AI Algorithms – 3: Logistic/Linear Regression

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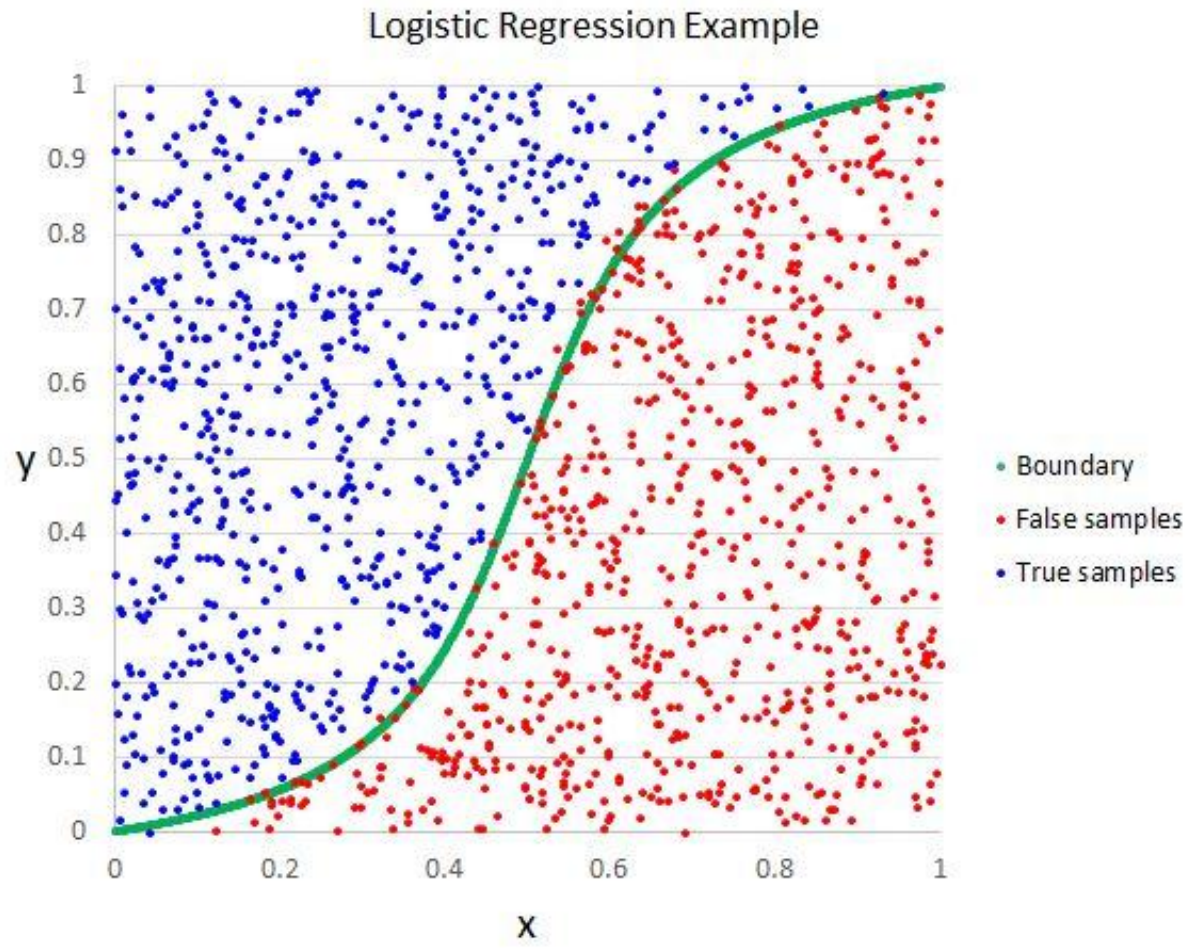
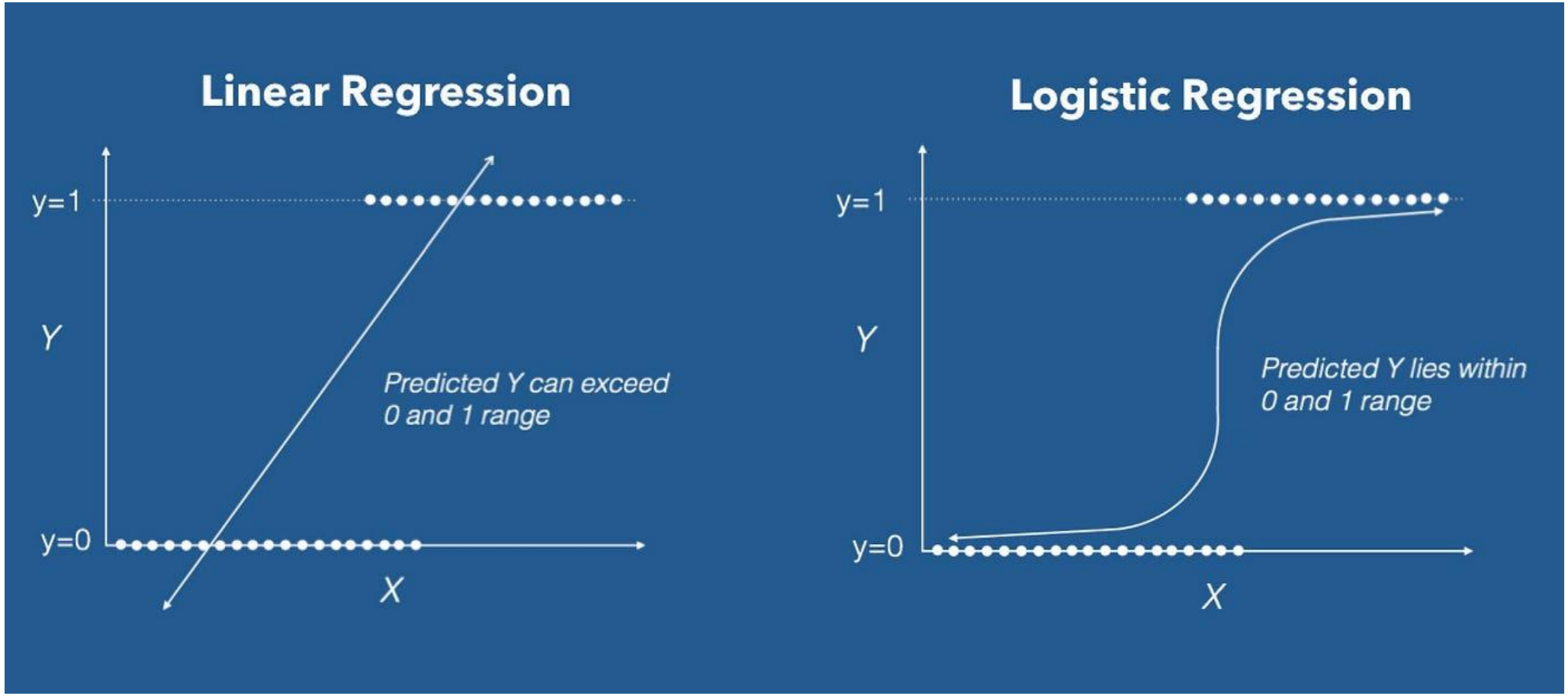
- PhD Studies in Electrical and Computer Eng. (McMaster University) (Partially Complete)
- Master of Engineering in Electrical and Computer Engineering (McMaster University)
- MSc in Data Science and Analytics (Toronto Metropolitan University/Ryerson)
- MSc in Computer Science (U of Manitoba)
- BSc. Engineering in Computer Science and Engineering (BUET)
- Extensive experience in Software Development and Engineering (primarily in Canada)
- Significant experience in Teaching
- Taught in Universities, Colleges, and Training Institutes

Logistic Regression



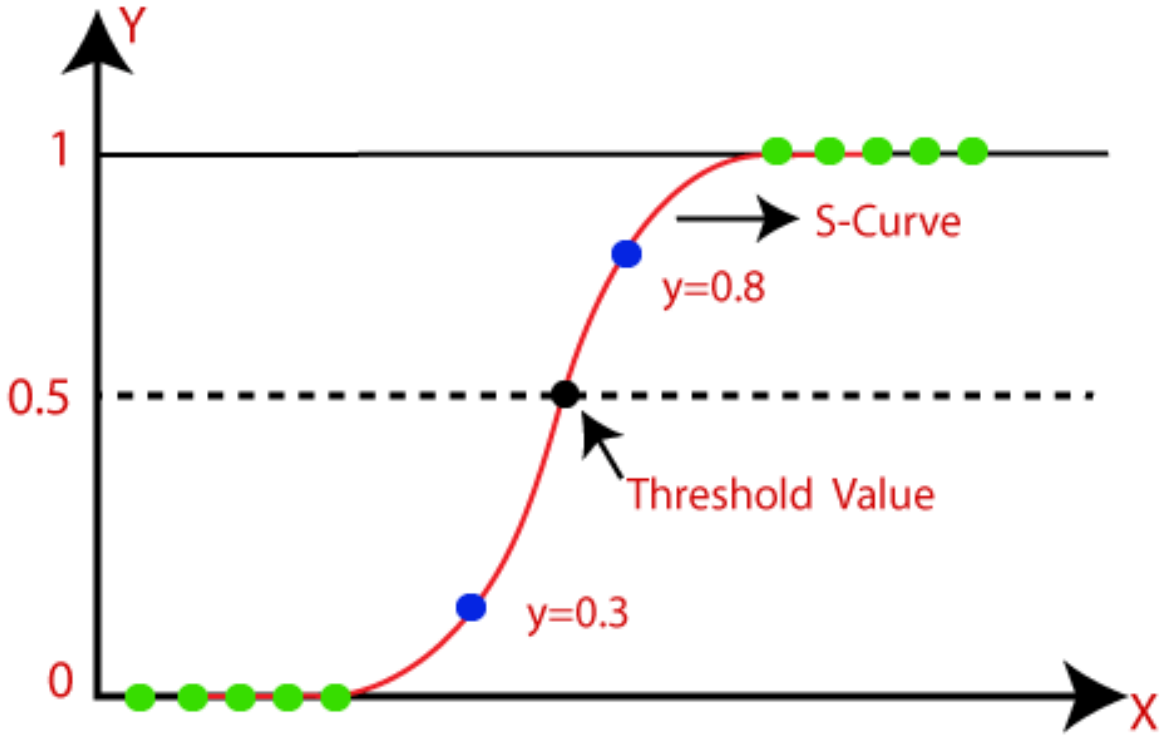
- https://helloacm.com/wp-content/uploads/2016/03/logistic-regression-example.jpg

Logistic and Linear Regression



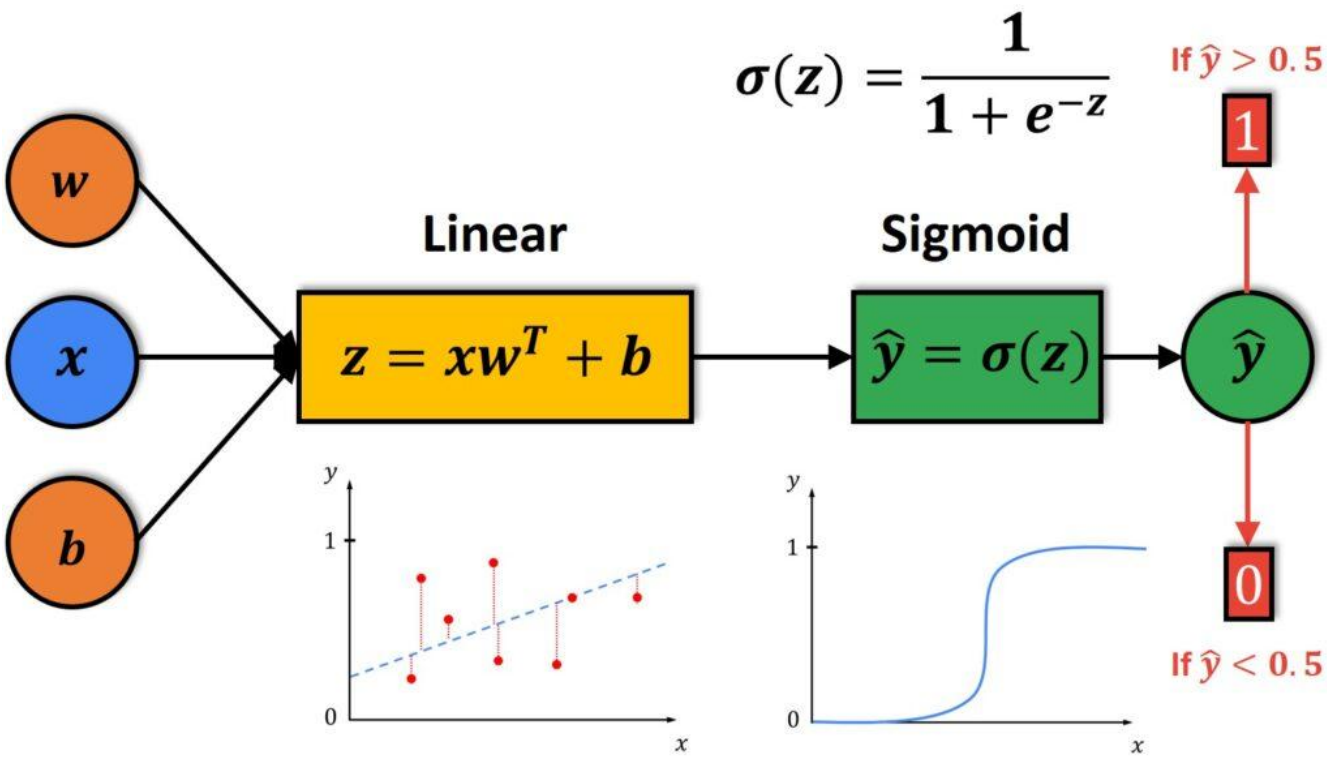
- https://miro.medium.com/v2/resize:fit:1400/1*dm6ZaX5fuSmuVvM4Ds-vcg.jpeg

Logistic Regression



- https://static.javatpoint.com/tutorial/machine-learning/images/logistic-regression-in-machine-learning.png

Logistic Regression/Sigmoid

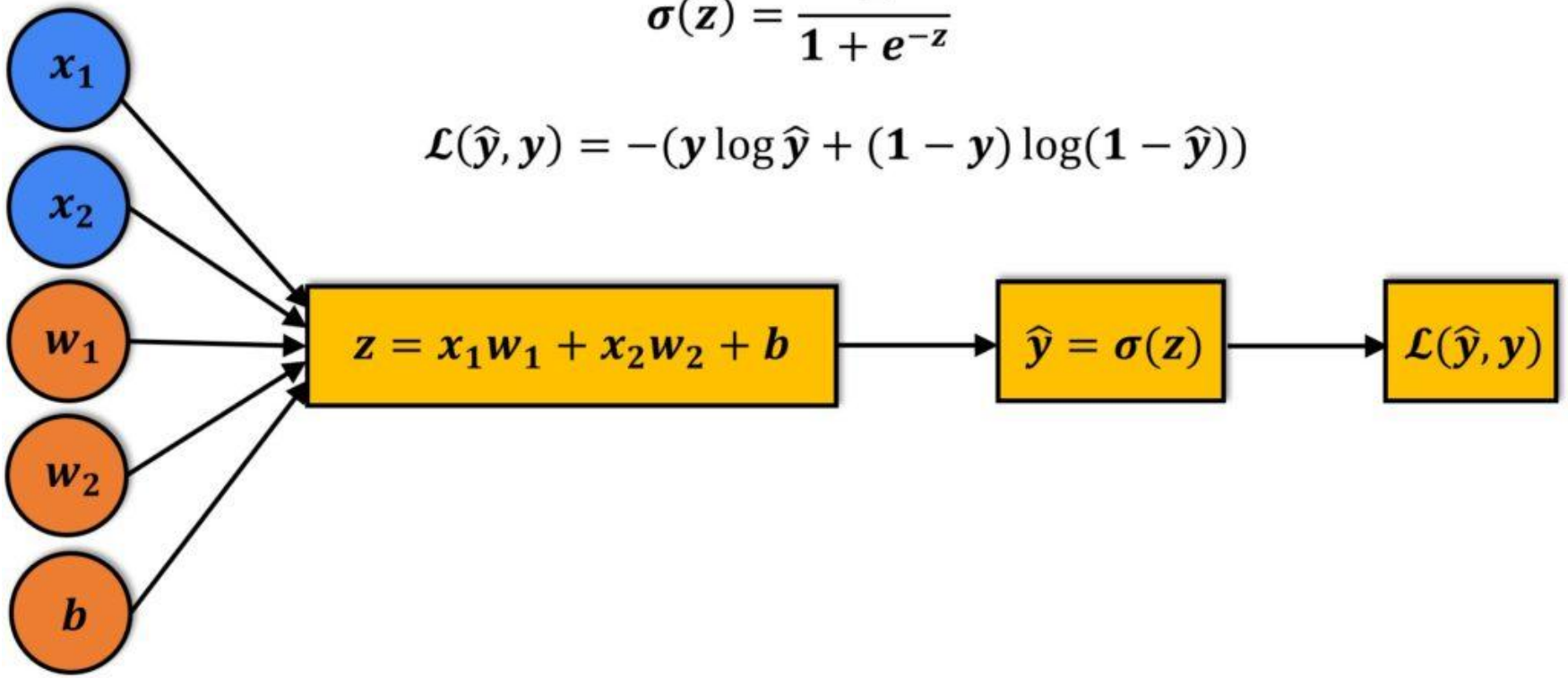


- https://datahacker.rs/004-machine-learning-logistic-regression-model/

Logistic Regression/Sigmoid

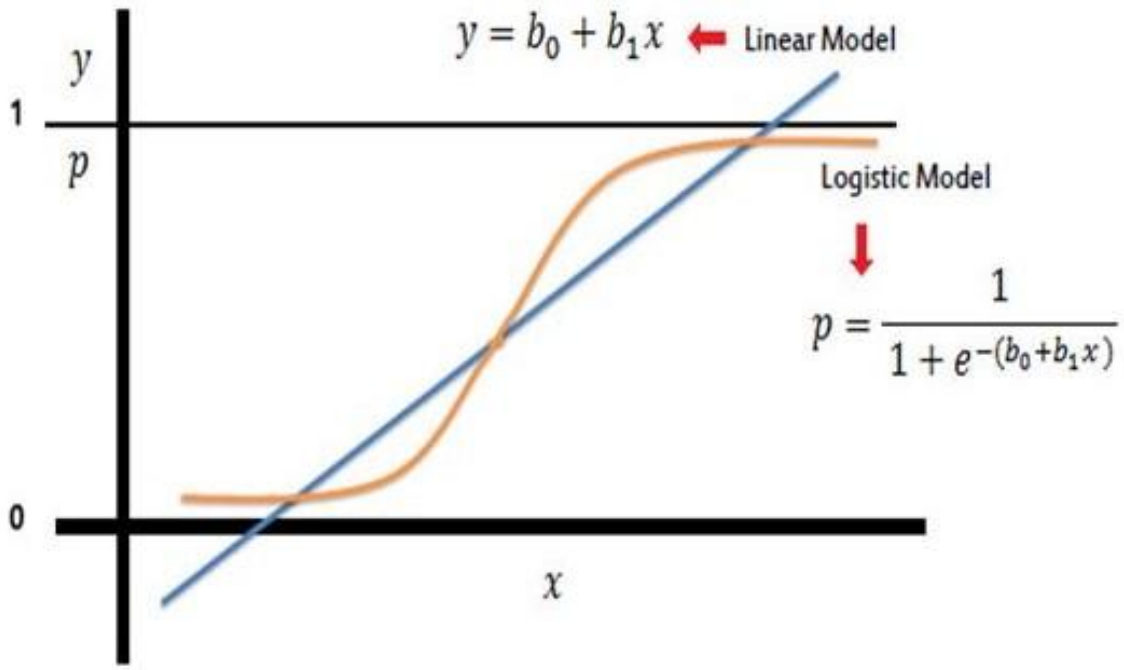
$$\sigma(z) = \frac{1}{1 + e^{-z}}$$

$$\mathcal{L}(\hat{y}, y) = -(y \log \hat{y} + (1 - y) \log(1 - \hat{y}))$$



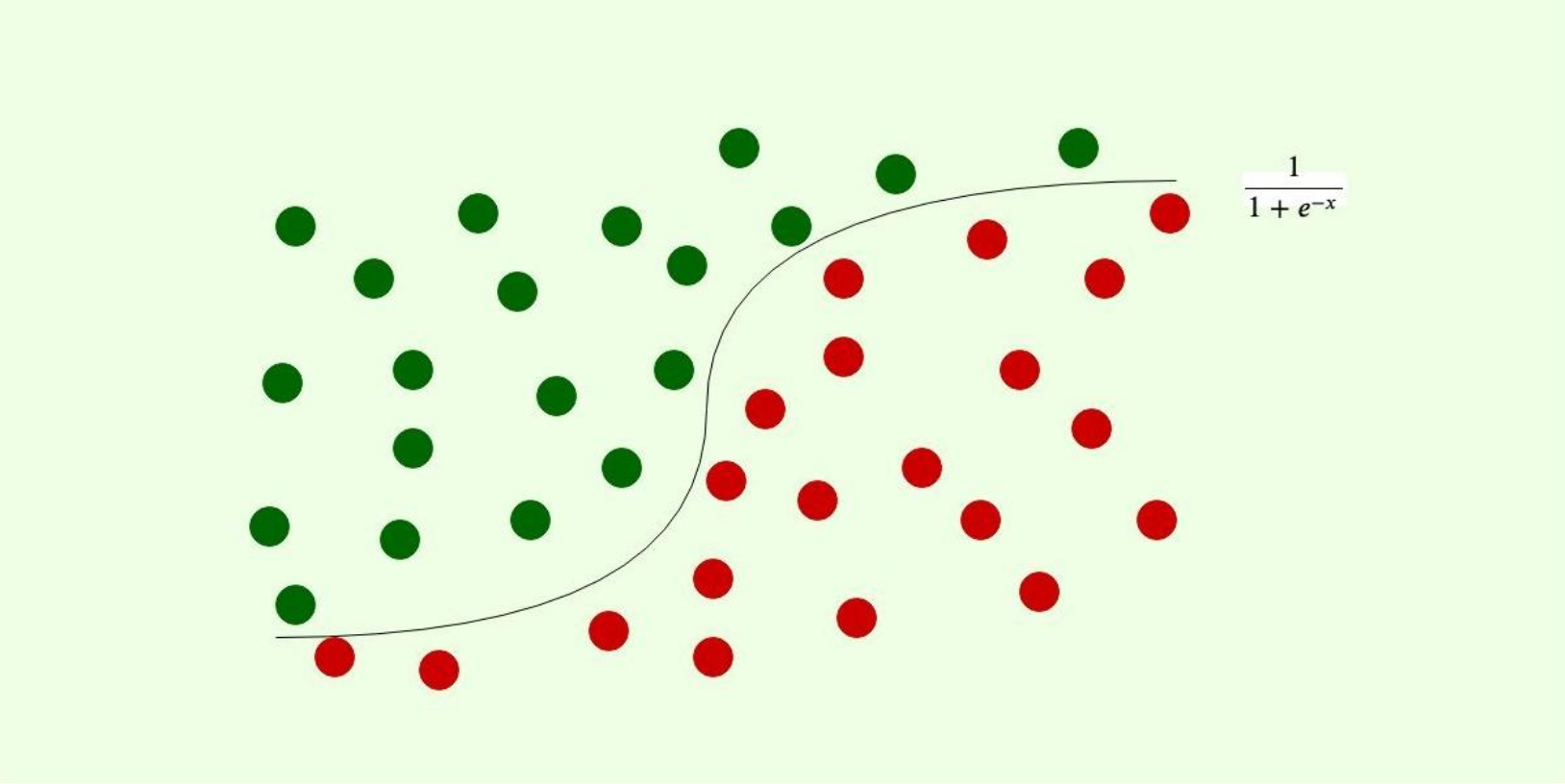
- https://datahacker.rs/004-machine-learning-logistic-regression-model/

Equation: Logistic and Linear Models



- https://www.fromthegenesis.com/wp-content/uploads/2018/07/logreg_dp.jpg

Logistic



- https://aigeekprogrammer.com/wp-content/uploads/2019/10/Logistic-Regression-for-binary-classification.jpg

Loss Function

Problem 5. Define the logistic regression loss function

$$L(w) = -\frac{1}{m}\sum_{i=1}^{m}\left(y_i \log(p_w(x_i)) + (1-y_i)\log(1-p_w(x_i))\right)$$

The vectorized representation is:

$$L(w) = -\frac{1}{m}\left(y^T \log(p_w(X_{tr})) + (1-y)^T \log(1-p_w(X_{tr}))\right)$$

with $p_w(X_{tr}) = \sigma(X_{tr}w)$ as defined above and $y_{tr} = (y_1, y_2, \ldots, y_{m_{tr}})^T$

Implement the vectorized version of the logistic regression loss function.

Check your code: The loss values is 0.0237 for the vector w defined in Problem 4 above.

- https://media.cheggcdn.com/media%2F367%2F367dc290-6750-4048-bfc9-76f7130082f3%2Fphpawathv.png

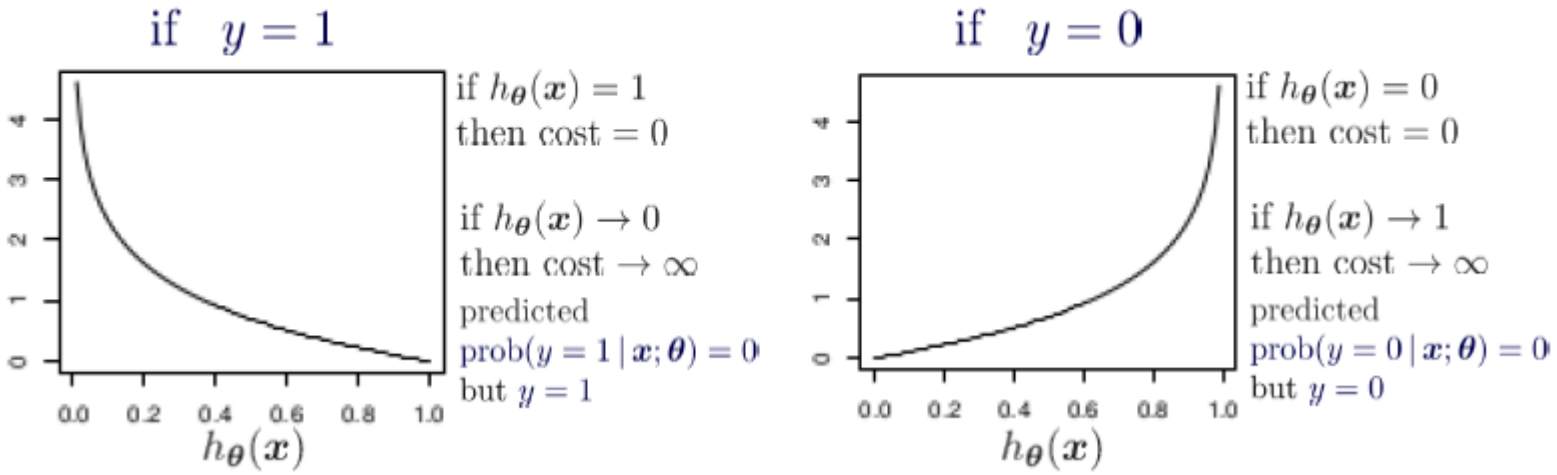
Loss Function

$$-(y \log(p) + (1 - y) \log(1 - p))$$

- https://miro.medium.com/v2/resize:fit:1400/1*90qLt3vge7Vojf9DTeGcLA.png

Cost Function

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



- https://miro.medium.com/v2/resize:fit:783/1*6oBgYMy4wOls9zGC-frSQg.png