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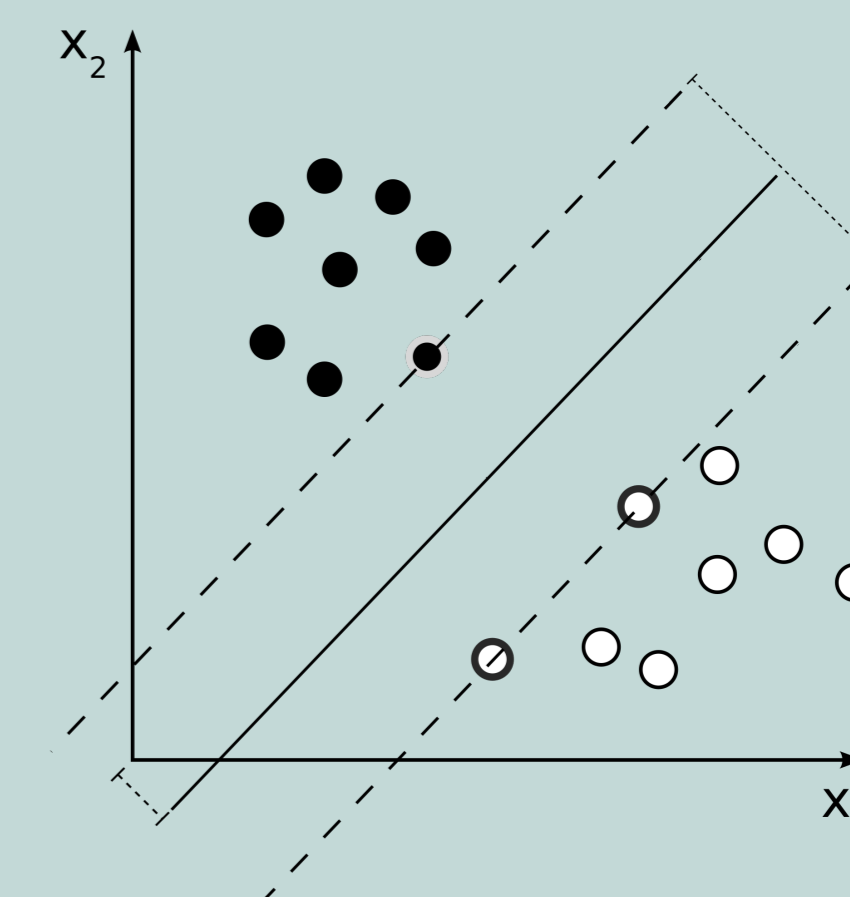
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Abstract

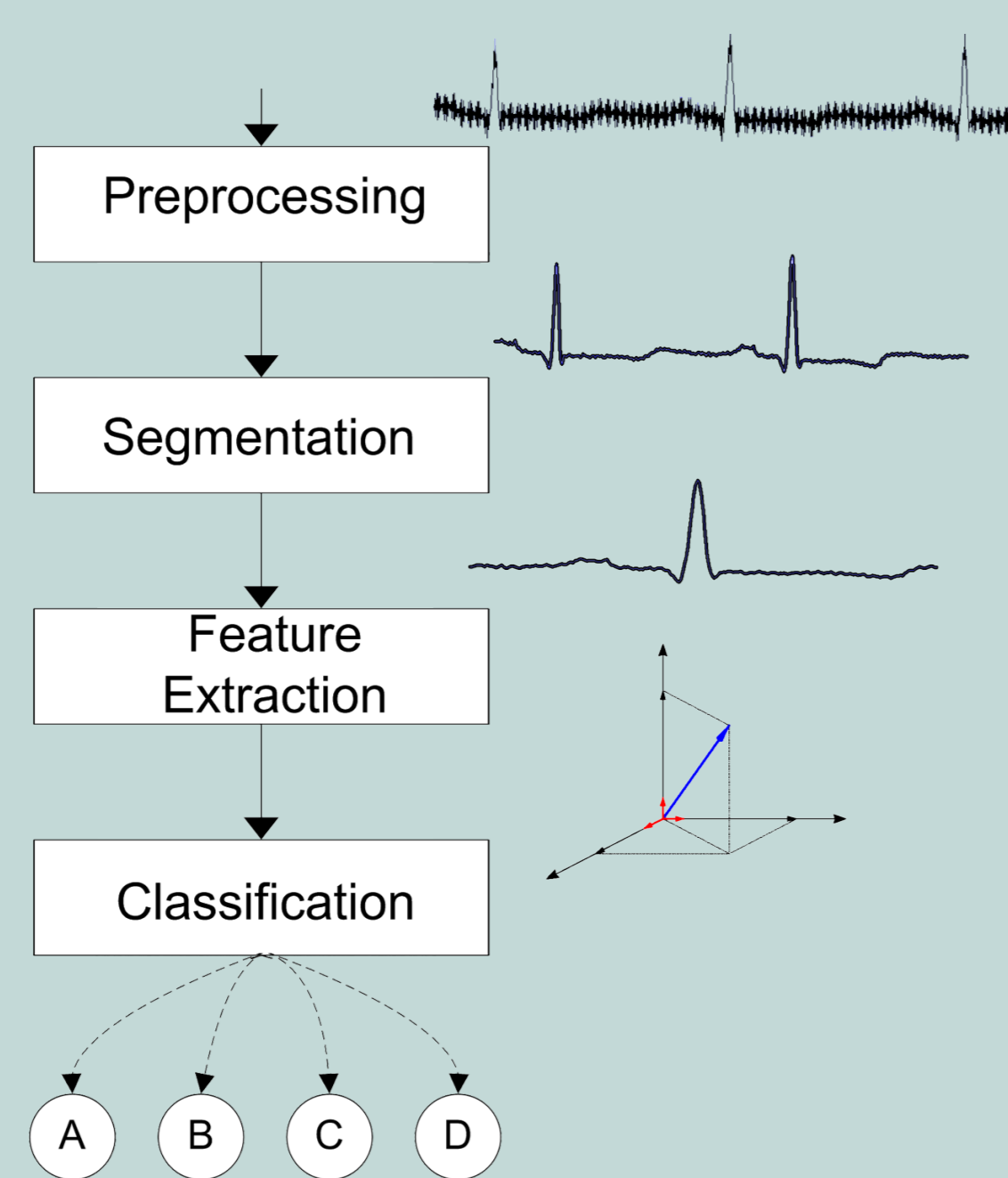
- ▶ The electrocardiogram (ECG) is the most widely used non-invasive technique in heart disease diagnoses
- ▶ The ECG is frequently used to detect cardiac rhythm abnormalities, otherwise known as arrhythmias
- ▶ The aiming of this work is:

Classification

- ▶ An accurate arrhythmia classification is desirable to correctly diagnose cardiac issues and in some cases, the early detection can save lives
- ▶ SVM has been widely used to classify arrhythmias



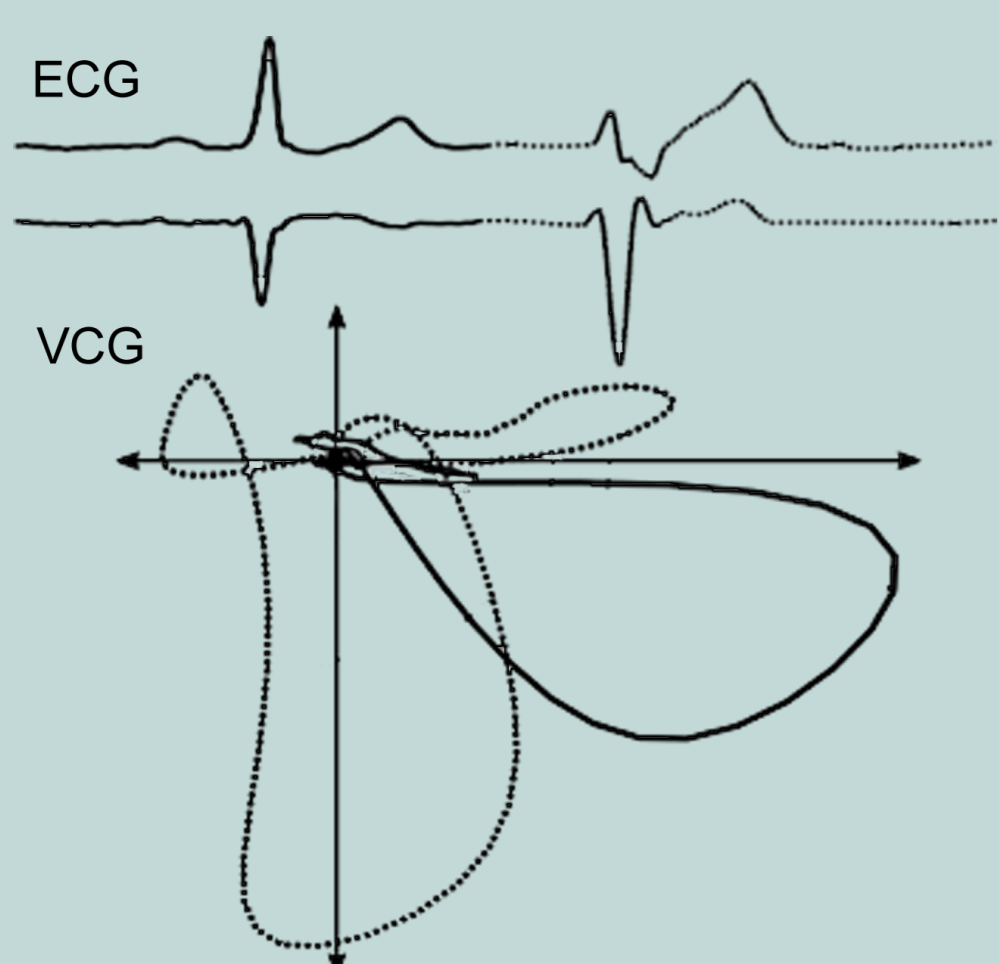
Arrhythmia classification system



(MIT-BIH) Arrhythmia Database

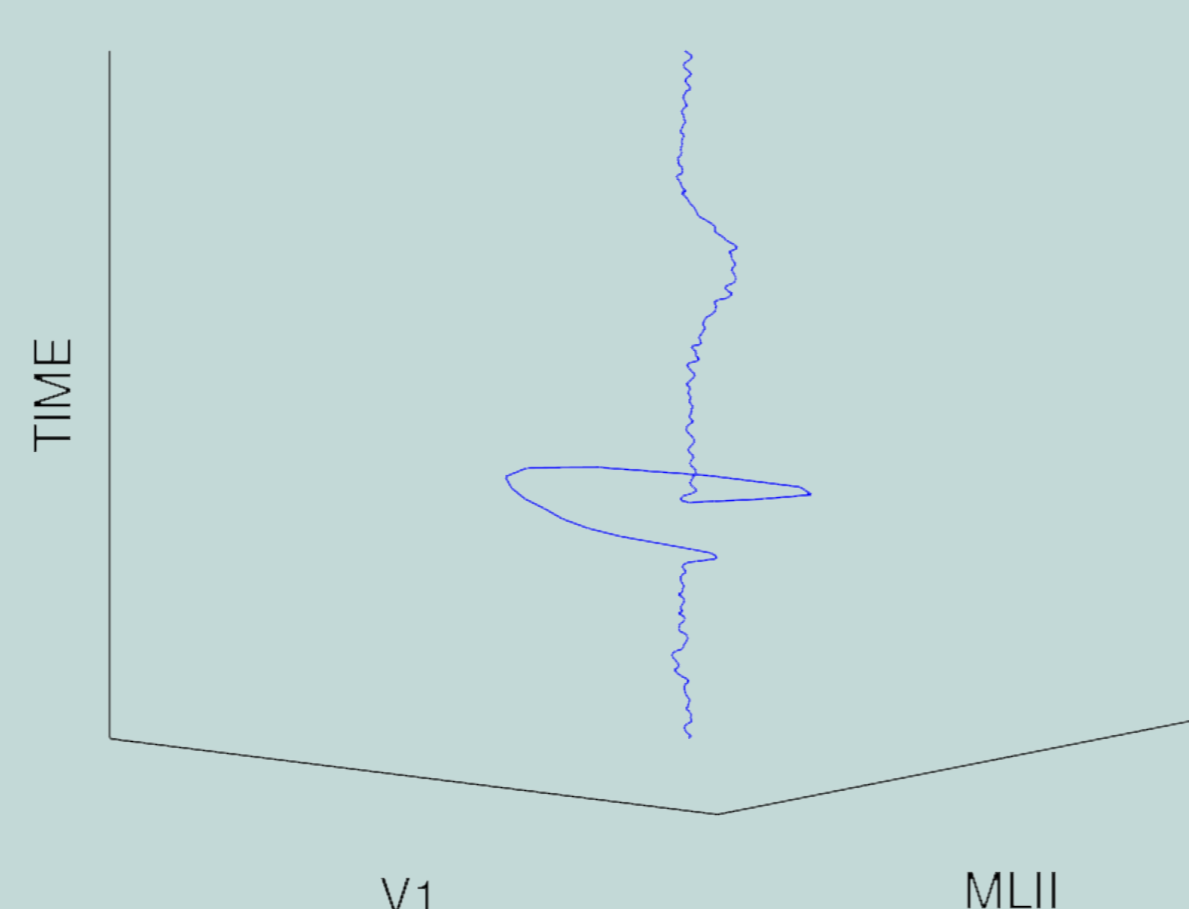
- ▶ It is essential a representative database for a good training and fair evaluation
- ▶ The Massachusetts Institute of Technology - Beth Israel Hospital Arrhythmia Database is one of the recommended databases by the Association for the Advancement of Medical Instrumentation

The Temporal Vectorcardiogram



- ▶ We propose a new representation method based in the VCG
- ▶ Where we take two leads and we add the time as a new axis, defining the temporal VCG
- ▶ It has a more rich representation than the normal VCG from ECG signal.

- ▶ This is the system responsible for the pumping action of heartbeats is formed by a group of specialized cells that send electrical signals
- ▶ Electrocardiogram (ECG) is the most common process to record these electrical signals



Results

- ▶ Test results (DS2) of the best Complex Network parameters configuration, chosen by the most relevant (DS1) training for Temporal VCG.

Filter	m	T_0	T_Q	Acc	N Se/+P/FPR	S Se/+P/FPR	V Se/+P/FPR
de Chazal's	2.0	0.055	0.6	90.2	94.0/ 96.3/ 29.6	28.2/ 22.2/ 3.8	84.8/ 64.7/ 3.1
Common	8.0	0.005	0.9	91.0	96.1/ 95.2/ 39.8	13.8/ 17.1/ 2.5	75.6/ 68.8/ 2.3
No Filter	2.0	0.055	0.6	91.2	95.0/ 96.5/ 27.9	29.6/ 26.4/ 3.1	85.1/ 66.3/ 3.0

- ▶ Test results (DS2) of the best Complex Network parameters configuration, chosen by the most relevant (DS1) training for VCG-2D.

Filter	m	T_0	T_Q	Acc	N Se/+P/FPR	S Se/+P/FPR	V Se/+P/FPR
de Chazal's	2.0	0.055	0.6	87.3	90.9/ 95.8/ 32.6	30.1/ 20.0/ 4.6	82.0/ 53.2/ 5.0
Common	4.0	0.005	0.9	90.8	95.1/ 95.7/ 35.0	29.3/ 23.0/ 3.8	76.6/ 73.6/ 1.9
No Filter	2.0	0.055	0.6	89.2	93.1/ 96.1/ 30.3	25.4/ 17.8/ 4.5	82.2/ 62.7/ 3.4

- ▶ The temporal VCG have increased the global accuracy, and have better results classifying the N and S classes, when it is compared with the best result of the VCG-2D.

Conclusions

- ▶ In this work we proposed a new 3D visualization of the vectorcardiogram, so called temporal vectorcardiogram, and complex network as feature extractor method with SVM based arrhythmia classification in ECG signals.
- ▶ The method achieves greater accuracy classifying Ventricular Ectopic Beats, Supraventricular Ectopic Beats and Normal Beats.
- ▶ New techniques to extract 3D features from the Temporal VCG could be an interesting research direction.