Electrocardiogram Waveform Feature Extraction Using the Matched Filter

Felipe E. Olvera, Jr.
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ECE 510: Statistical Signal Processing II

Outline
- ECG Historical Background
- Project Goals
- Types of ECG Signals Used
- Feature Extraction
- Results
- Questions

ECG History
- Dr. Augustus Waller: First Human Cardiogram - 1887
- Dr. Willem Einthoven: Identifies ECG Features - 1895
- String Galvanometer - 1901
- Nobel Prize - 1924

Project Goals
- Implement the Matched Filter
- Extract features from an ECG Signal
- Test the Matched Filter on different ECGs

ECG Signal Types Used
- The Normal ECG: 26-year old female

ECG Signal Types Used continued
- The Arrhythmia ECG: 24-year old female
ECG Signal Types Used continued

- The Cardiac Arrest ECG: 43-year old male
- The Long Term ST ECG: 39-year old female

Feature Extraction

- R-Wave Peak
- QRS Complex
- ST Segment

Results

- Matched Filter Out: R-Wave Peak Detection
- Matched Filter Out: QRS Complex Detection
- Matched Filter Out: ST Segment Detection
Results continued

• Normal ECG: R-Wave Peak vs. QRS Complex

• Arrhythmia ECG: R-Wave Peak vs. QRS Complex

• Cardiac Arrest ECG: R-Wave Peak vs. QRS Complex

• Long Term ST ECG: R-Wave Peak vs. QRS Complex

• ST Segment Detection

• Detection Metrics

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<th>Arrhythmia</th>
<th>Cardiac Arrest</th>
<th>Long Term ST</th>
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Results continued

• Heart Rate Variability

![Heart Rate Variability Graph]

• Power Spectral Density of the HRVs

![Power Spectral Density Graph]

Conclusion

• Expected Performance
• Unexpected Performance
• What was learned
• Questions

Picture Source: http://chem.ch.huji.ac.il/~eugeniik/history/