Machine Learning

- Gradient Descent Algorithm
- Linear Regression
- Non-Linear Regression
- Logistic Regression
- Decision Trees
  - Regression Trees
  - Classification Trees
- Clustering Algorithms
  - K-Means
  - Hierarchical clustering
  - DB-Scan
  - Mean Shift
  - GMM
- Support Vector Machine

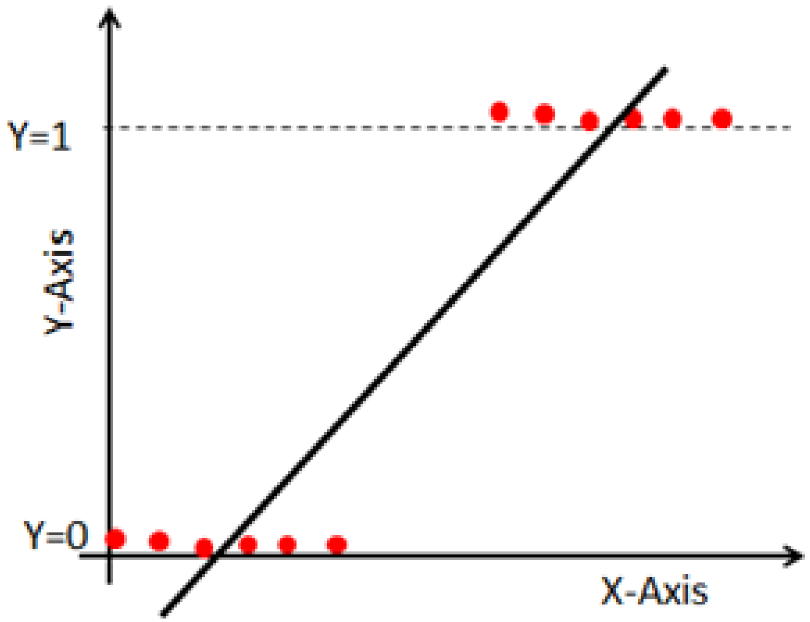
Deep Learning

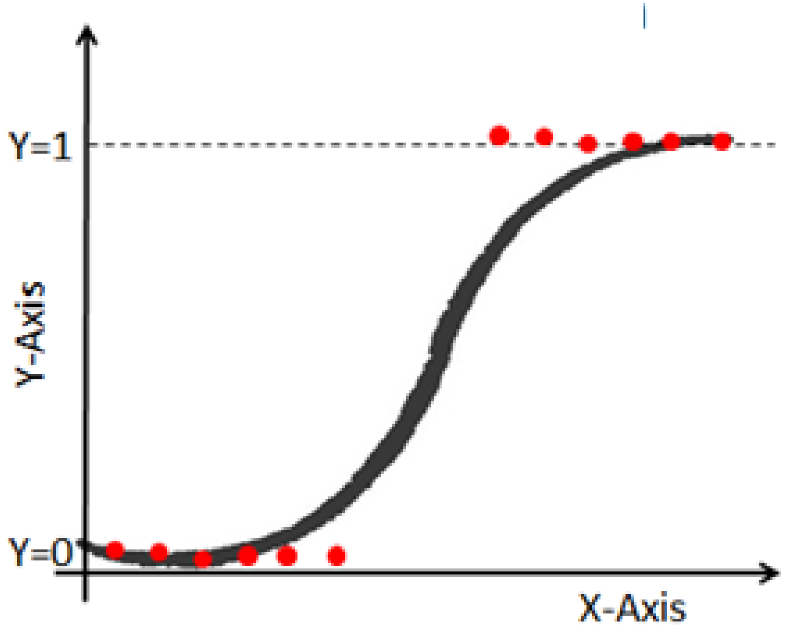
- MLP
- CNN

Datasets

- Breast Cancer Wisconsin
- MIMIC-III
- Framingham Heart Study
- Alzheimer’s Disease Neuroimaging Initiative
- Drug discovery
- Microbiome

C3 - Logistic Regression

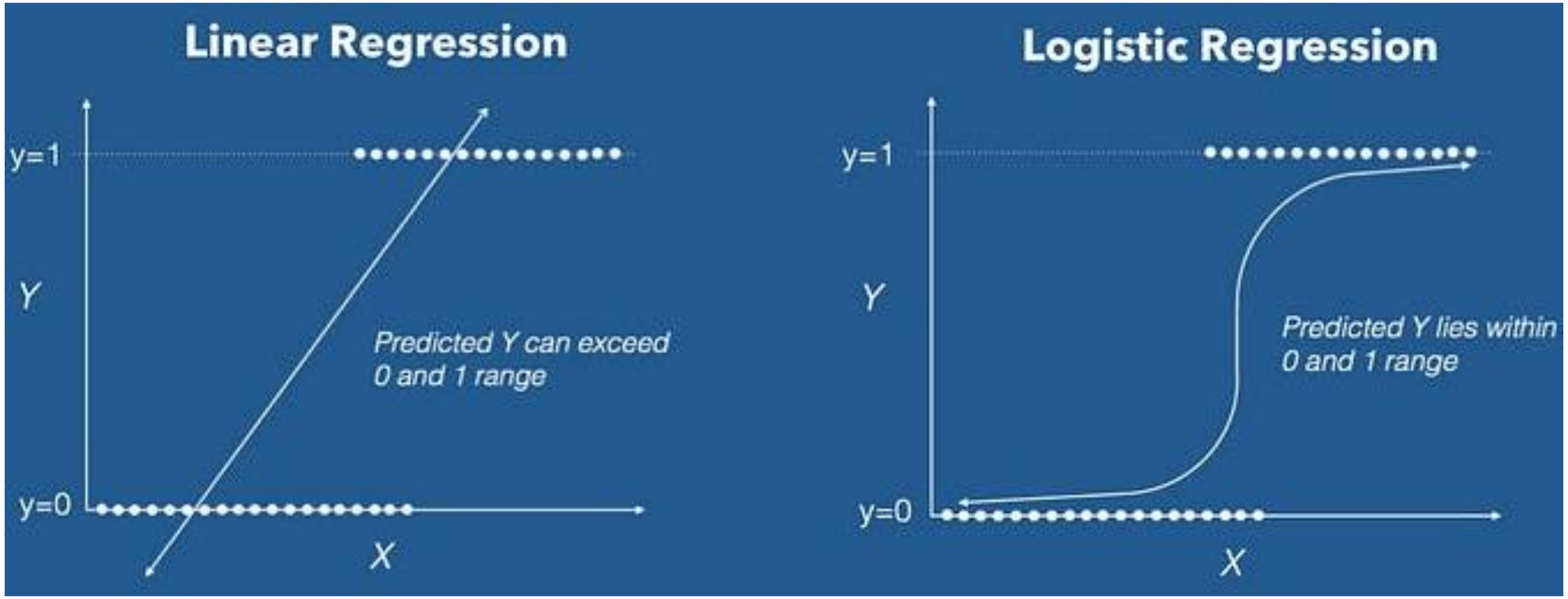




Logistic Regression

- supervised ML model & parametric classification model
- transforms the linear regression function continuous value output into categorical value output using a sigmoid function.

$$0 \leq h_\theta(x) \leq 1$$



Sigmoid function

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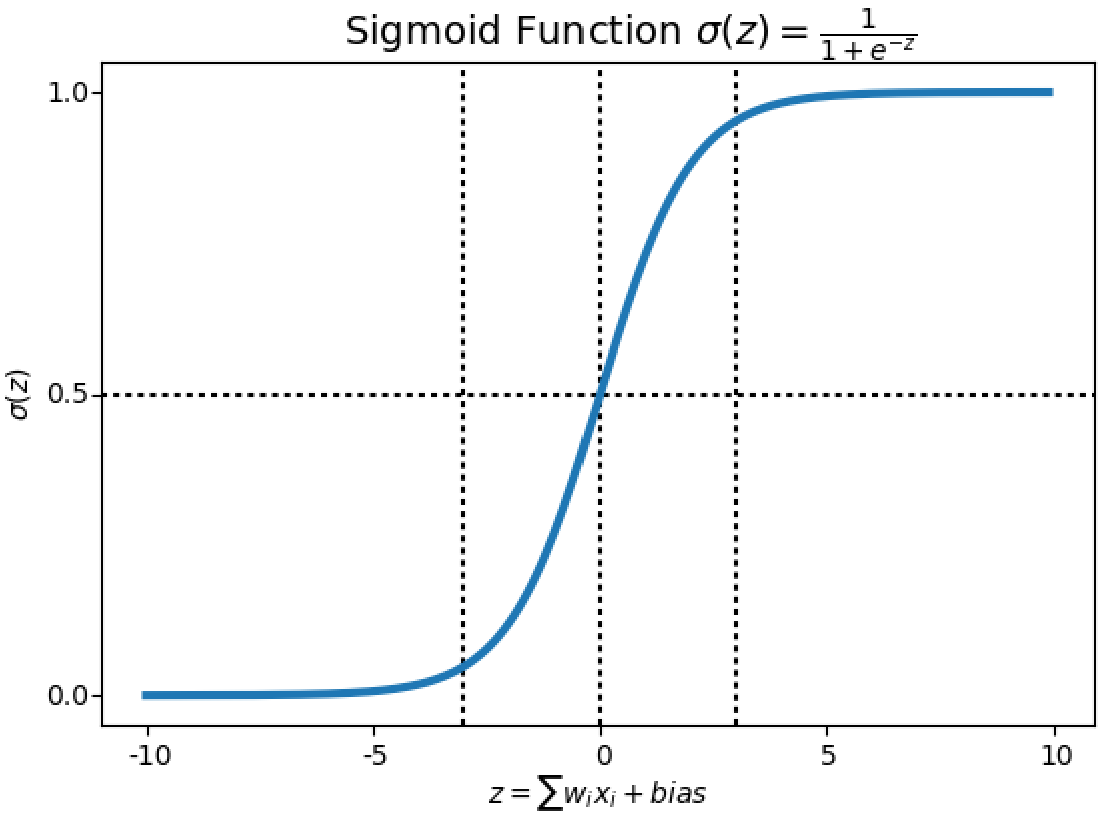


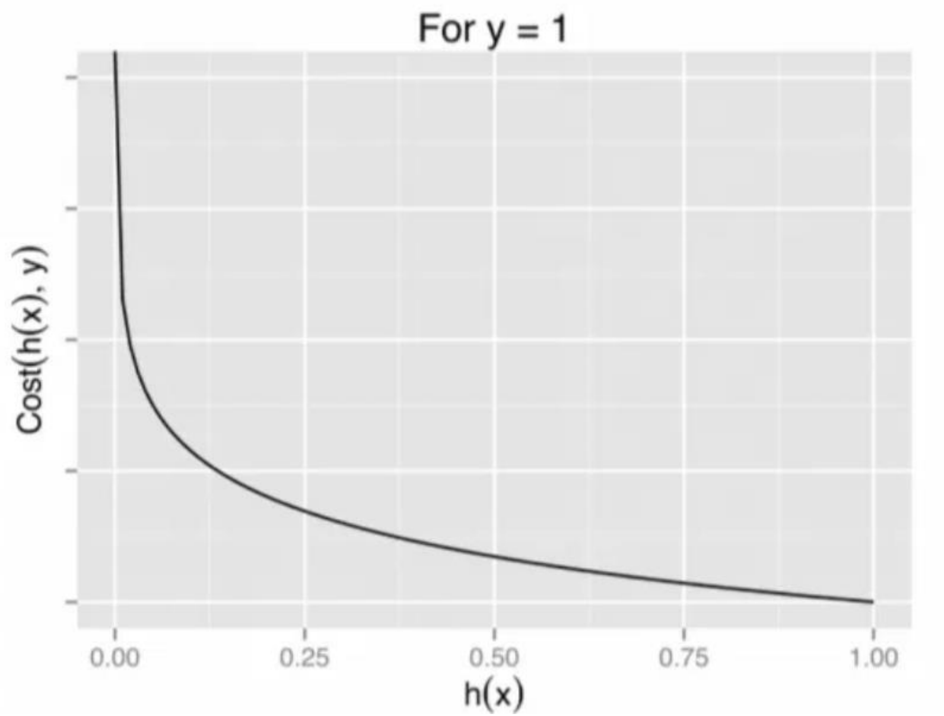
$$h\Theta(x) = \beta_0 + \beta_1 X$$

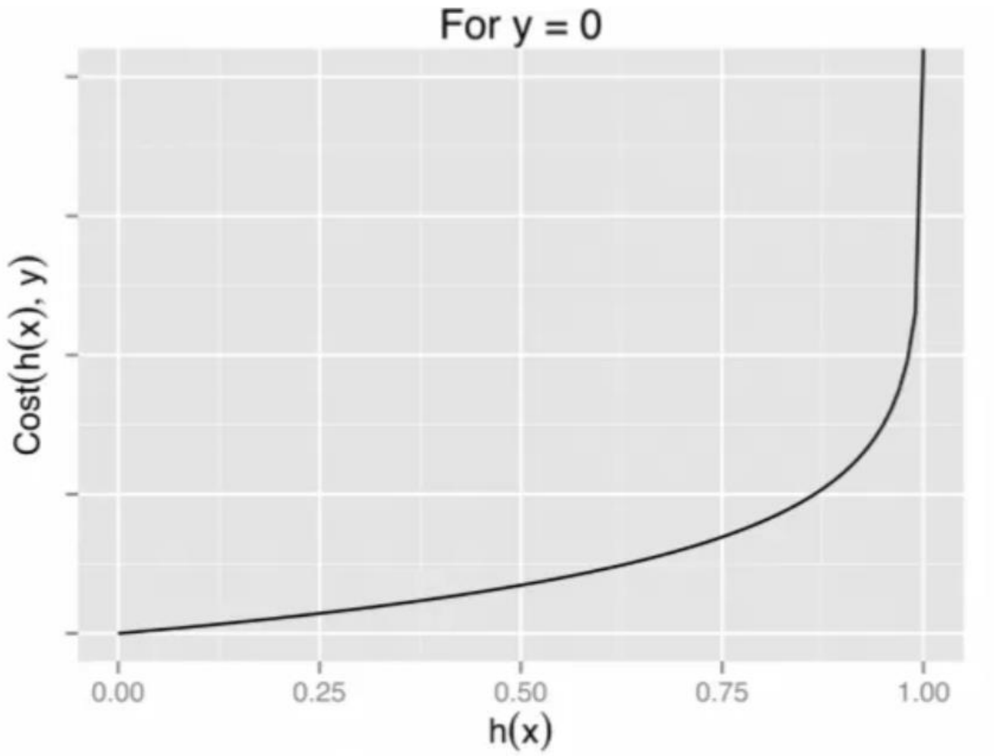
$$\sigma(Z) = \sigma(\beta_0 + \beta_1 X)$$

$$h\theta(X) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X)}}$$

Cost function

$$cost(h_\theta(x), y) = \begin{cases} -log(h_\theta(x)) & , \text{if } y = 1 \\ -log(1 - h_\theta(x)) & , \text{if } y = 0 \end{cases}$$





$$J(\theta) = -\frac{1}{m}\sum_{i=1}^{m}[y^{(i)}\log(h_\theta(x^{(i)})) + (1 - y^{(i)})\log(1 - h_\theta(x^{(i)}))]$$

Gradient descent

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$$J(\theta) = -\frac{1}{m}\sum_{i=1}^{m}[y^{(i)}\log(h_\theta(x^{(i)})) + (1-y^{(i)})\log(1-h_\theta(x^{(i)}))]$$

$$\min_\theta J(\theta)$$

$$\theta_j \leftarrow \theta_j - \alpha\frac{\partial}{\partial\theta_j}J(\theta)$$

$$\frac{\partial}{\partial\theta_j}J(\theta) = \frac{1}{m}\sum_{i=1}^{m}\left(h_\theta(x^{(i)}) - y^{(i)}\right)x_j^{(i)}$$

Decision boundary

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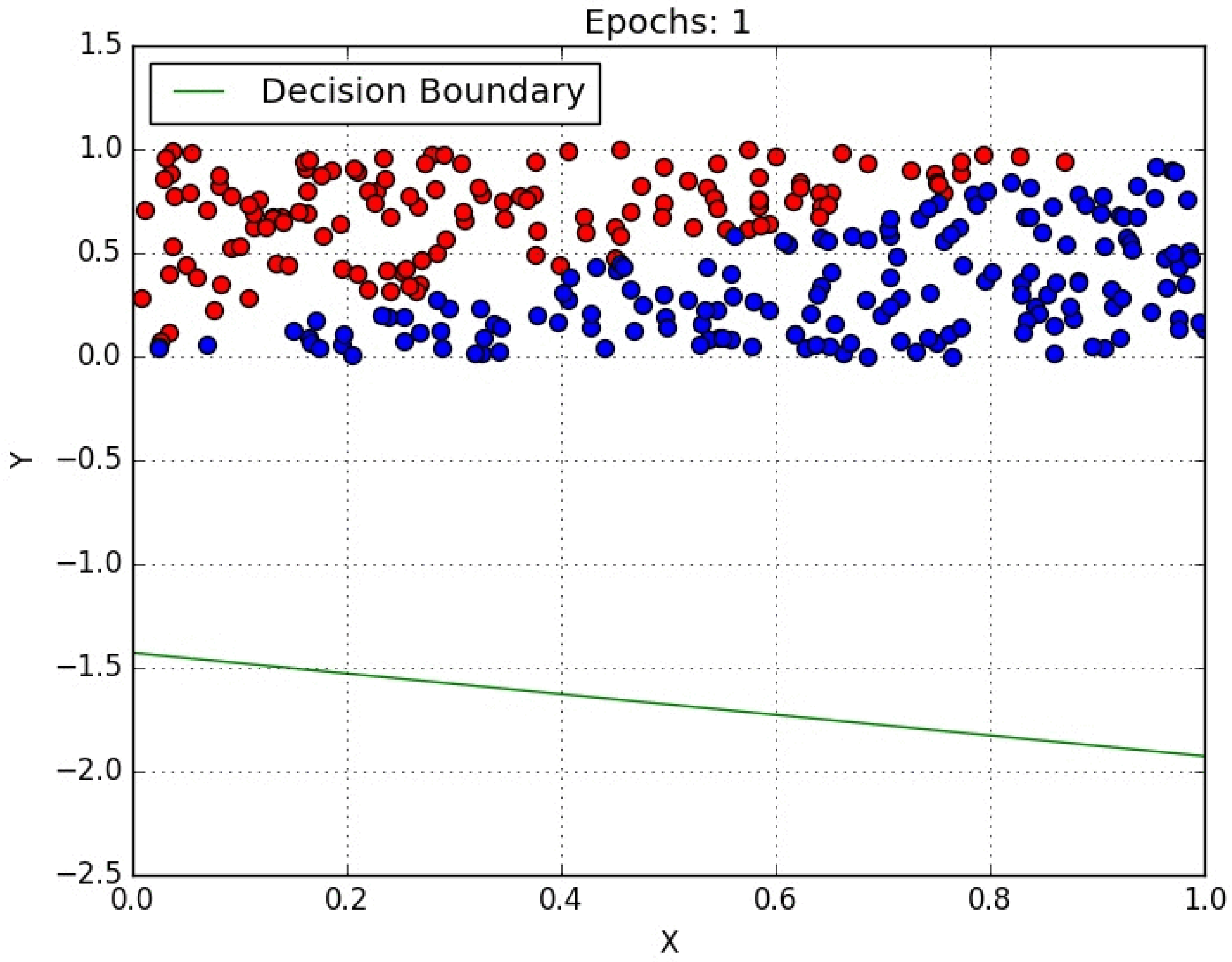

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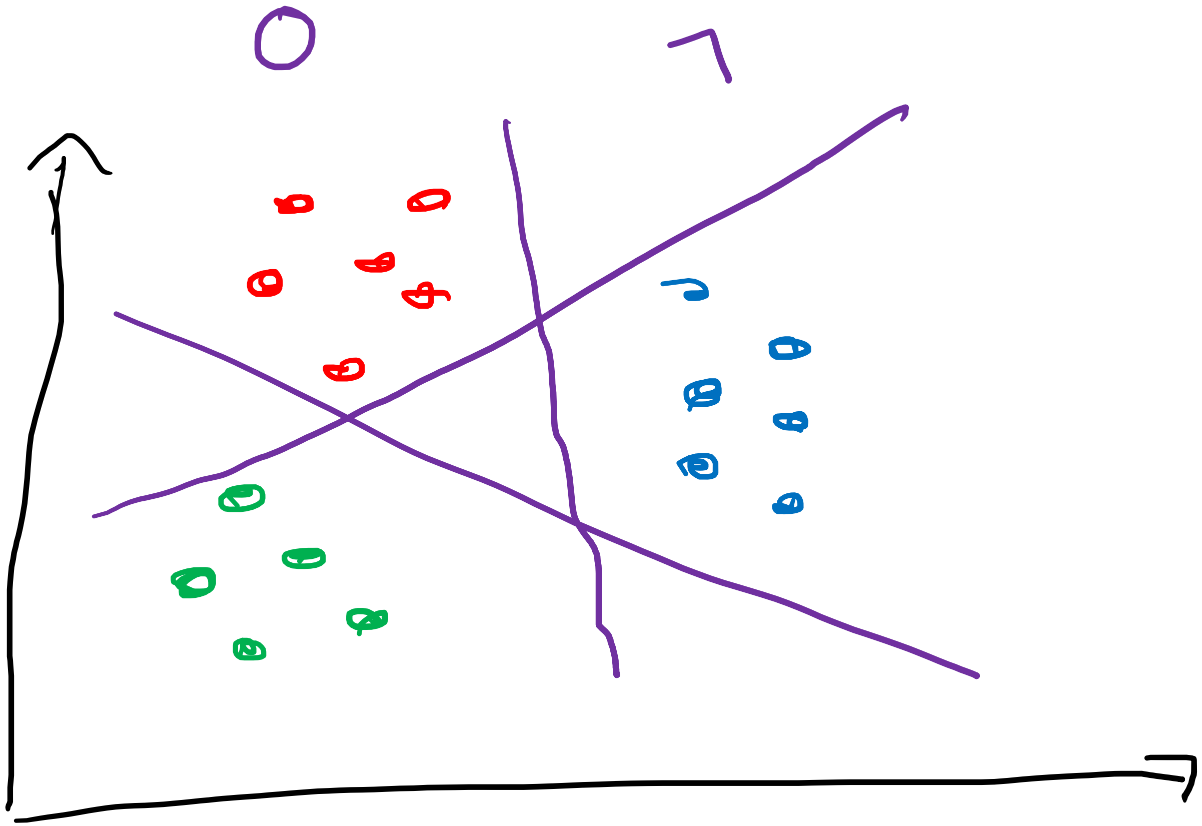

R → 1R 0NR
G → 1G 0NG
B → 1B 0NB

RL
SVM

MULTICLASE

Code