Lecture 9

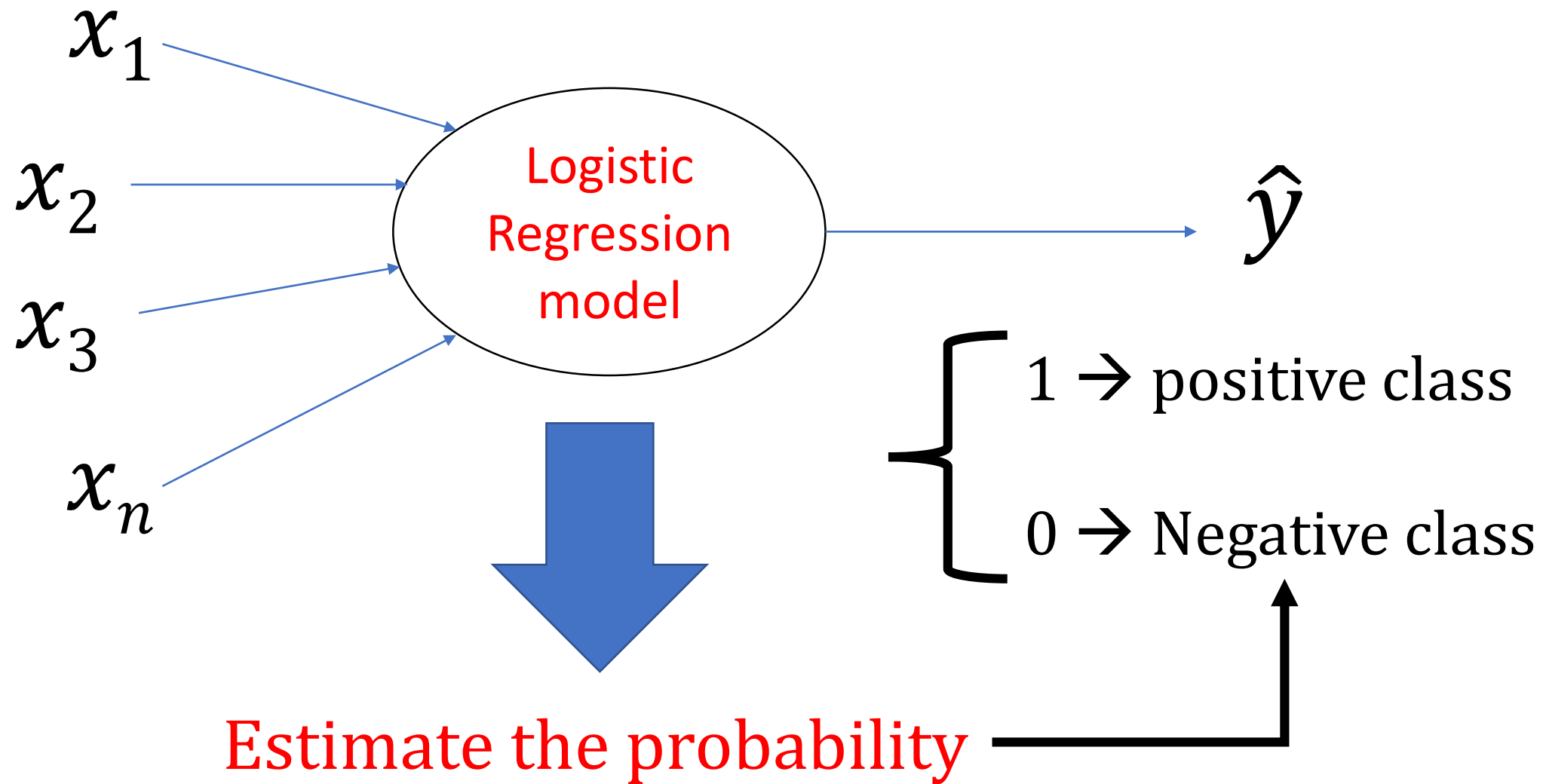# Important concepts of
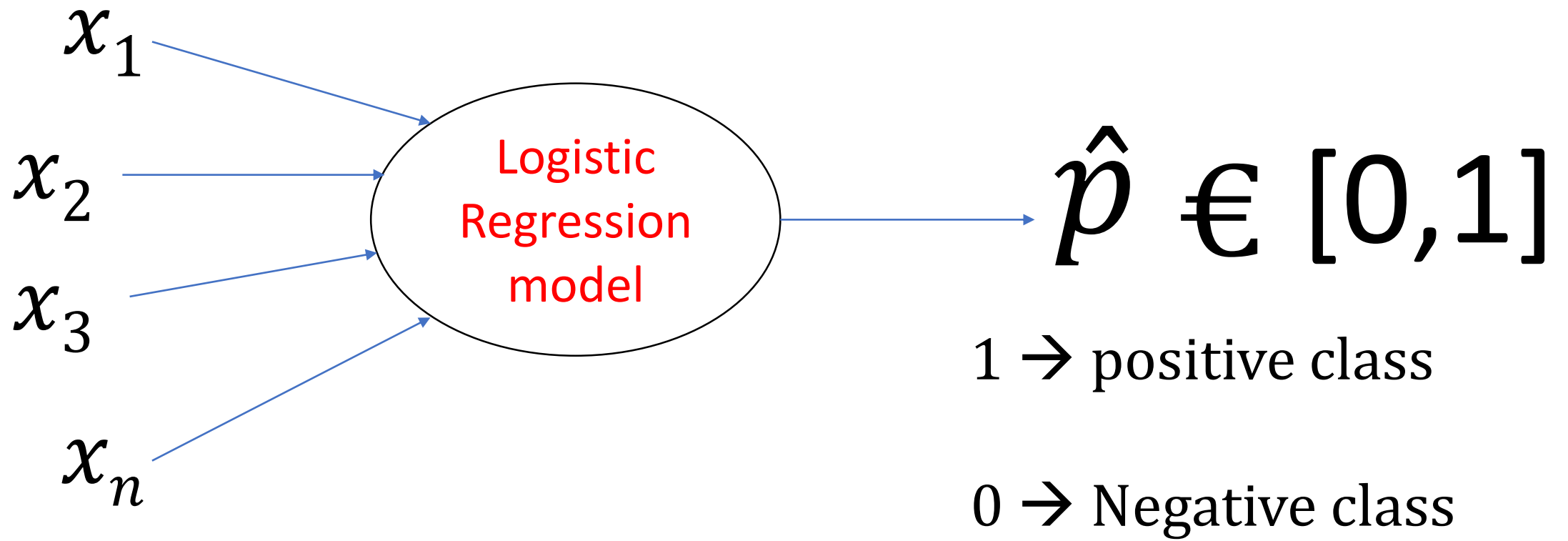# Logistic Regression

Suman Samui

Contents

- Logistic regression model → Probabilistic model

- Where from the name 'logit' comes from?

- What are the important aspects to train a LR model?

Logistic Regression

- Binary classification model

- Why the name contains the 'Regression' term?

- It can be extended to multiclass classification problem in different ways.
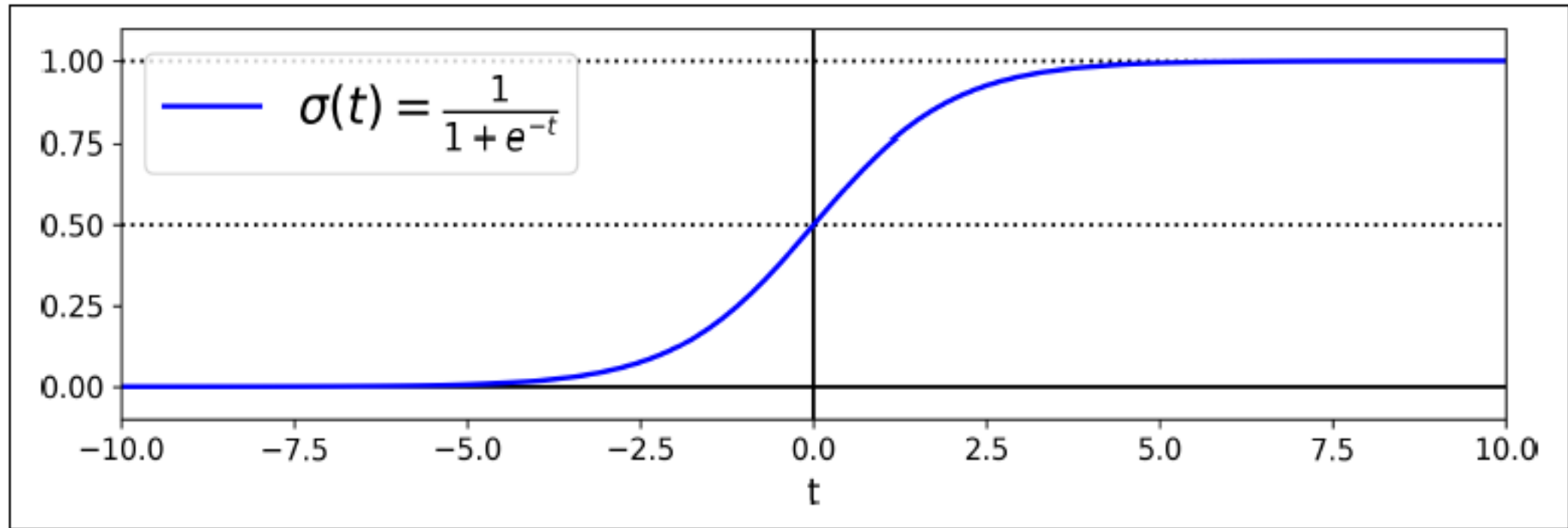
x_1

x_2

x_3

x_n

Logistic Regression model

$\hat{y}$

Estimate the probability

$1 \rightarrow$ positive class

$0 \rightarrow$ Negative class

$$x_1$$
$$x_2$$
$$x_3$$
$$x_n$$

Logistic Regression model

$$\hat{p} \in [0,1]$$

1 → positive class

0 → Negative class

$$t = b + w_1 x_1 + w_2 x_2 + w_3 x_3 + \cdots + w_n x_n$$

$$\hat{p} = \sigma(t) = h_w(x)$$

Logistic / Sigmoid function

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

Prediction model

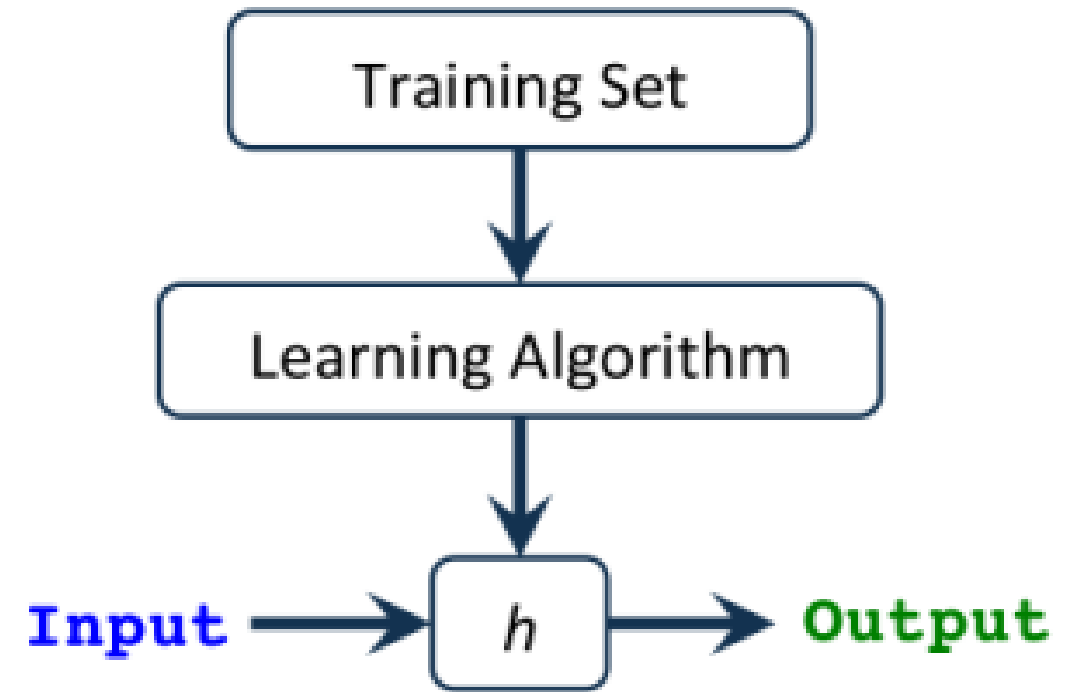$$\hat{y} = \begin{cases} 0 \text{ if } \hat{p} < 0.5 \\ 1 \text{ if } \hat{p} \geq 0.5 \end{cases}$$

Where from this **logit** term comes?

$$p = \frac{1}{1 + e^{-t}}$$

$$t = log\left(\frac{p}{1-p}\right) \longrightarrow \text{Logit function}$$

Next questions: How to train the model

- Find out the best parameter that give us the ***least error*** in predicting the output.

- We need to define a cost (loss) function

- Select an Optimization algorithm

Training Set

Learning Algorithm

Input → h → Output

Important concepts to be explored

- What should be the loss function?

- Intuitive meaning of Cross-entropy

- Optimization criteria → Convex cost function → Can we optimum solution?

- Is there any closed form equation to compute the parameters (w,b)?