



**SNS COLLEGE OF ENGINEERING**

**(Autonomous)**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**



**Artificial Intelligence & Machine Learning**

# **Logistic Regression**

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# Logistic Regression

- Logistic regression is another technique borrowed by machine learning from the field of statistics.
- It is the go-to method for binary classification problems (problems with two class values). In this post you will discover the logistic regression algorithm for machine learning.



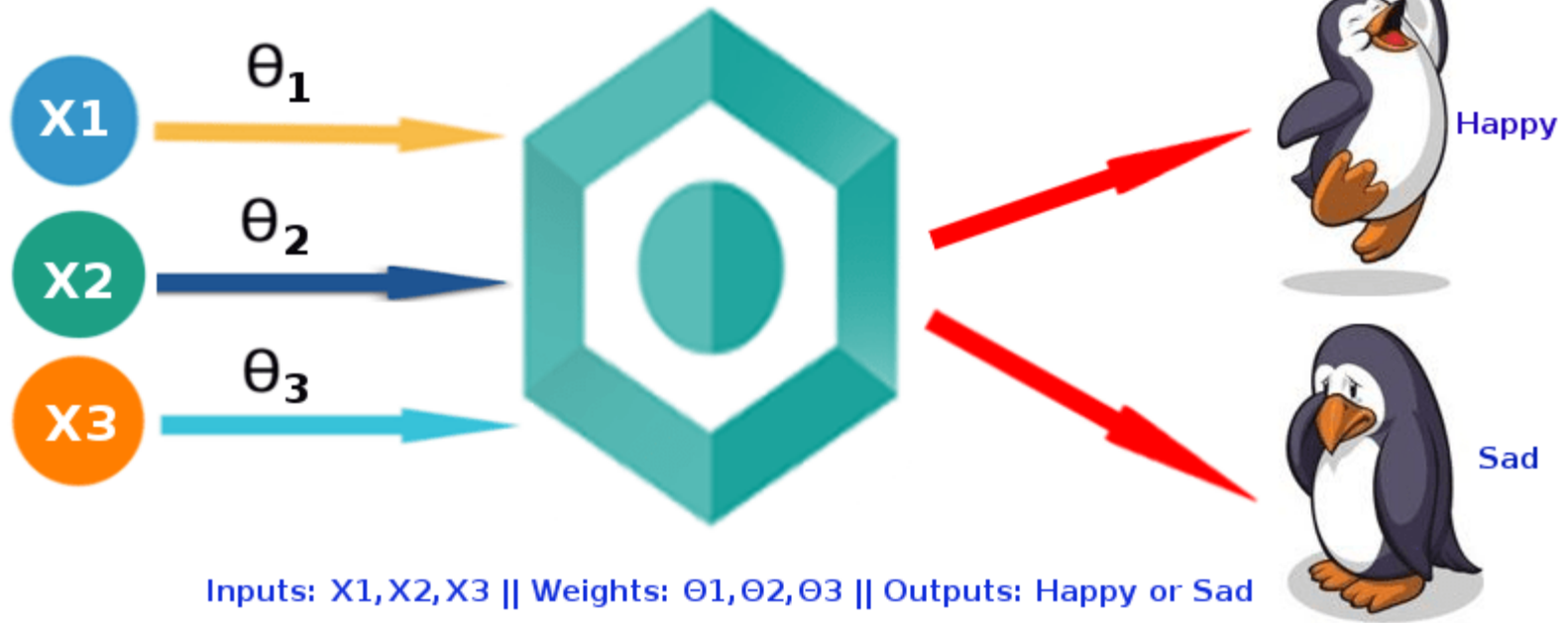
## Going to see about...

- The many names and terms used when describing logistic regression (like log odds and logit).
- The representation used for a logistic regression model.
- Techniques used to learn the coefficients of a logistic regression model from data.
- How to actually make predictions using a learned logistic regression model.
- Where to go for more information if you want to dig a little deeper.



Contd...

## Logistic Regression Model



Inputs:  $X_1, X_2, X_3$  || Weights:  $\theta_1, \theta_2, \theta_3$  || Outputs: Happy or Sad

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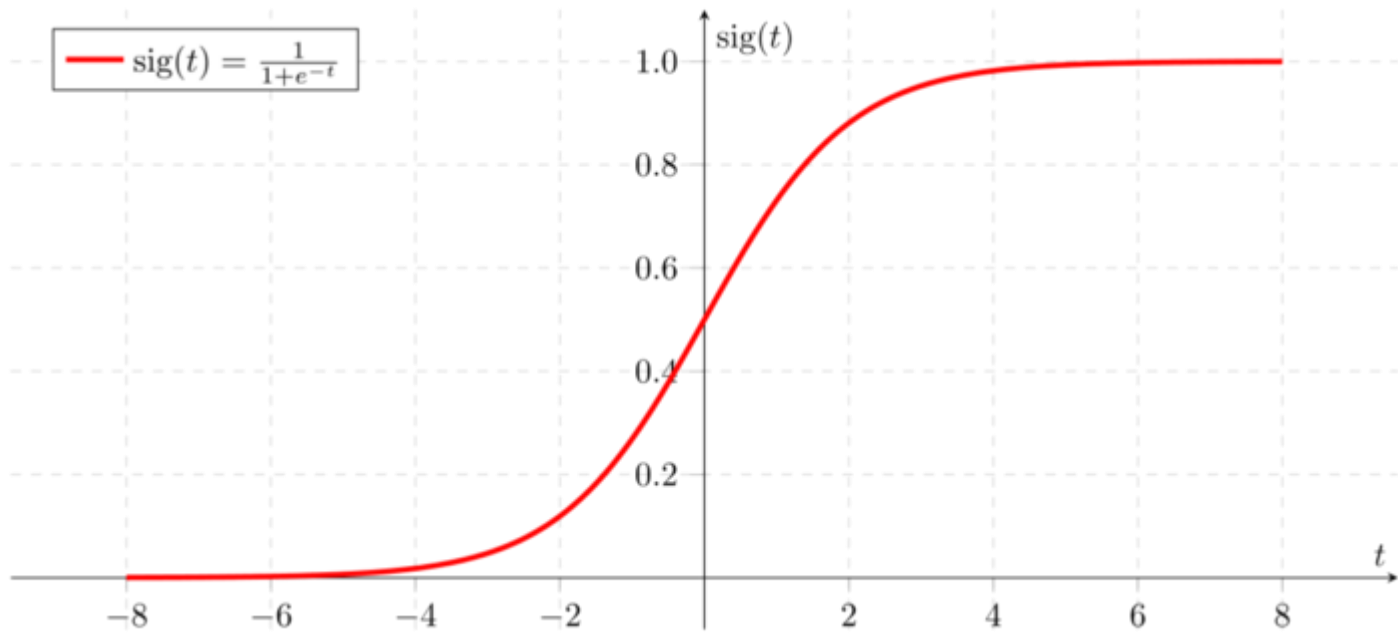
# Contd...

Model

Output = 0 or 1

Hypothesis  $\Rightarrow Z = WX + B$

$h_{\Theta}(x) = \text{sigmoid}(Z)$



# Types of Logistic Regression

3 Types

- Binary Logistic Regression
- Multinomial Logistic Regression
- Ordinal Logistic Regression



# Contd...

## **1. Binary Logistic Regression**

The categorical response has only two possible outcomes. Example: Spam or Not

## **2. Multinomial Logistic Regression**

Three or more categories without ordering. Example: Predicting which food is preferred more (Veg, Non-Veg, Vegan)

## **3. Ordinal Logistic Regression**

Three or more categories with ordering. Example: Movie rating from 1 to 5



# Decision Boundary

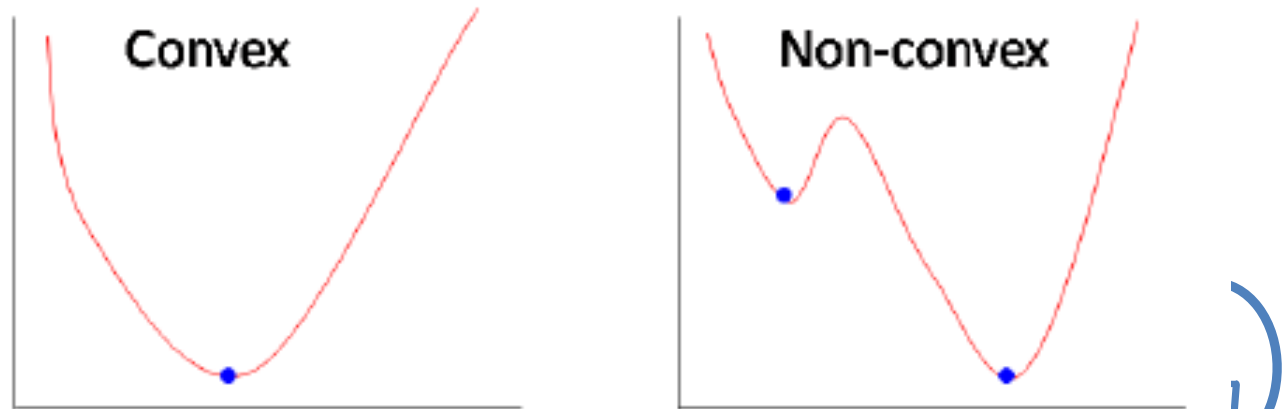
- To predict which class a data belongs, a threshold can be set. Based upon this threshold, the obtained estimated probability is classified into classes.
- Say, if  $\text{predicted\_value} \geq 0.5$ , then classify email as spam else as not spam.
- Decision boundary can be linear or non-linear. Polynomial order can be increased to get complex decision boundary.





# Cost Function

- Why cost function which has been used for linear can not be used for logistic?
- Linear regression uses mean squared error as its cost function. If this is used for logistic regression, then it will be a non-convex function of parameters ( $\theta$ ). Gradient descent will converge into global minimum only if the function is convex.



Thank you