MONASH University

Week 6

FIT5202 Big Data Processing

Classification Models

Week 6 Agenda

- Week 5 Review
- Classification Algorithms
  - Decision Trees
  - Random Forest
  - Logistic Regression
- Model Evaluation
  - Confusion Matrix
  - ROC Curve
- Tutorial Use Case
  - Bank : Will customers subscribe?

Random Forest

- Use ensemble approach
  - The outcome of the model
    - Majority voting (mode) (for classification)
    - Mean of all outcomes (for regression)
- Generalise the model
  - Build multiple different (uncorrelated) trees
  - Avoid overfitting issue found in decision tree
- Use generalisation technique
  - Bagging (bootstrapping) – Randomise (with replacement) a different dataset (from the training dataset) used for training each tree.
  - Each tree uses a random subset of features for splitting nodes.

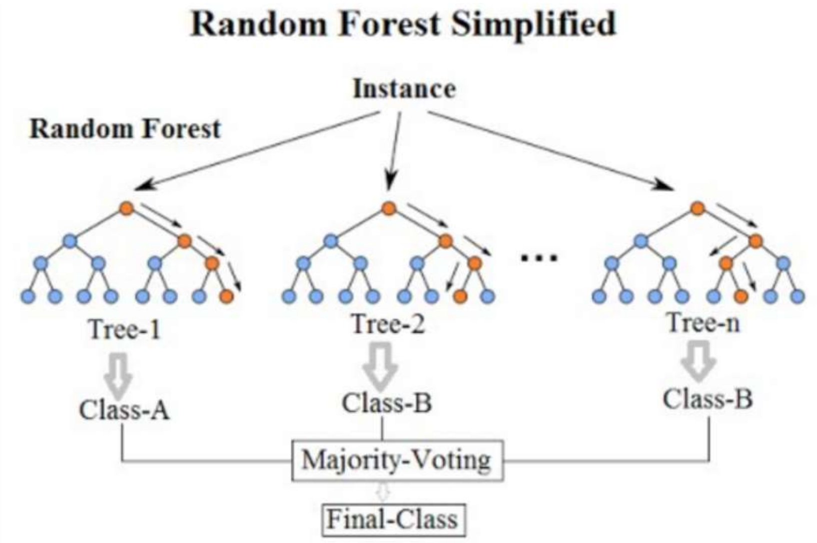


image: https://medium.com/@williamkoehrsen/random-forest-simple-explanation-377895a60d2d

Logistic Regression

- Based on linear model approach
  - Instead of predicting continuous target variable,
  - Logistic regression predicts categorical target variable (e.g. binary classification)
- Define the hyperplane (decision boundary) used to classify data (e.g. to separate the two classes in the data in case of binary classification)

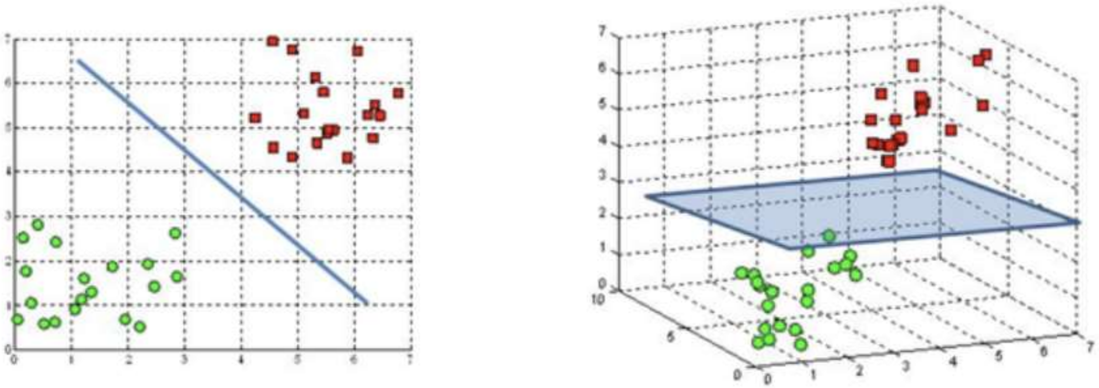
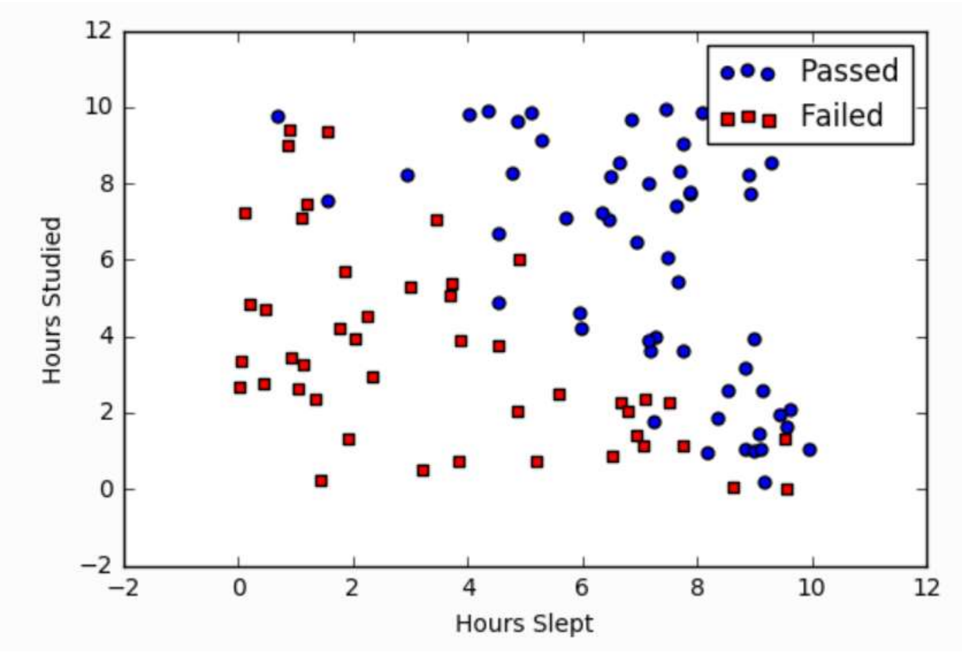


image: https://www.quora.com/What-is-a-hyperplane-in-machine-learning?top_ans=198420733

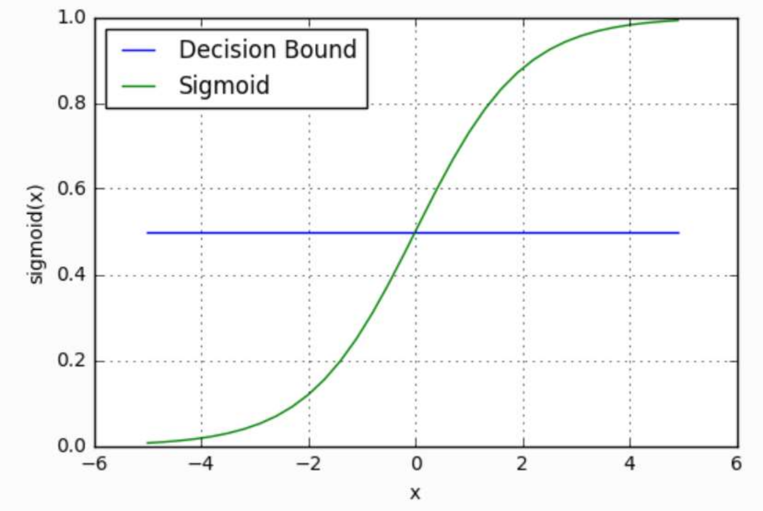
Example: Logistic Regression



- **2 features:** Hours slept, Hours studied
- **2 classes:** Passed and Failed

$$z = W_0 + W_1 Studied + W_2 Slept$$

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



https://ml-cheatsheet.readthedocs.io/en/latest/logistic_regression.html

Evaluating Classifiers

- Threshold Metrics
  - Confusion Matrix
    - True Positive, True Negative, False Positive, False Negative
    - Accuracy, Precision, Recall (sensitivity) and F1-score
- Ranking Metrics
  - ROC Curve

Classification **accuracy** is almost universally **inappropriate for imbalanced classification**.

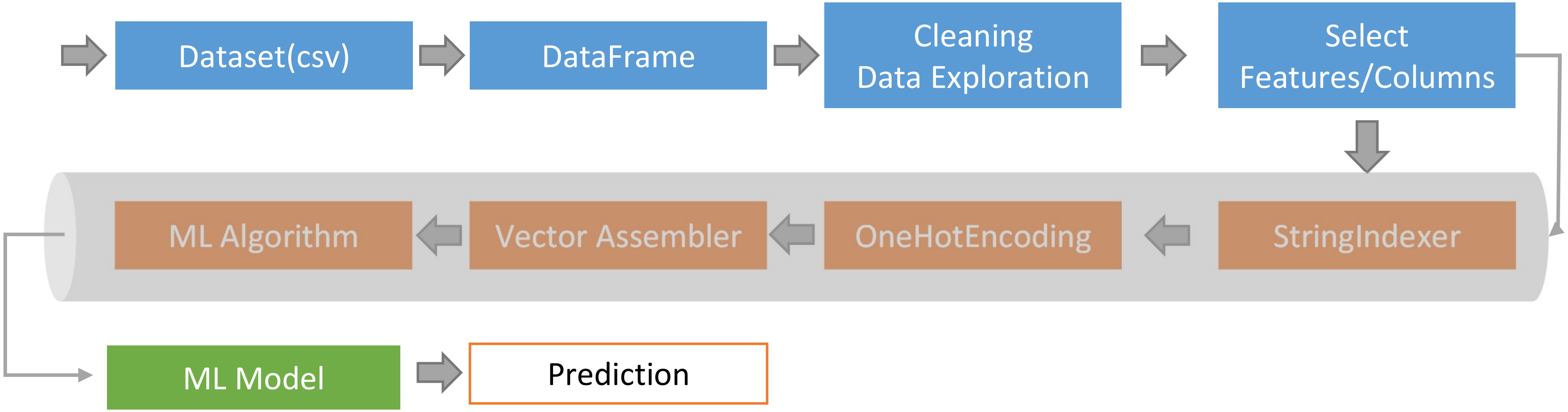
https://machinelearningmastery.com/tour-of-evaluation-metrics-for-imbalanced-classification/

Choosing the right model?

- Understand characteristics of your data?
- Understand characteristics of the model?
- Meets business goals?
- How accurate is the model?
- How explainable is the model?
- How fast is the model?
- How scalable is the model?

https://hackernoon.com/choosing-the-right-machine-learning-algorithm-68126944ce1f

Bank Use Case: Will the customers subscribe?



Dataset(csv)

DataFrame

Cleaning
Data Exploration

Select
Features/Columns

StringIndexer

OneHotEncoding

Vector Assembler

ML Algorithm

ML Model

Prediction

Thank You!

See you next week.