Intelligent Analysis of ECG Signals for the Identification of Alcoholics

BY

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1. Introduction

Technology has advanced in various fields at rapid rates, however in an area that concerns the common well being of humans, technology has remained dormant. Identifying accurately if a person is intoxicated is utmost important to keep public harm and nuisance at bay. The most common device used, the breathalyser has drawbacks that we aim to rectify. The common drawbacks of a breathalyser are:

i) Contamination of SiO2 sensor requires frequent recalibration and replacement
ii) Breathalysers being a medium for propagation of contagious diseases
iii) Interfering components (like acetone) being higher in the breath of dieters and diabetics make them more prone to being detected falsely
iv) Infrared sensors are prone to error in environments where lighting is harsh or uneven and atmosphere is polluted and region is windy

These disadvantages mentioned above are addressed with the use of infallible computers and well trained machine learning algorithms.

HRV (Heart rate variability) obtained from ECGs is a useful biomarker and is used extensively in our paradigm to extract features. The features extracted are then used to train the system to classify patients as chronic alcoholic or otherwise. This may be useful in discriminating individuals based on their habits while preventing other external environmental conditions from altering or corrupts the readings.

2. Problem Statement

To develop a prototype to read ECG signals, perform HRV analysis to extract features, and use these to classify the person under test as an alcoholic (person under the influence of alcohol) or otherwise.

3. Objectives

(a) To study the recently developed ECG sensor and improve it.
(b) Identify an effective method to extract and analyze Heart rate variability(HRV) features from the raw ECG sensor data.
(c) Use the aforementioned extracted features to obtain sufficiently accurate classification results for Alcoholic and Normative data.
(d) Implement algorithms on a Raspberry-Pi to perform real time feature extraction and classification.

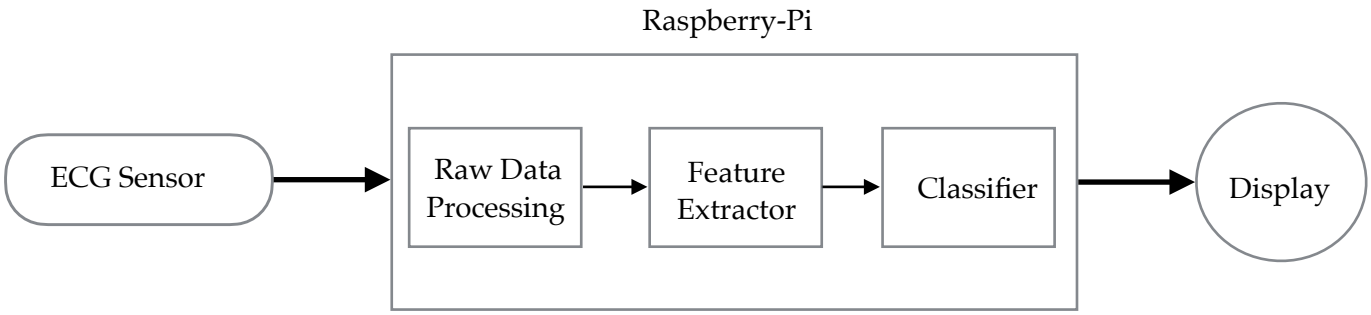
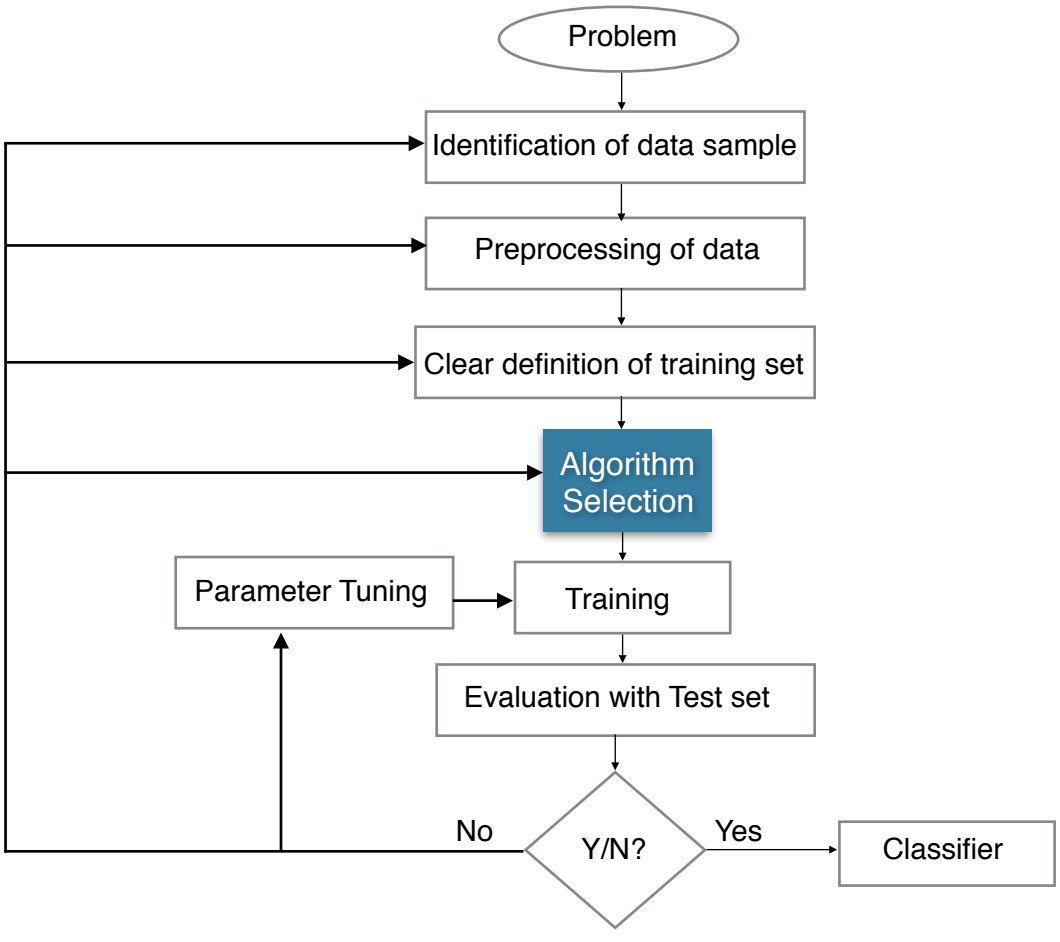


Figure-1: System Block Diagram

4. Methodology

(a) Study of the advantages of HRV (Heart Rate Variability) analysis over other markers for cardiovascular health.
(b) Survey of various tools and techniques available for HRV analysis.
(c) Familiarization with form and structure of the ECG signals.
(d) Survey of the available devices for measuring and recording ECG signals.
(e) Study and improvement of the device previously developed for the recording of ECG signals.
(f) Selection of a controller board on which HRV analysis will be performed.
(g) Study and selection of feature extraction techniques
(h) Implementation of a feature extraction technique
(i) Selection of a classification algorithm to classify the extracted features as chronic alcoholic or otherwise.
(j) Implementation of the selected classifier on the processing board.

Figure-2: Applying Machine Learning to a Real World Scenario



5. **Software and Hardware Requirements**

(i) Software:

(a) MATLAB
(b) Python Libraries
(c) MultiSim

(ii) Hardware:

(a) Raspberry Pi - processing board to implement the classifier
(b) ECG Sensor

6. **Expected outcome:**

By the end of the project we should have an end to end working model of the system proposed. Real time ECG graphs will be obtained, features from the graph will be extracted, and classification of test subject as alcoholic or normative will be performed.

7. **References**

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