ECG Classification Using kNN and LDA for Continuous Heart Monitoring

Adrian Ocneanu, Colin Jones, Andy Adler
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Can we predict a heart problem BEFORE it happens?

What warning SIGNS are there?

How does this translate to sports PERFORMANCE TRACKING?
Global Causes of All Deaths

- Cardiovascular Diseases: 31%
- Communicable, maternal, perinatal: 27%
- Injuries: 9%
- Cancer: 13%
- Respiratory Diseases: 8%
- Other NCDs: 10%
- Diabetes: 2%

Legend: Non-Communicable Diseases (NCDs)
Other Causes of Death

Source: DATA: World Health Organization
IMAGE: www.HeartNewsLinks.com
Global Causes of All Deaths

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Legend: NCD - Non-Communicable Diseases
Other Causes of Death

Source: DATA: World Health Organization
IMAGE: www.HeartNewsLinks.com

Prevention is key!

What happens when the heart cannot pump adequately? There is already a problem, and failure is imminent.

Many of these deaths could have been prevented if, beforehand, the victims knew their risk factors and the warning signs of an impending cardiac event.
Prevention is key!

What happens when the heart conditions are already there and failure is "imminent"?
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Again, prevention is key!

Is CONTINUOUS and MOBILE monitoring of
Again, prevention is key!

Is CONTINUOUS and MOBILE monitoring of the heart possible?

Can we predict a heart problem BEFORE it
Again, prevention is key!

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ECG database

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what does all of this look like?
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*what does all of this look like?*
what does all of this look like?
Linear Discriminant Analysis

ECG database
near Discriminant Analysis
PCA

LDA: discovers a discriminating projection
PCA

LDA: discovers a discriminating projection

Eigen heart beats - PCA

Eigen heart beats - LDA
Eigen heart beats - PCA
Eigen heart beats - LDA
Linear Discriminant Analysis

kNN Classifier
kNN Classifier
kNN Classifier

Results
Results
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<th>Dysrhythmia</th>
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Is CONTINUOUS and MOBILE monitoring of the heart possible?

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How does this translate to sports PERFORMANCE TRACKING?
Activate iPhone
connect to iTunes

slide for emergency
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- Qualcomm Tricorder X Prize - $10 million
- Nokia Sensing X Challenge - $2.25 million
• Qualcomm Tricorder X Prize - $10 million

• Nokia Sensing X Challenge - $2.25 million

Vital Signs Set (5)
• Blood pressure
• Electrocardiography (heart rate/variability)
• Body temperature
• Respiratory rate
• Oxygen Saturation

Core Set (13)
• Anemia
• Urinary tract infection, lower
• Diabetes, type 2
• Atrial fibrillation
• Stroke
• Sleep apnea, obstructive
• Tuberculosis
• Chronic obstructive pulmonary disease (COPD)
• Pneumonia
• Otitis ("ear infection")
• Leukocytosis
• Hepatitis A
• Absence of conditions

Elective Set (12)
• Pertussis (Whooping Cough)
• Hypertension
• Mononucleosis
• Allergens (airborne)
• Hypothyroidism/hyperthyroidism
• Food borne illness
• Shingles
• Melanoma
• Strep throat
• Cholesterol Screen
• HIV Screen
• Osteoporosis
Our Work's Status
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