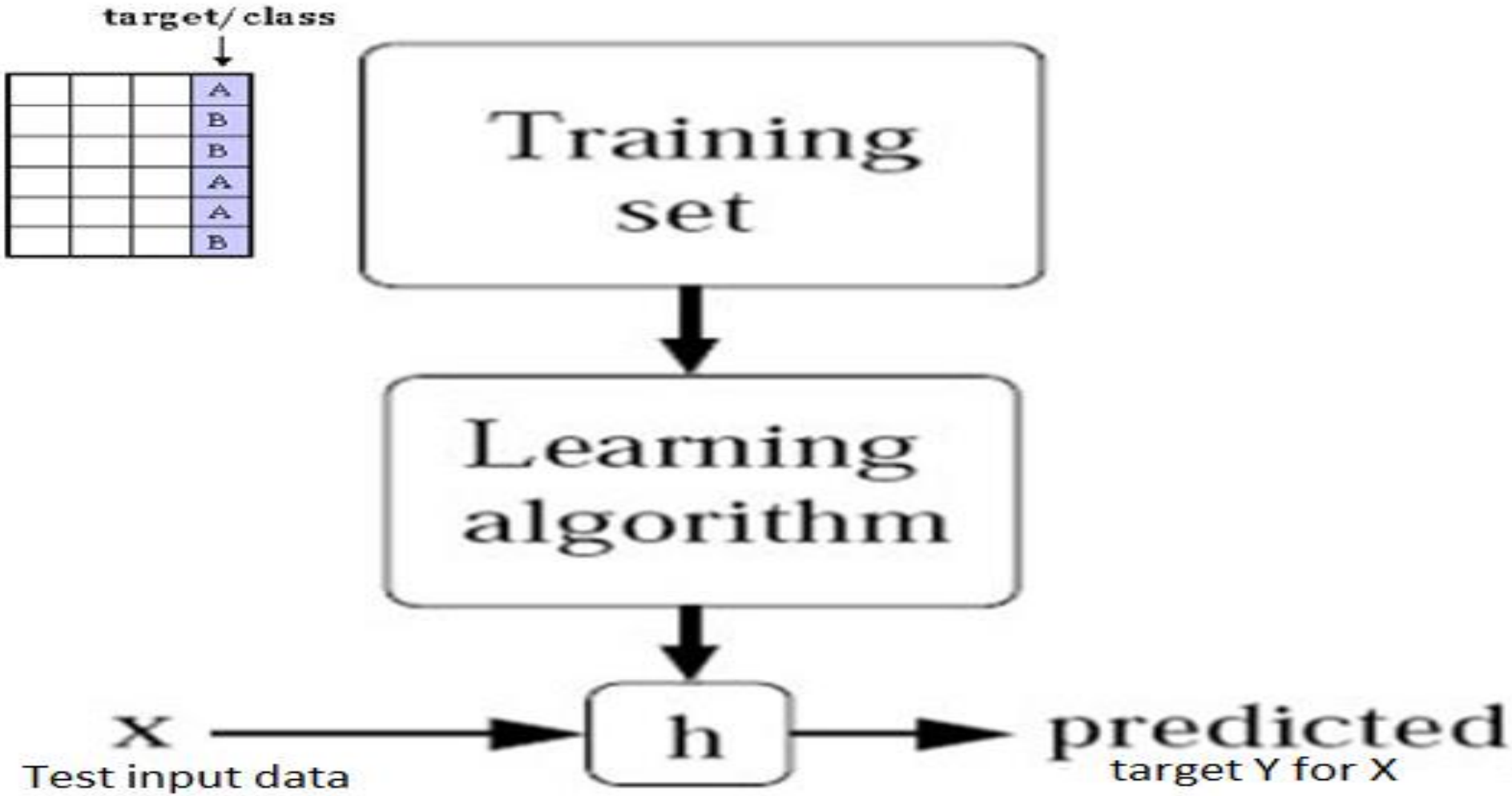
Task : Classification

- Example : Classify whether the patient is suffering from cancer or not.



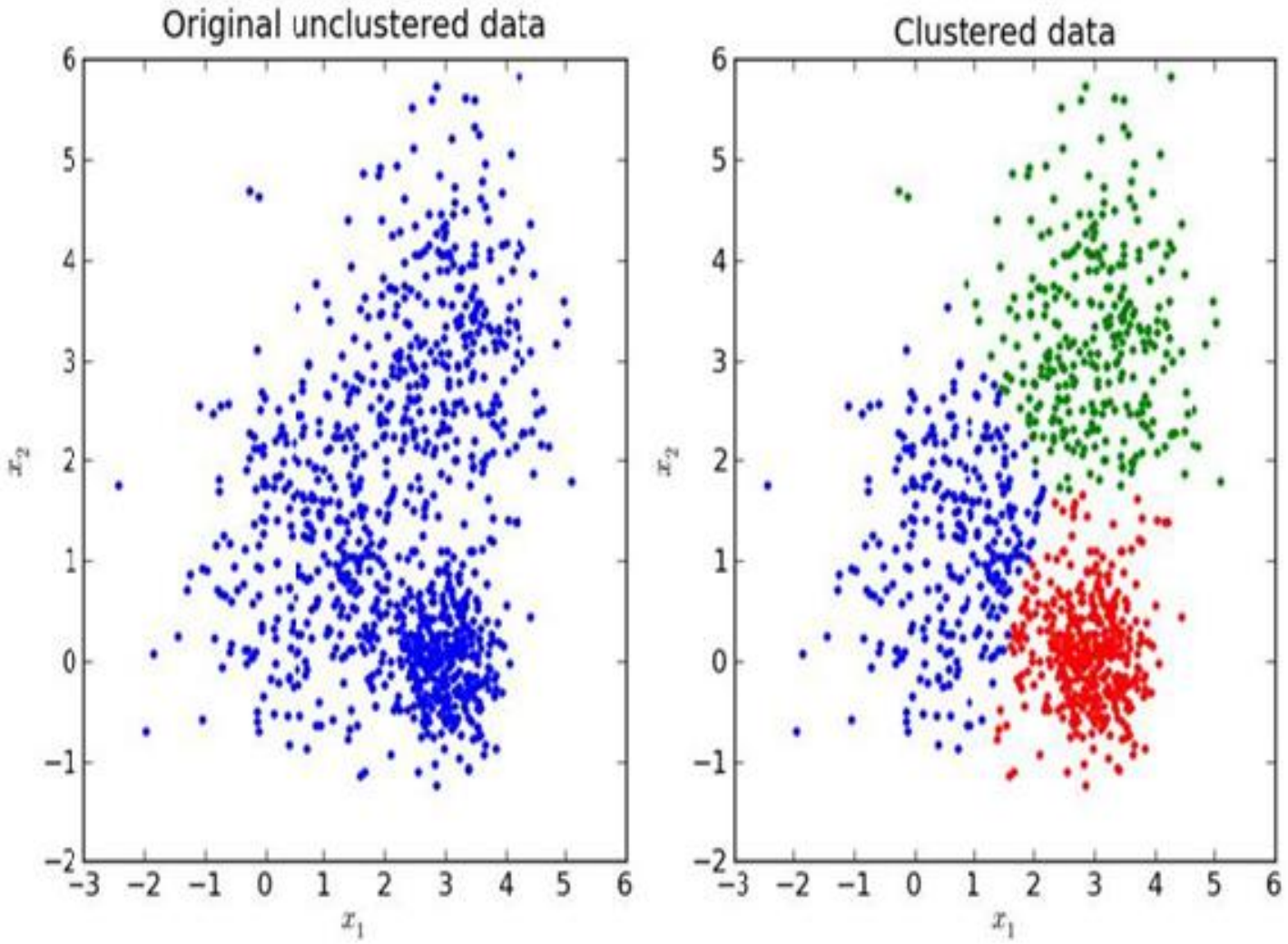


Supervised Learning



Unsupervised Learning

- Task : Clustering
- No Target variable



Task : Association mining

TID	Items
1	Bread, Milk
2	Bread, Diaper, Beer, Eggs
3	Milk, Diaper, Beer, Coke
4	Bread, Milk, Diaper, Beer
5	Bread, Milk, Diaper, Coke

{milk} → {bread}
{milk, cheese, eggs} → {bread}
{milk, diaper} → {beer}

Task : Dimensionality Reduction

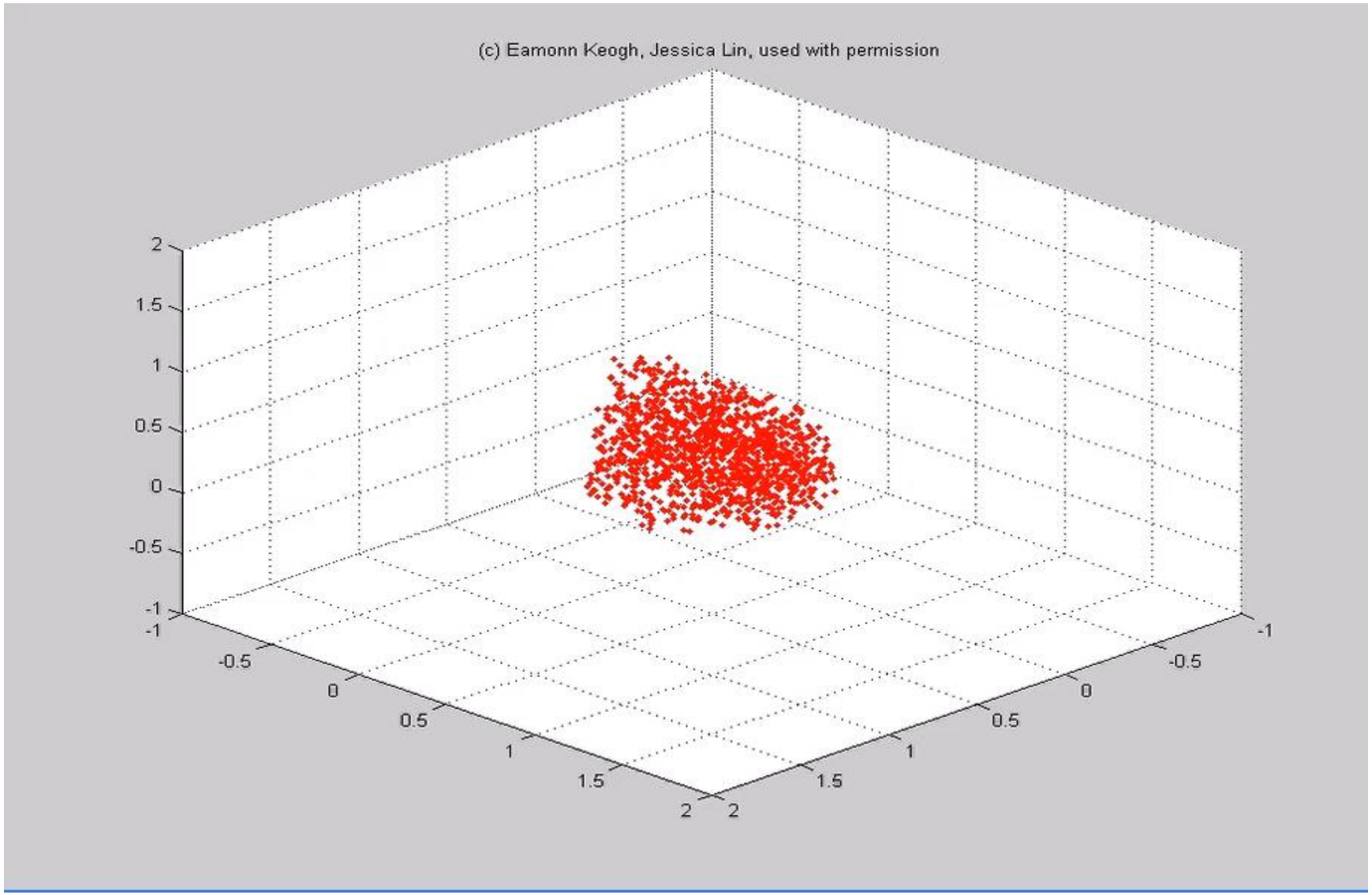
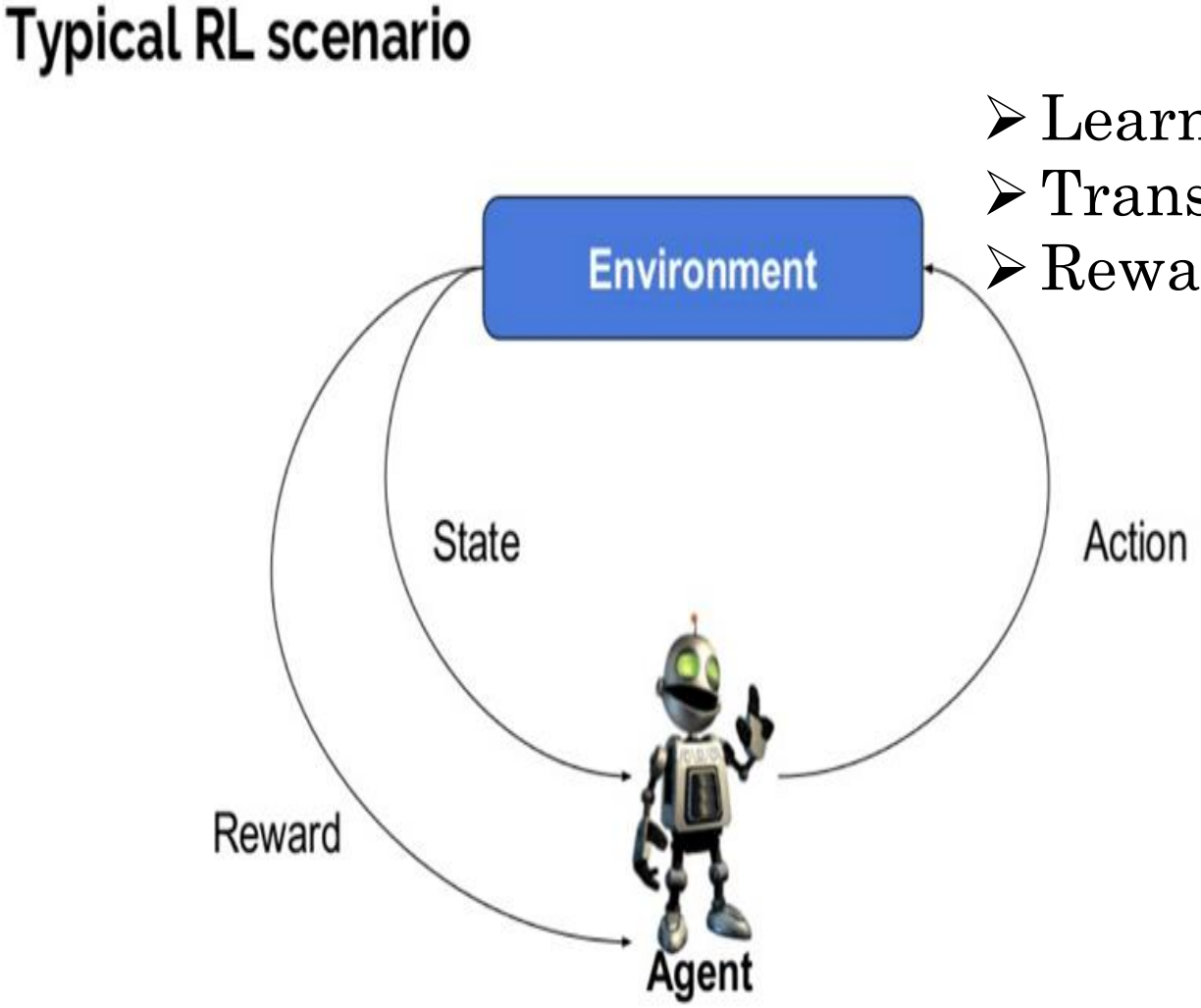


Image Source : https://cs.gmu.edu/~jessica/DimReducDanger.htm

Reinforcement Learning



- Learn from interaction with the environment
- Transition from one state to another
- Rewards/punishments from sequence of actions

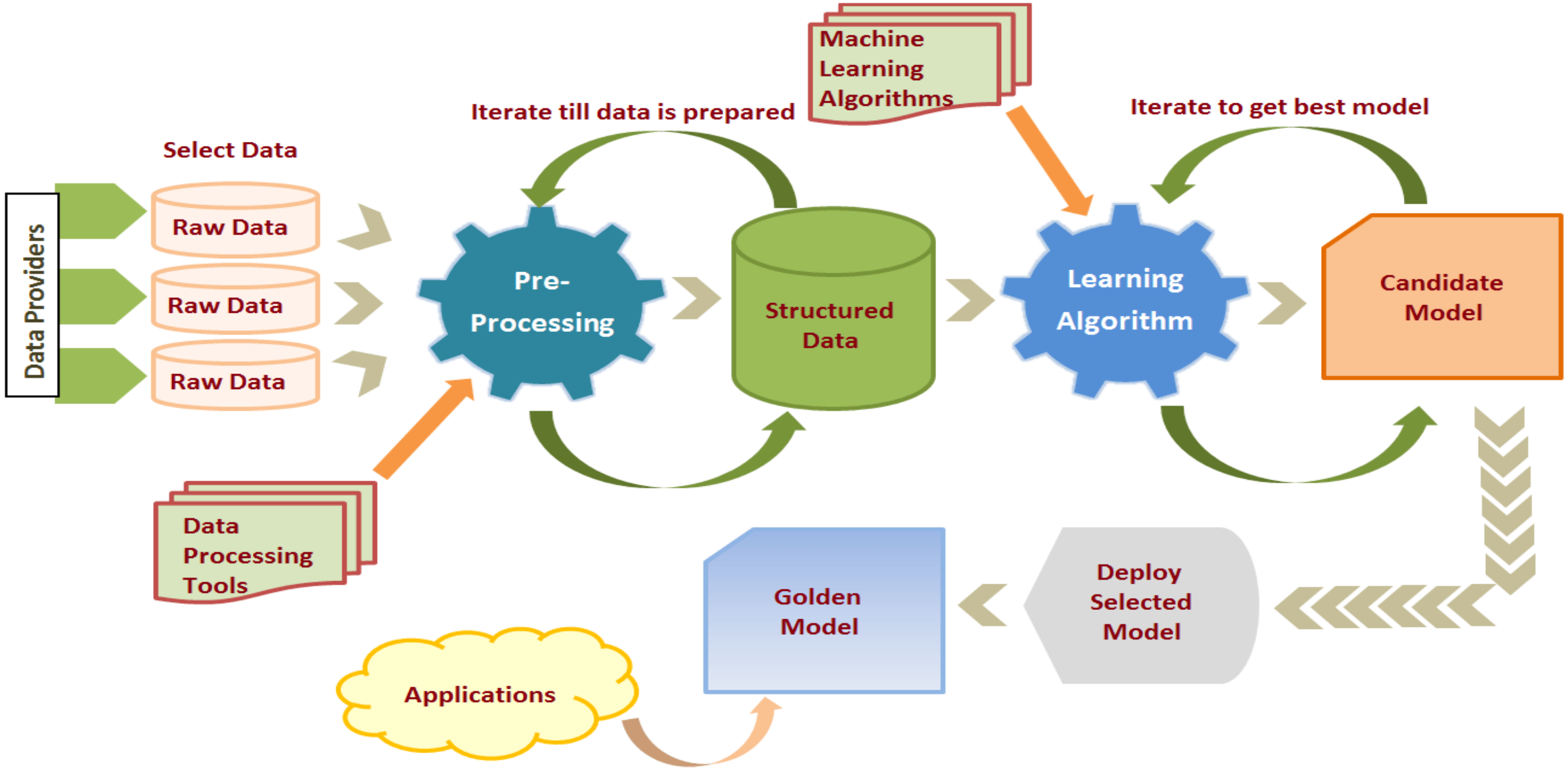
Game Playing
Robotics

Image Source : https://www.guru99.com/reinforcement-learning-tutorial.html

Applications

- Manufacturing
  - Pick a device and put it in right container
- Self-driving cars
  - Detect obstacles, proper routing, traffic signal
- Power systems
- Network routing

Data Mining and Machine Learning Process



References

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