

Supervised Machine Learning

Module 3



Module 3 Summary

SESSION	TITLE	TEACHER
1	ML Foundations	Juan
2	Regression Introduction and Practice	Juan
3	Classification Introduction and Practice	Carlos
4	Feature Engineering and Selection for ML	Carlos
5	Advanced Supervised Models 1	Carlos
6	Advanced Supervised Models 2	Carlos
7	Hands-on Practice	Carlos

Early Detection of Heart Arrhythmias



Motivation

Automatic External Defibrillators (AEDs) are electronic devices which are used to treat certain type of cardiac arrhythmias. Some shockable cardiac arrhythmias as **ventricular tachycardia (VT)** and **ventricular fibrillation (VF)** can be treated by AEDs in scenarios outside of a hospital when an appropriate shock could increase the chances of survival for a patient.

- **AEDs** as user friendly as possible for the operator
- The accuracy of the heartbeat analysis is of the upmost importance both to correctly deliver a shock if the patient is suffering from VF or VT and to not deliver shock for nonshockable rhythms such as normal sinus rhythms.



Specifications

- The American Heart Association (AHA) has released recommendations for VF and VT detection algorithms and suggests that accepted algorithms should have a **sensitivity higher than 90%** for shockable rhythms and a **specificity higher than 95%** for nonshockable rhythms
- The accuracy of the heartbeat analysis is of the utmost importance both to correctly deliver a shock if the patient is suffering from VF or VT and to not deliver shock for nonshockable rhythms such as normal sinus rhythms.

Objective

- Analyse labelled ECG data from public datasets
- Separate labels as shockable and nonshockable
- Segment and extract features from labelled ECG data
- Train a number of models using different machine learning algorithms
- Determine which algorithms are most effective for the classification of heart rhythms

Public Datasets



MIT-BIH Malignant
Ventricular Arrhythmia
Database (VFDB)

- 22 ECGs – 30 mins each
- Sample Rate – 360 Hz
- 2 recording channels

Creighton University
Ventricular Tachycardia
Database (CUDB)

- 35 ECGs – 8 mins each
- Sample Rate – 250 Hz

Outline

- Business Understanding
- Data Analysis
- Data Modelling
 - Logistic Regression
 - Naïve Bayes
 - Decision Tree
 - Random Forest
 - Adaboost
 - XGBoost
- Final Conclusions





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