LEARNING MODELS TO CLASSIFY PPG WAVEFORMS

Técnicas Avançadas de Análise de Dados

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OBJECTIVES

- Classify different PPG waveforms: adults vs neonates
- Study different learning models
- Create and choose signal features
- Test and develop the best learning model

CHALLENGES

- Two sets of known data: training and testing
- Segments of 10 seconds for 50 different people of each type
- Normalized and labeled data: 0 for adult and 1 for neonate

DATASET

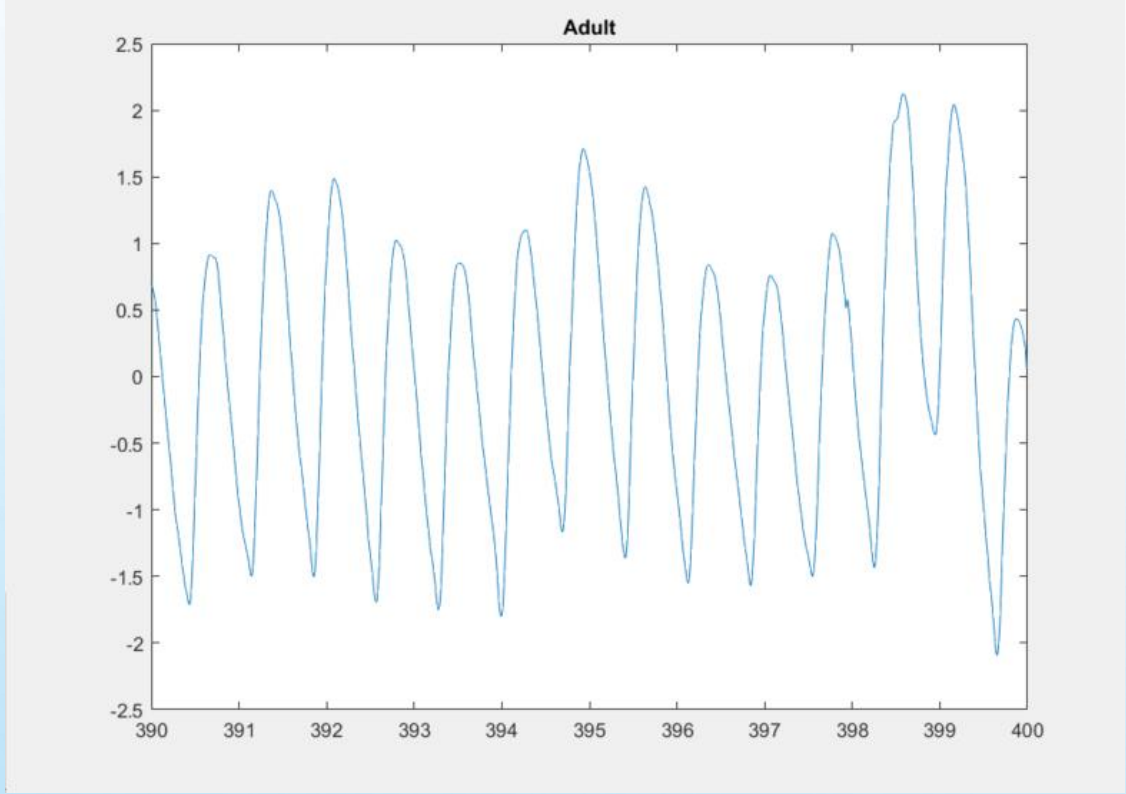

Fig.1 – Adult's signal example

DATASET

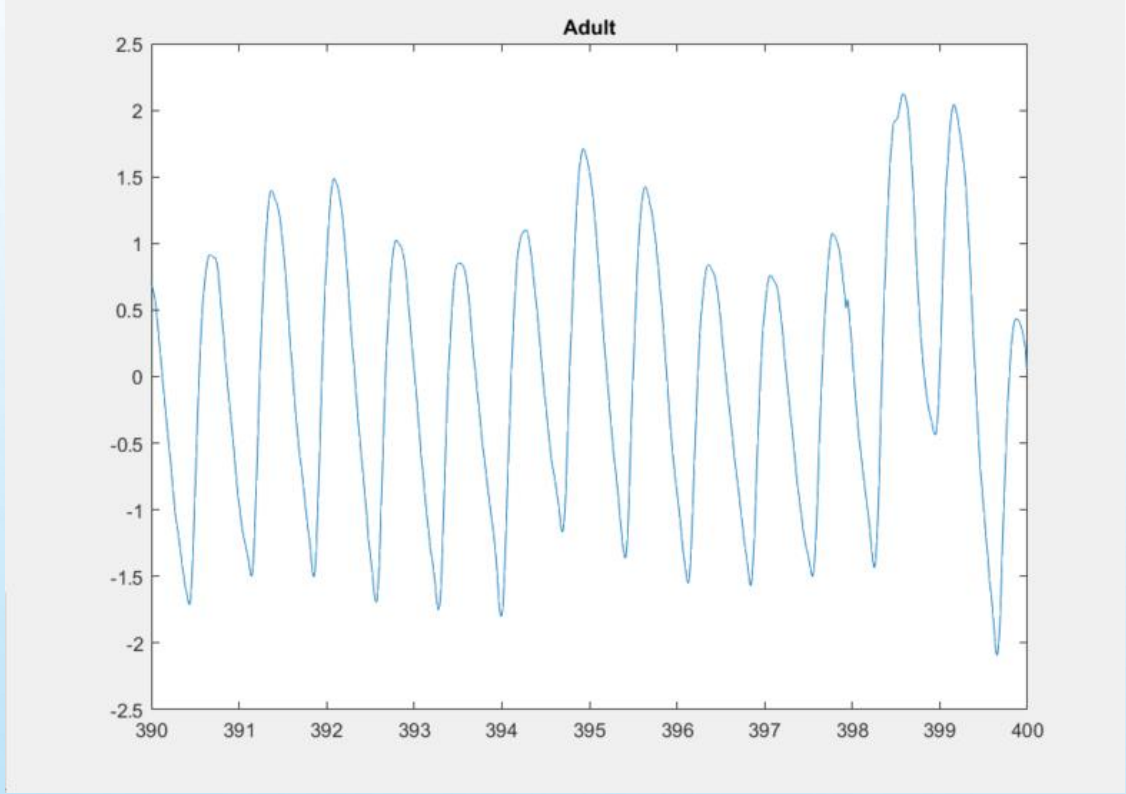

Fig.1 – Adult's signal example

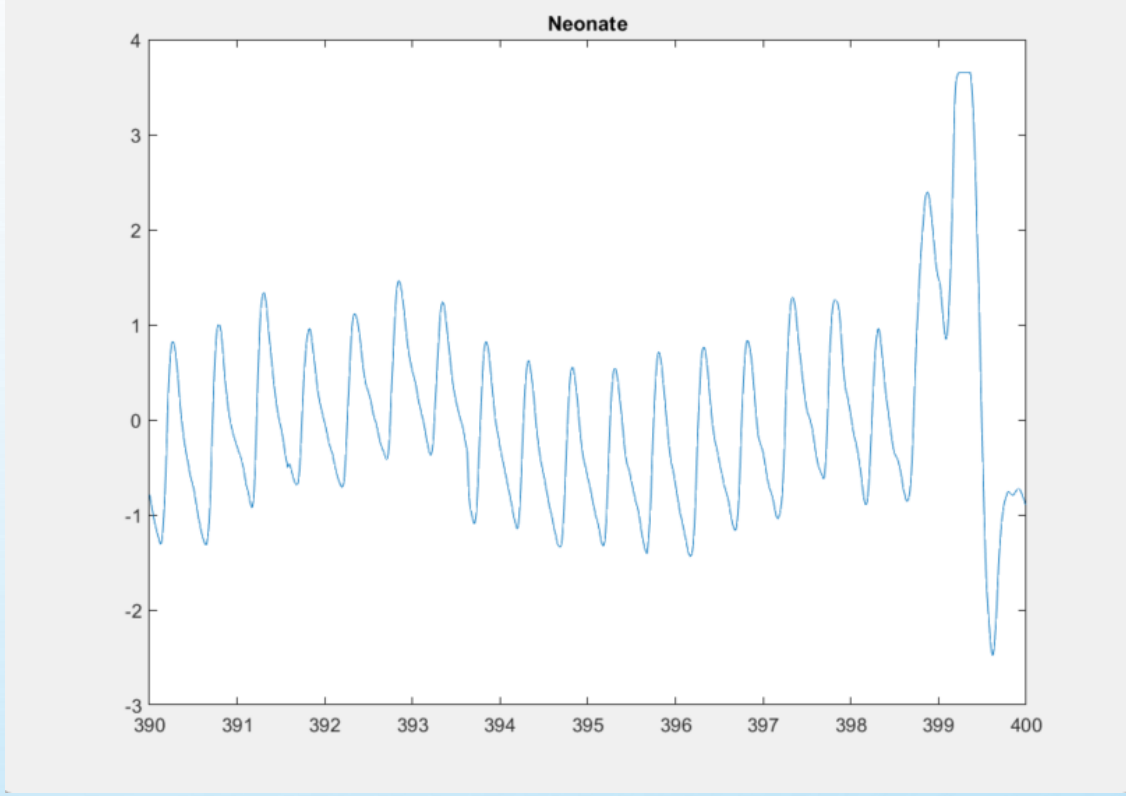

Fig.2 – Neonate's signal example

PREPROCESSING

- 14 chosen features
- Normalized features

FEATURE EXTRACTION

Time domain statistics	Frequency domain statistics
Mean Bandwidth	Total Power
Peaks Distance	Full Bandwidth
Interquartile	Median Frequency
Kurtosis	Mean Frequency
Skewness	Peak Amplitude
Peak to Peak	Maximum Frequency
Peak to RMS	Spurious Free Dynamic Range

MACHINE LEARNING TECHNIQUES

- Random Forest
- Discriminant Analysis
- SVM

FINE-TUNING OF PARAMETERS

- Best parameters
- Test models for training data and apply for testing data

FINE-TUNING OF PARAMETERS

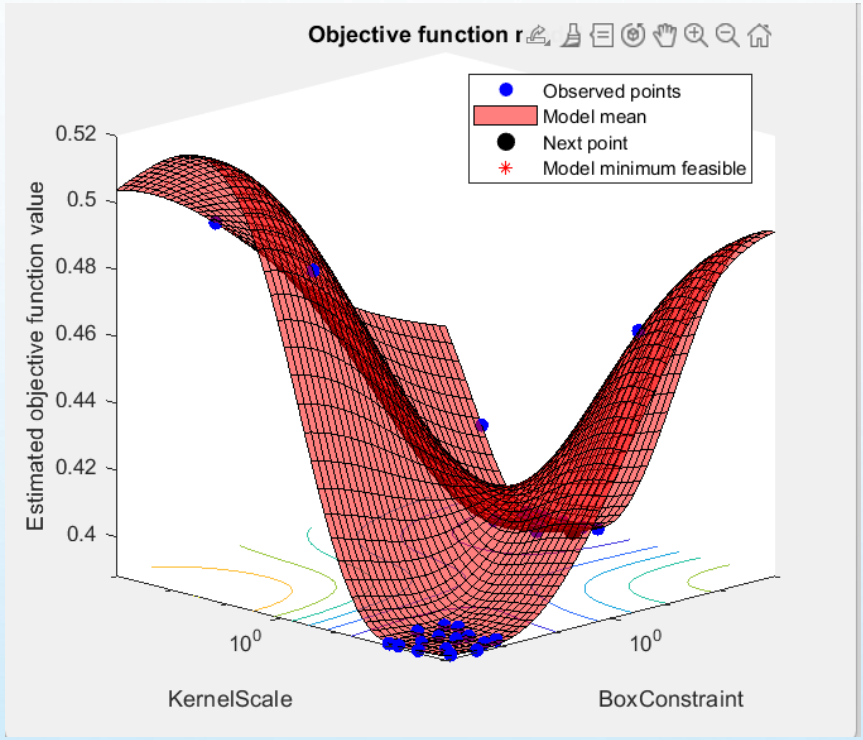

Fig.3 – Parameters optimization

```
SVM = fitcsvm(X,label,'KernelScale',8.8765,'BoxConstraint',368.65,'KernelFunction','polynomial','PolynomialOrder',5);
```

PERFORMANCE ASSESSMENT

Fig.4 – Confusion chart

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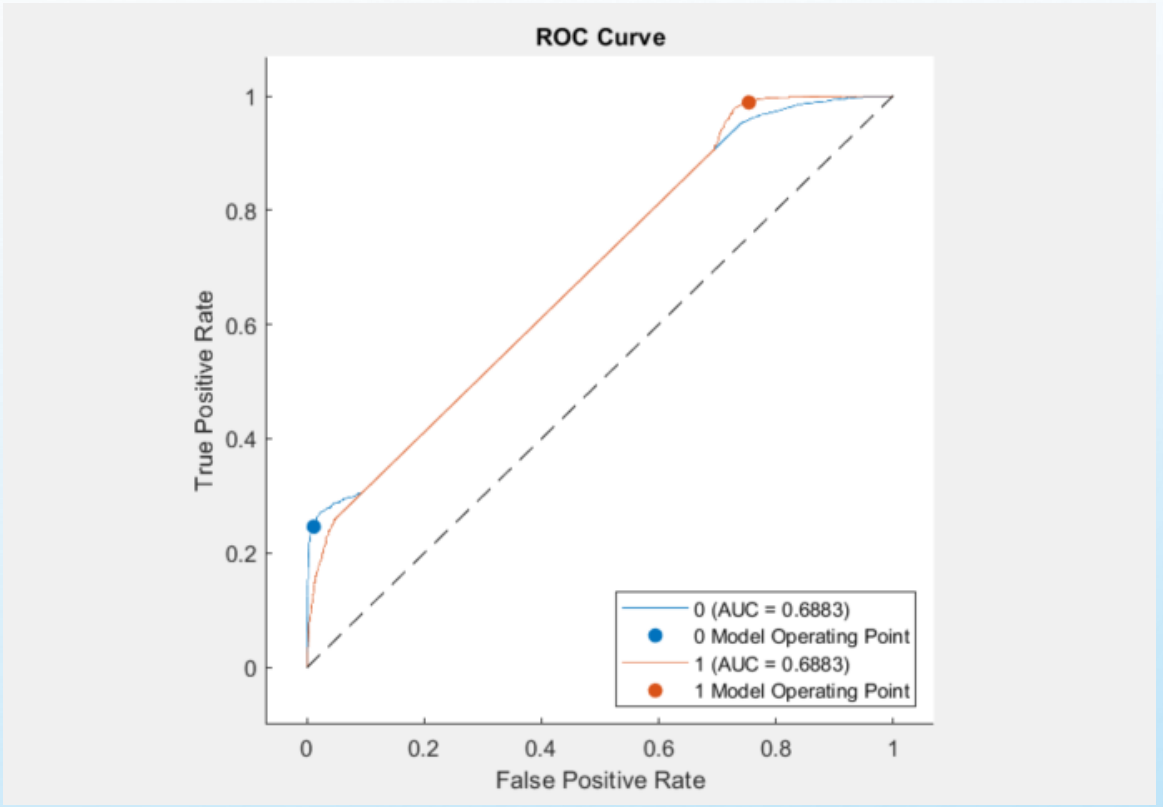


Fig.5 – ROC curve

PERFORMANCE ASSESSMENT

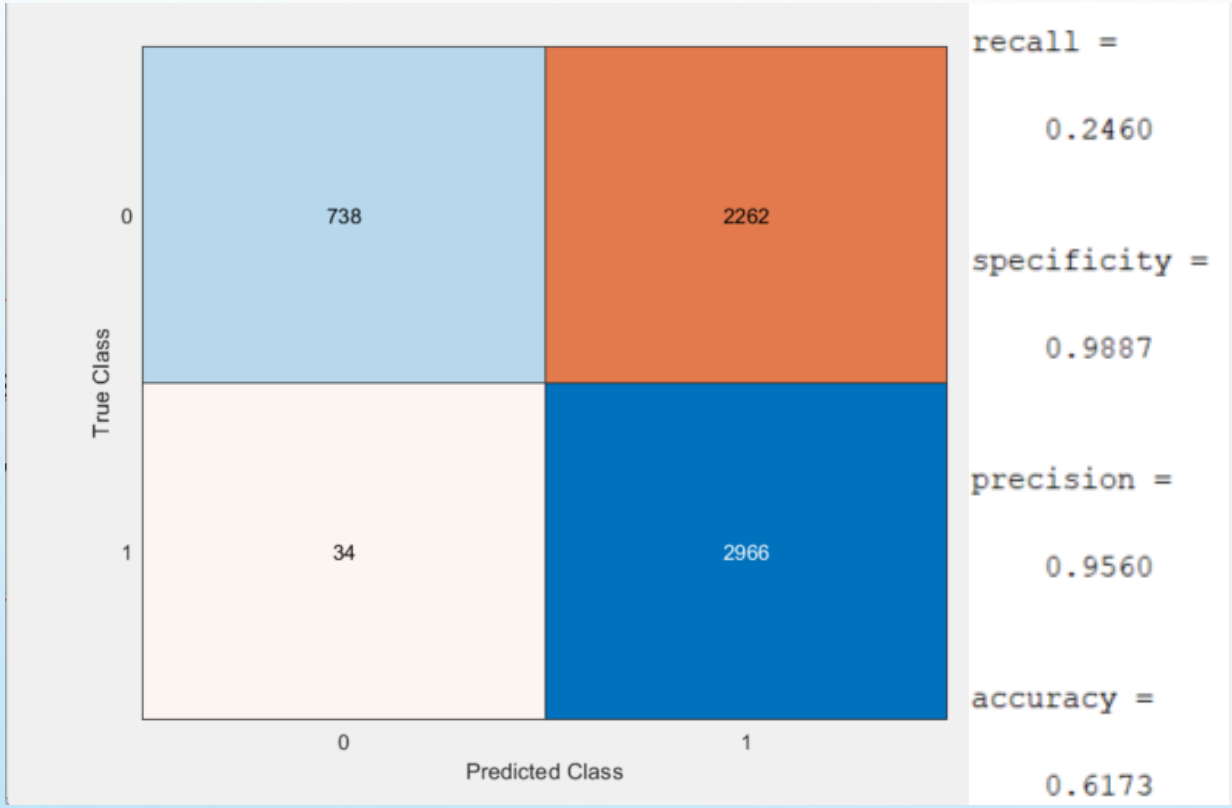


Fig.4 – Confusion chart

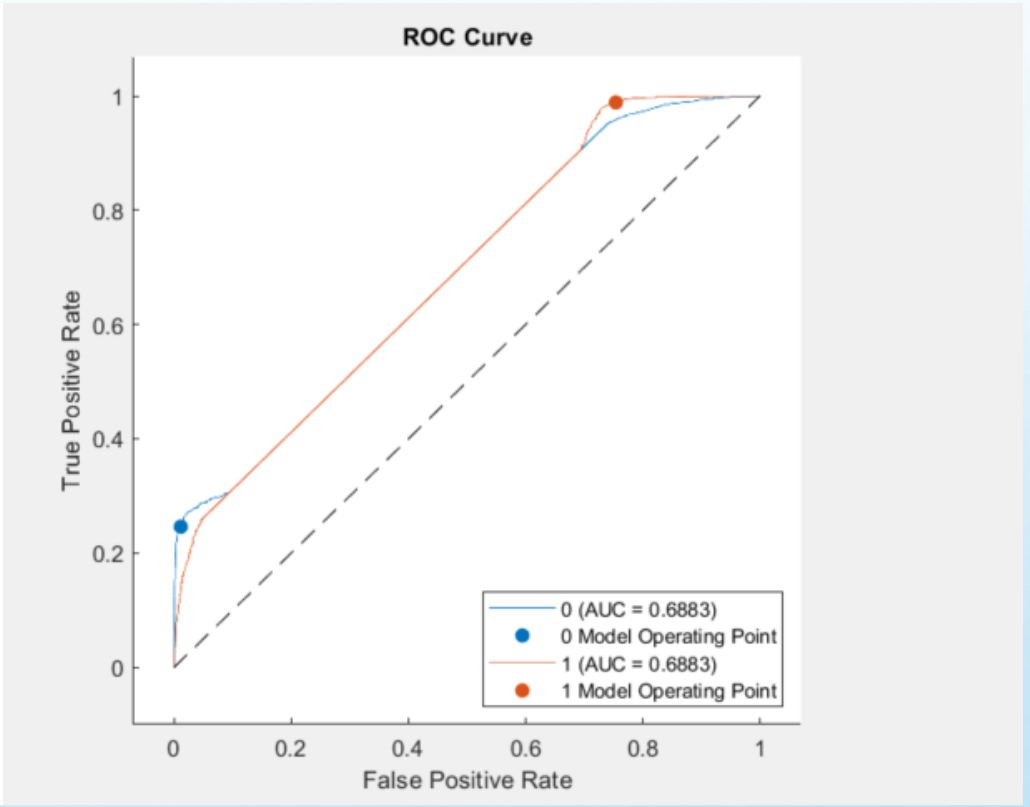
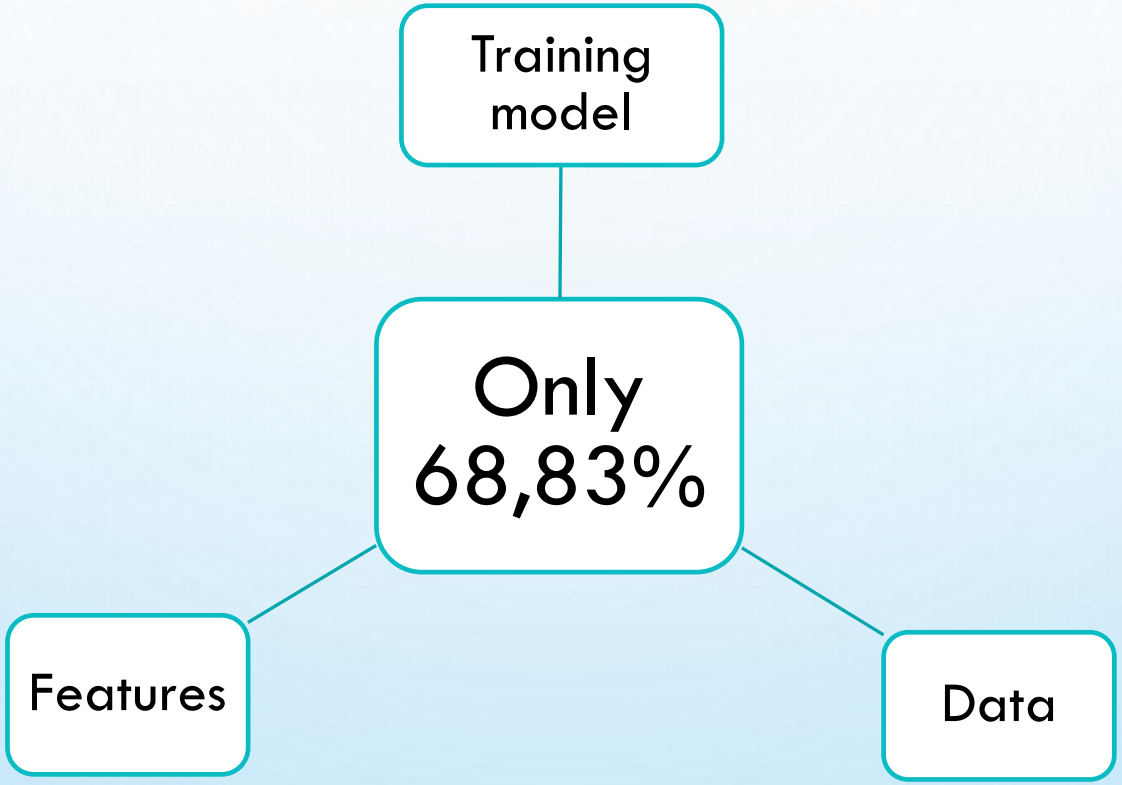
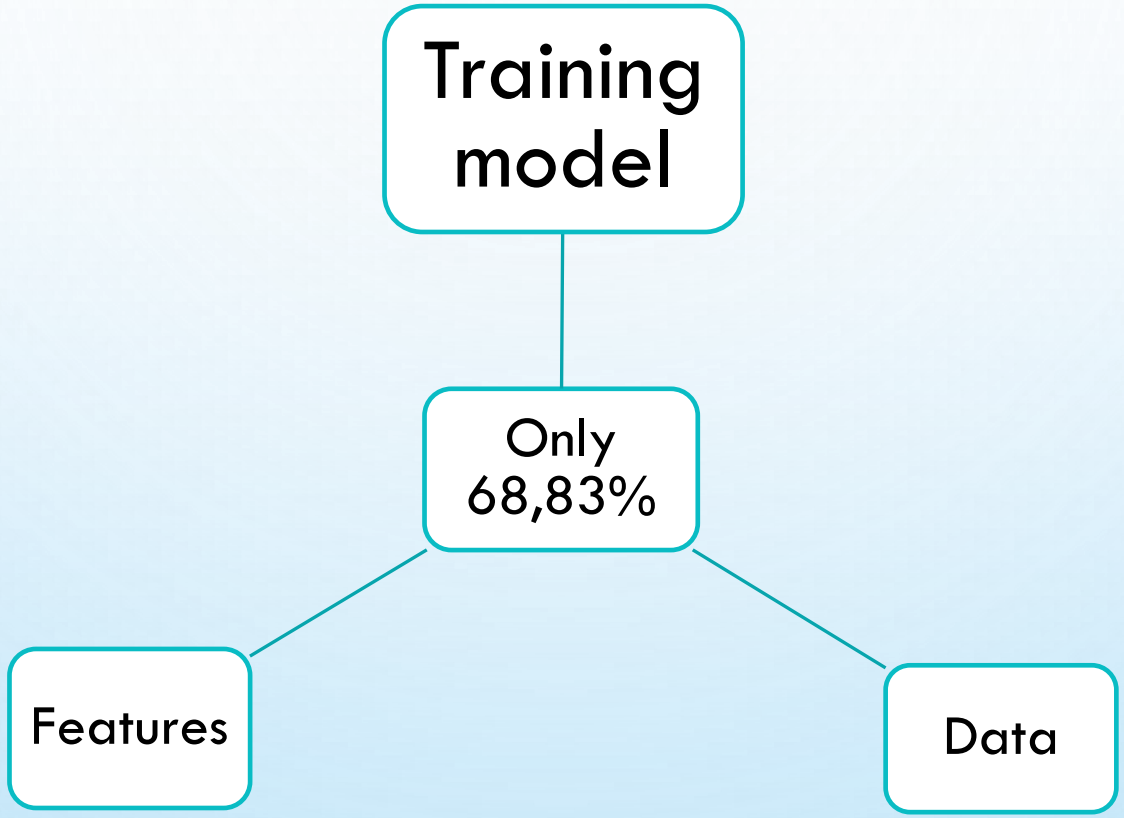


Fig.5 – ROC curve

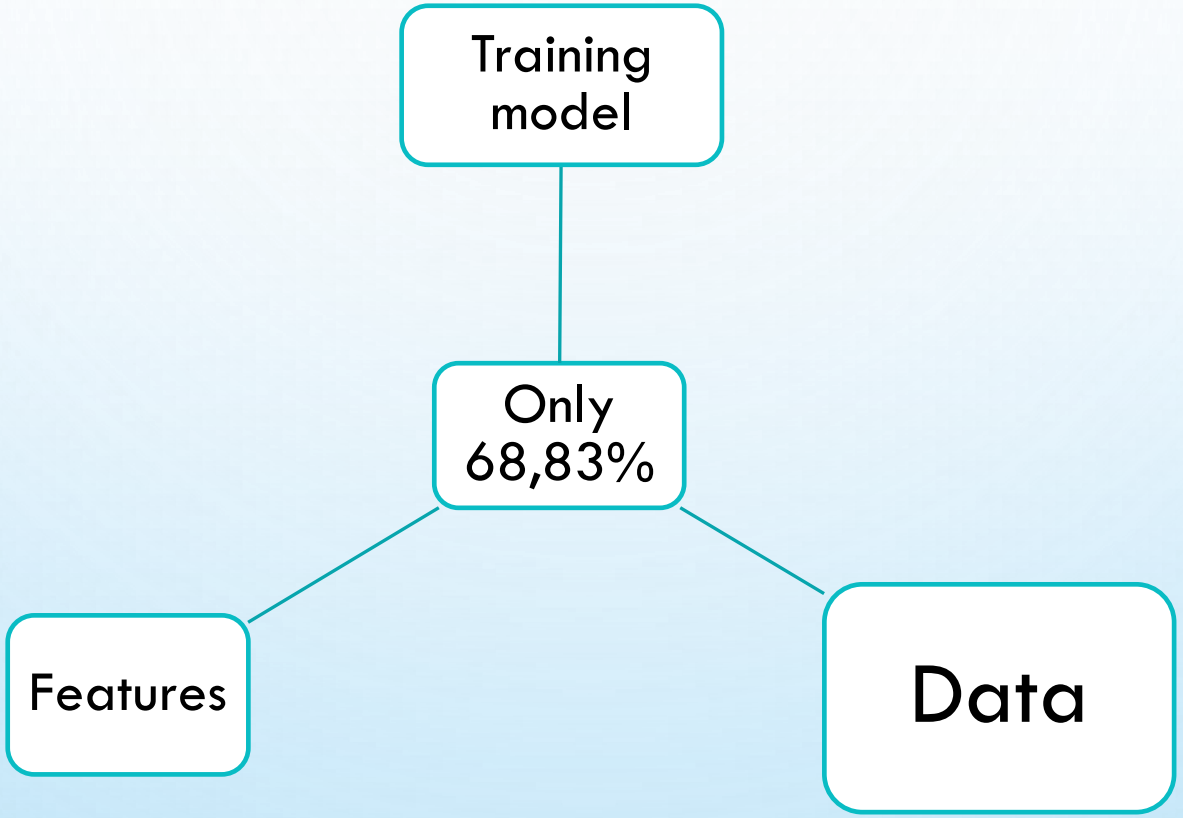
DISCUSSION



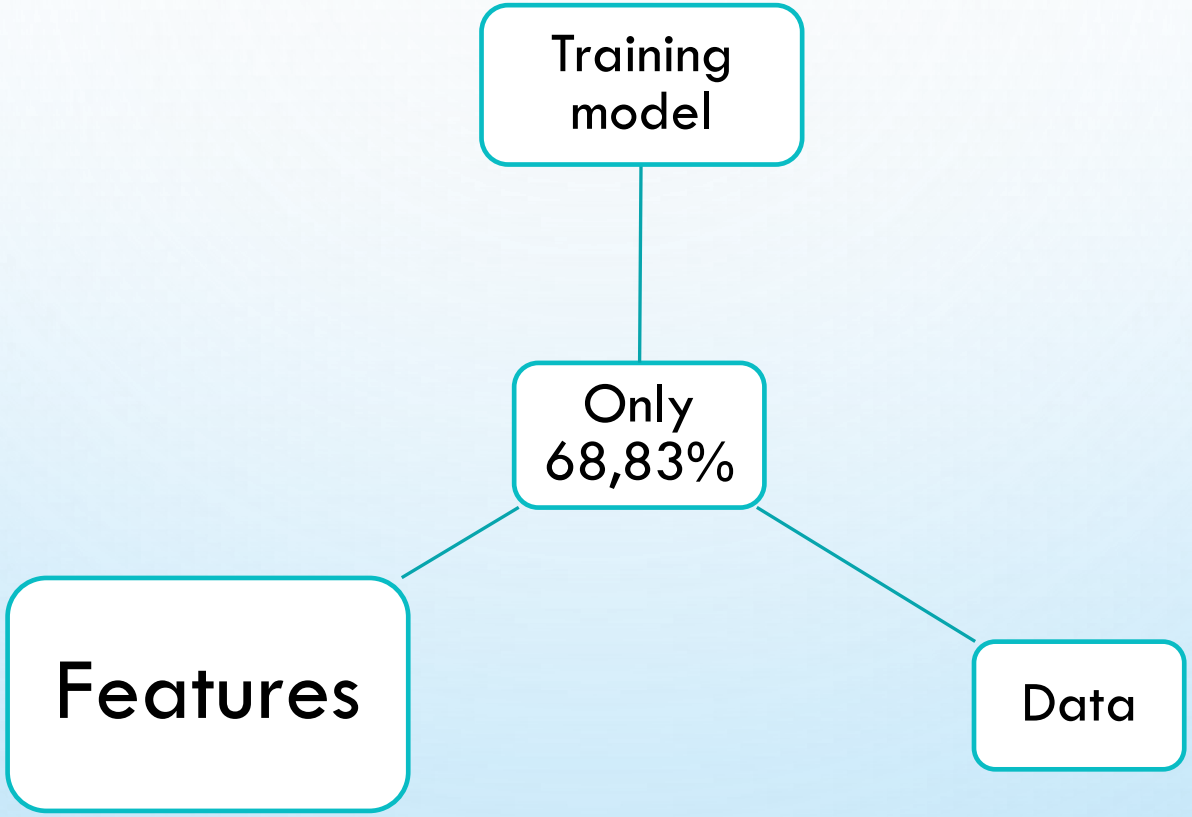
DISCUSSION



DISCUSSION



DISCUSSION



FEATURE ANALYSIS

- Compare features

FEATURE ANALYSIS

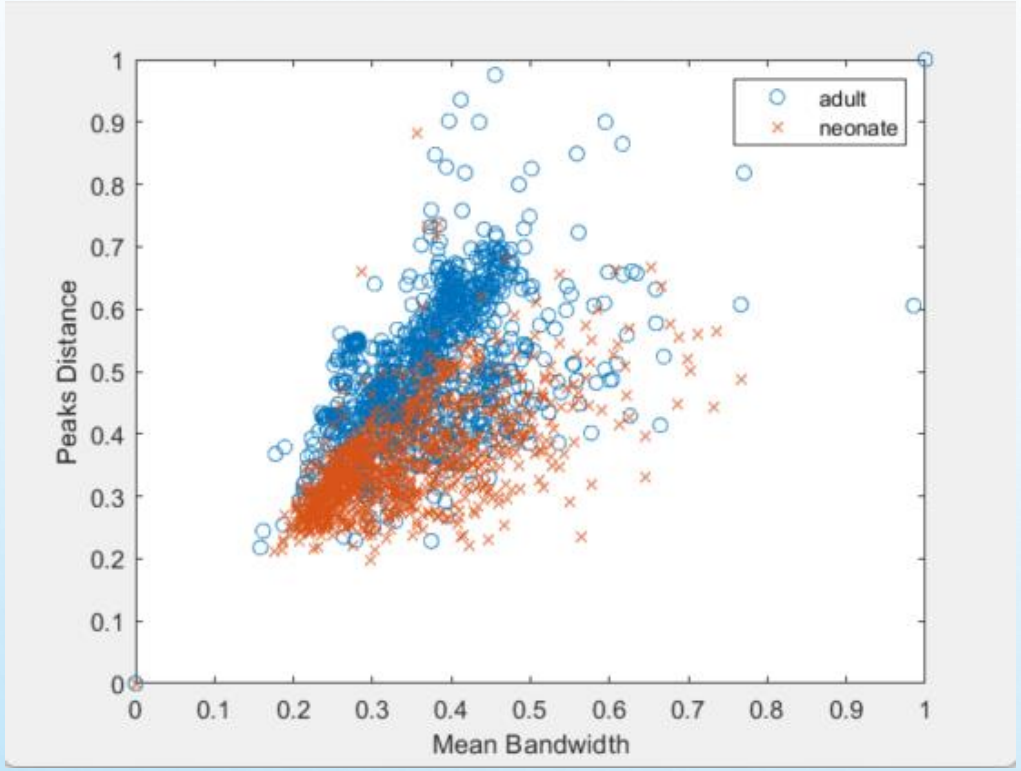
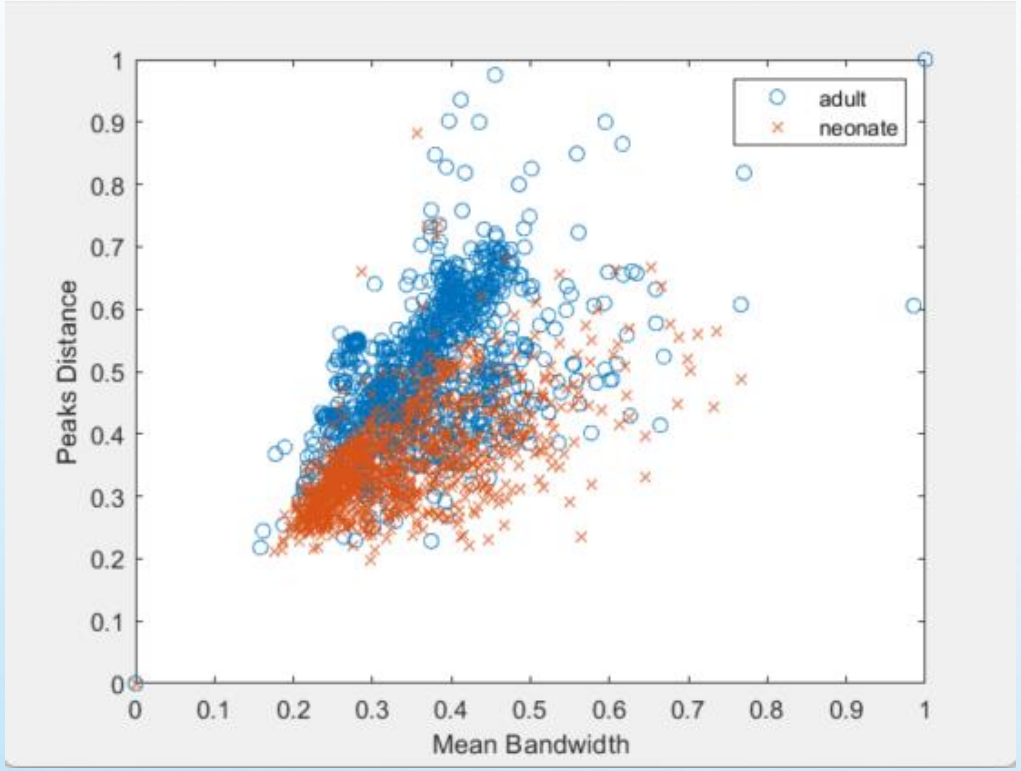


Fig.6 – Mean Bandwidth vs Peaks Distance

FEATURE ANALYSIS



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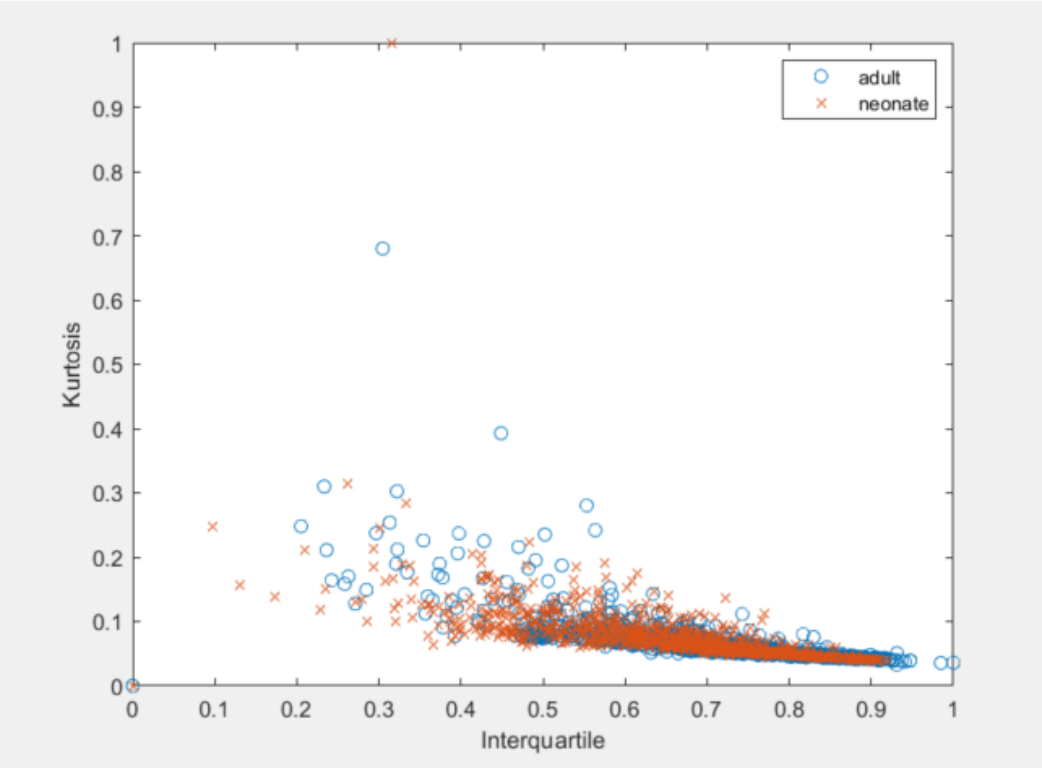

Fig.7 – Interquartile vs Kurtosis

FEATURE ANALYSIS

- Compare features
- Principal Component Analysis

FEATURE ANALYSIS

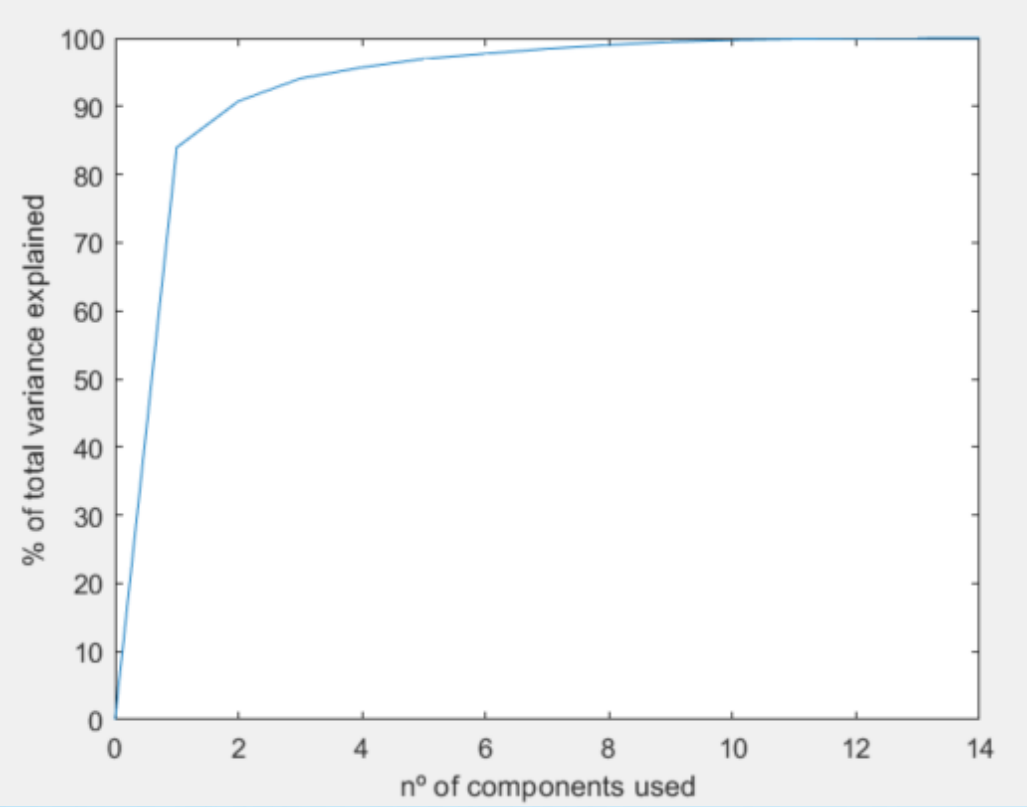

Fig.8 – Principal Component Analysis

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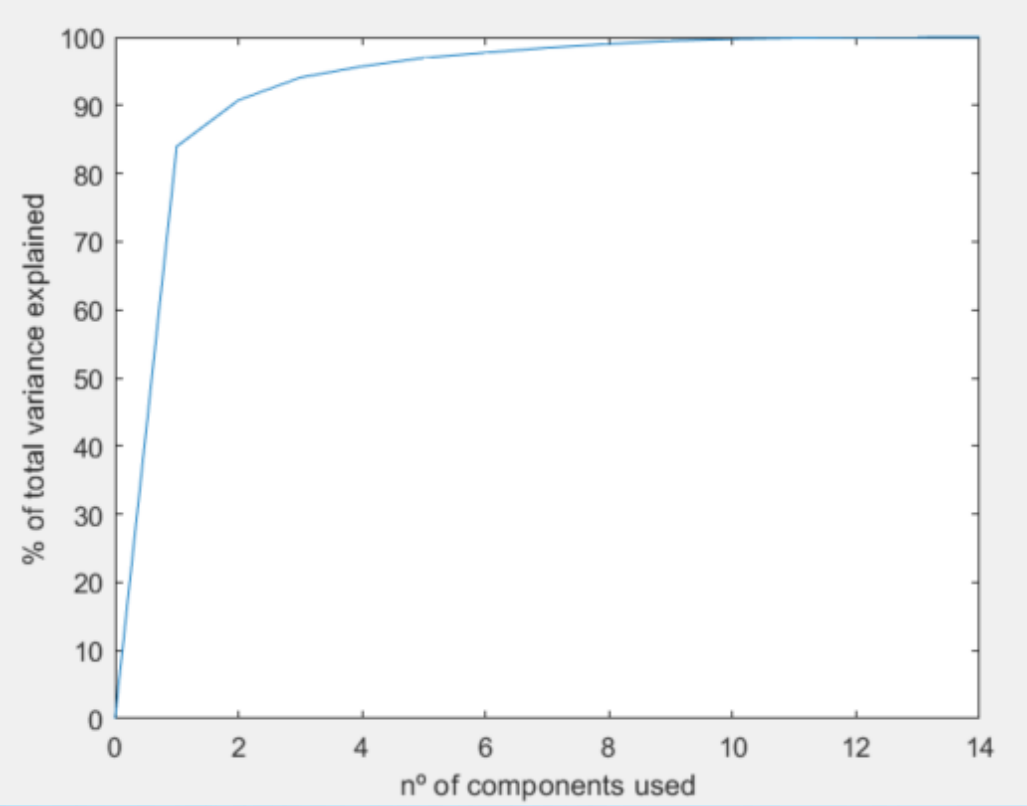

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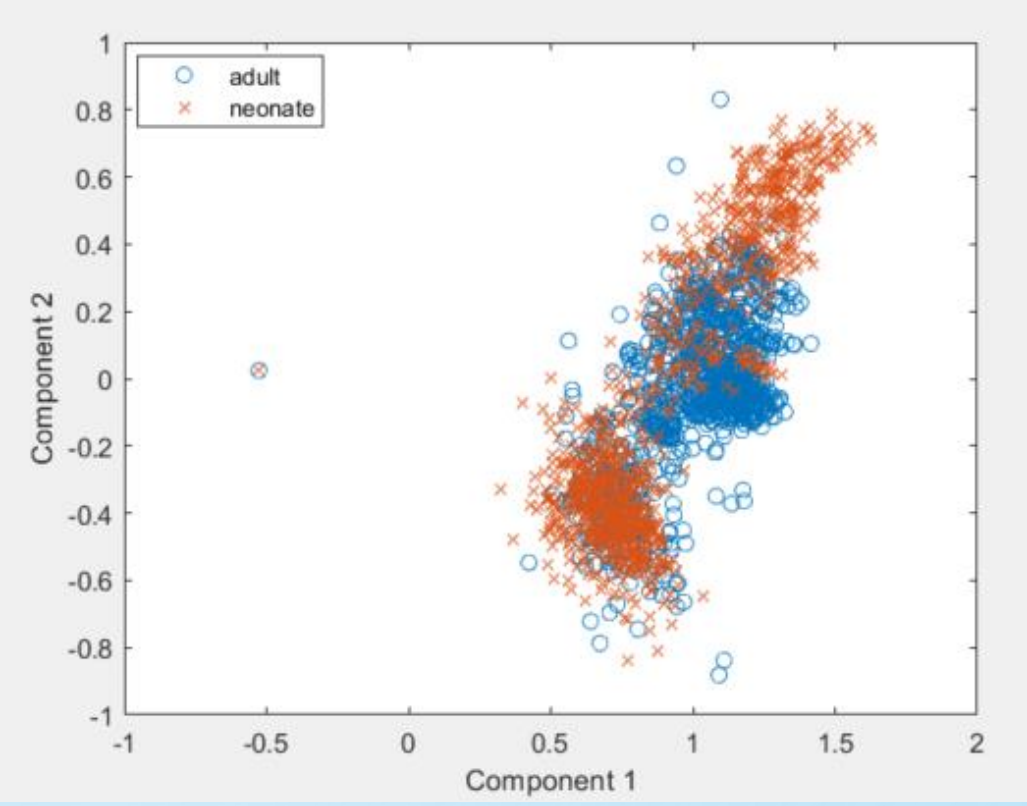

Fig.9 – Component 1 vs Component 2

CONCLUSION

- What is the next step?
- More pacients
- Better features