



Using Smartwatch Sensor Data to Predict Drunkenness



Mario Gutierrez, Michelle Fast, Anne Ngu, Byron Gao | National Science Foundation's Research Experience for Undergraduates | Texas State University

Introduction

Project

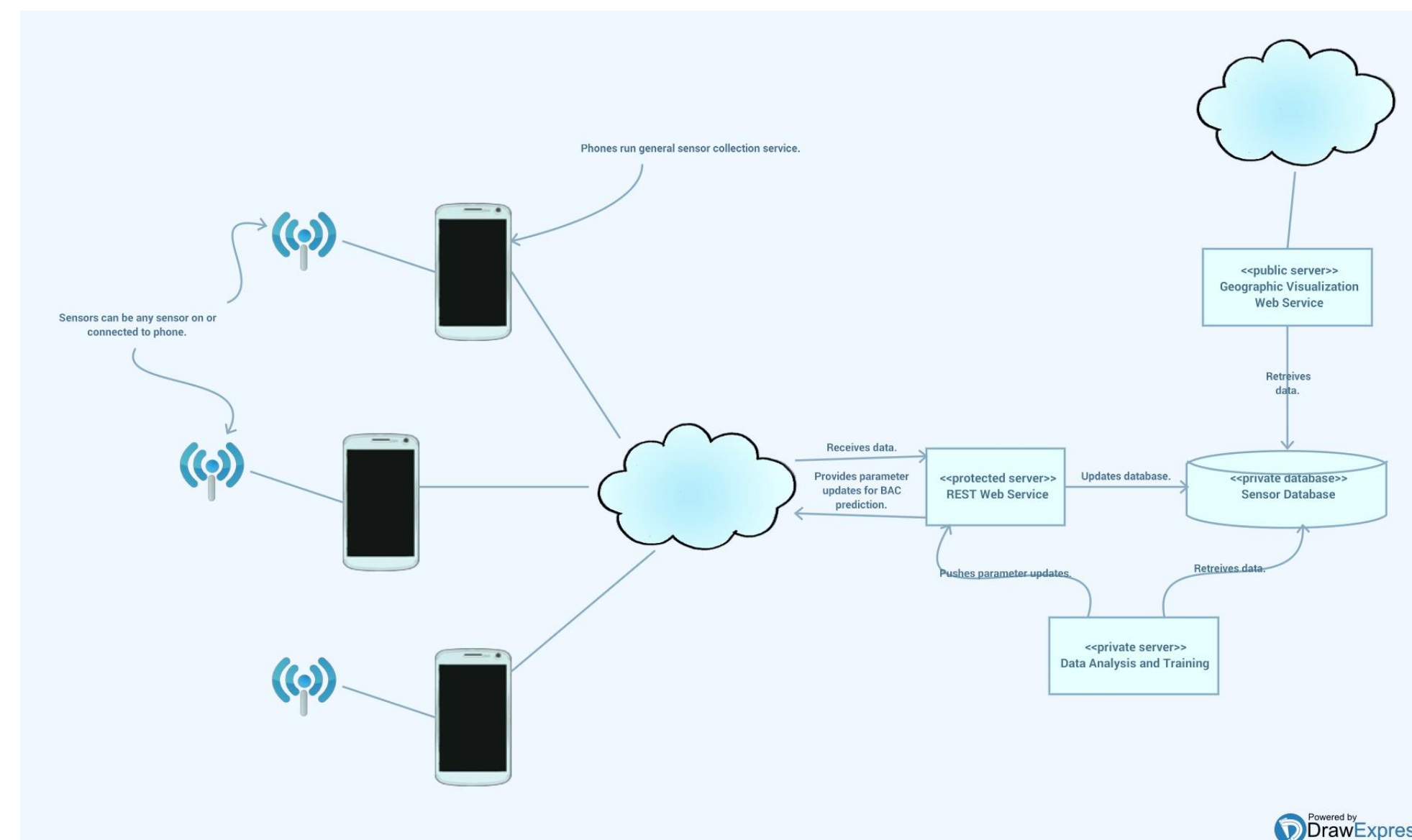
Is it possible to determine if a person is drunk using data from smartwatch sensors? In this project we attempt to figure this out.

Motivations

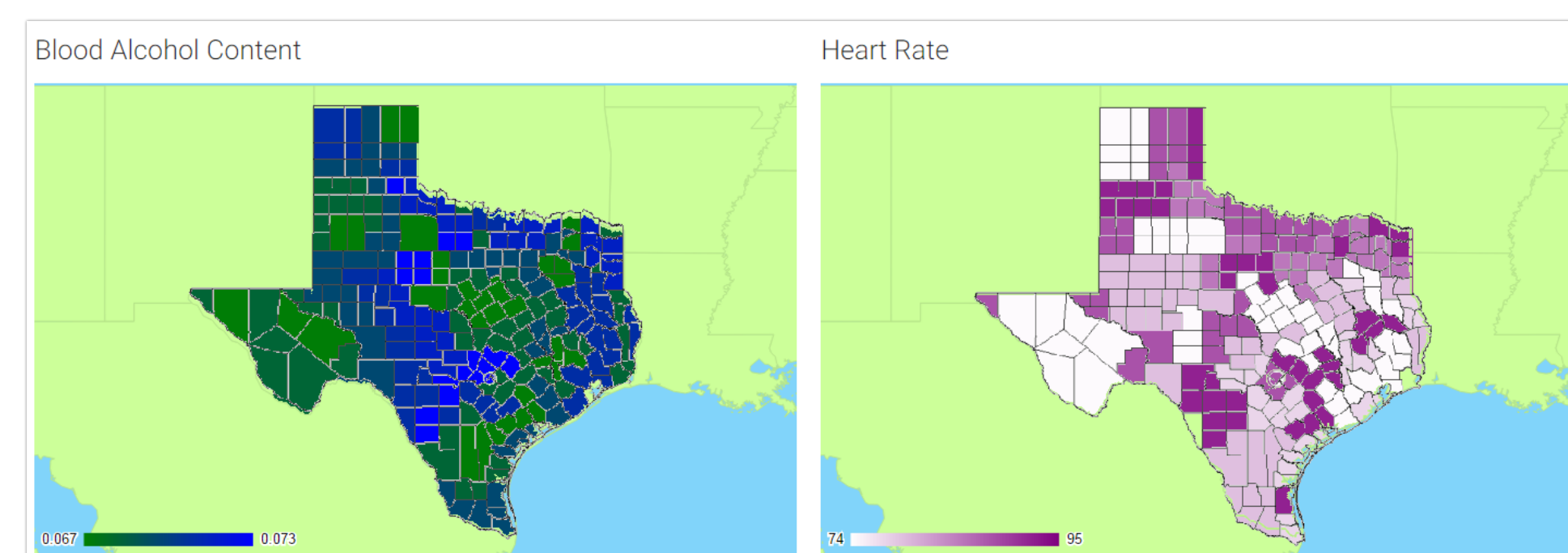
Could prevent drunk driving and other dangers related to the consumption of alcohol by giving users a way to measure personal blood alcohol content (BAC) without the use of breathalyzers or other typically undesired methods.

Goals

- The development of an Android-based sensor gateway and Android data collection platform.



- Experimentation with machine learning models to attempt to classify drunk behavior.
- Collection of a BAC-labeled set of sensor data from several volunteers.
- The development of a system for geographically visualizing aggregated, live sensor data.



Online visualization system (image simulated).

Methodology

Data collection

The project required volunteers for study and data collection. Each session was planned to take 2 hours. Volunteers provided their height, weight, and age in order to estimate the number of standard drinks required to reach a BAC of .08 at the 1.5 hour mark using the popular formula:

$$EBAC = \frac{0.806 \cdot SD \cdot 1.2}{BW \cdot Wt} - (MR \cdot DP)$$

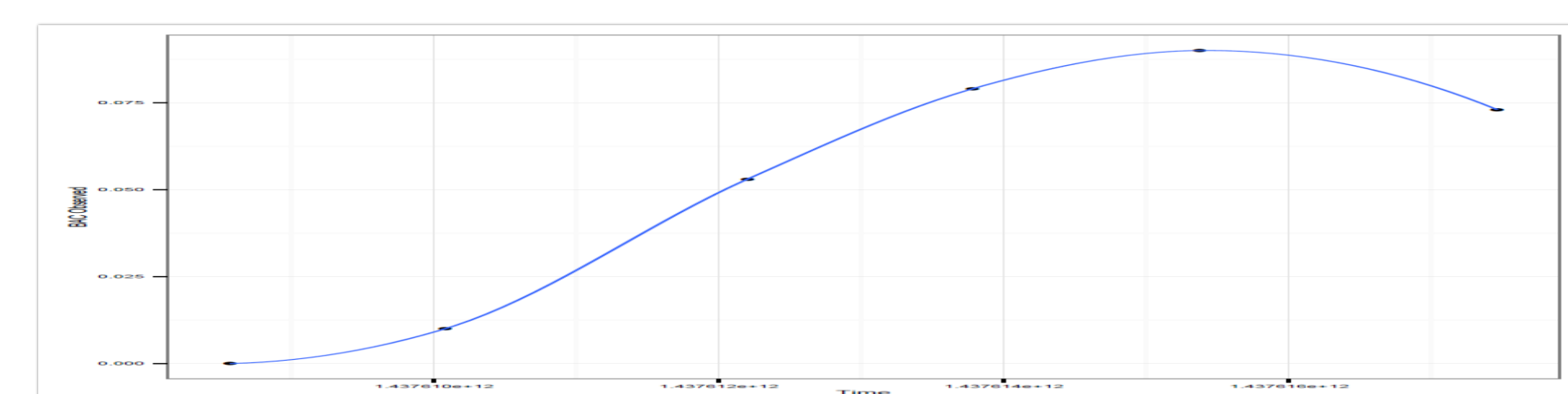
The volunteers wore a Microsoft Band on their 'drinking hand' for the session.

Every 25 minutes, the volunteers' BAC was measured with a breathalyzer and logged on Android system.



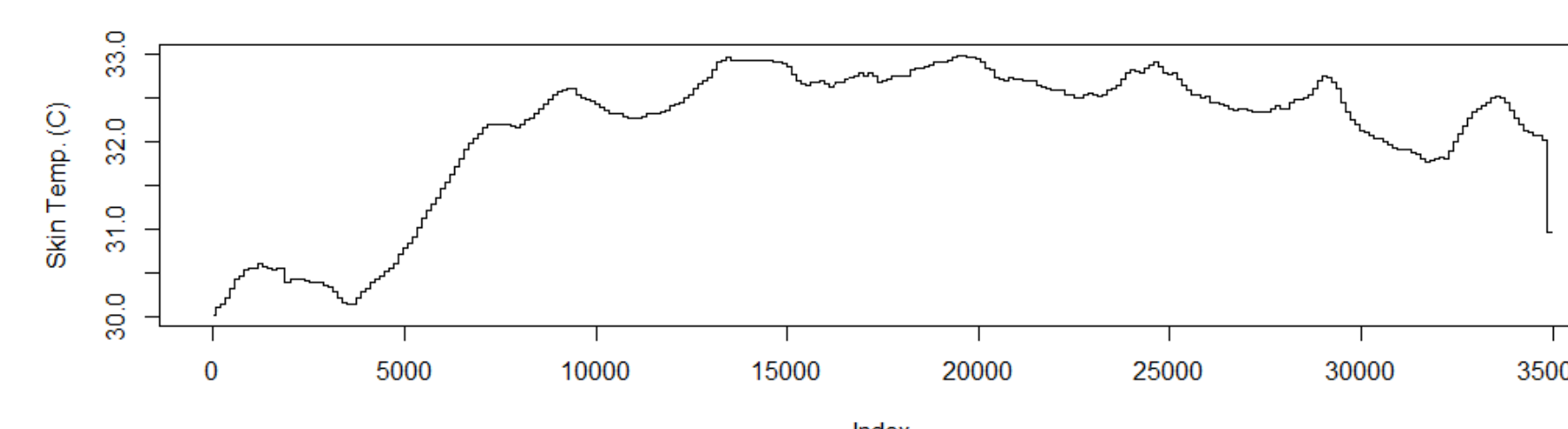
Preparation

To prepare the data for training, the BAC values were interpolated using locally weighted scatterplot smoothing and the features were standardized.



Analysis

No immediately evident correlations were seen except for in the skin temperature data.



Results

Training

To classify drunkenness a logistic regression model was first evaluated. Using only skin temperature data and classifying drunkenness at 0.6 BAC, the following result was achieved:

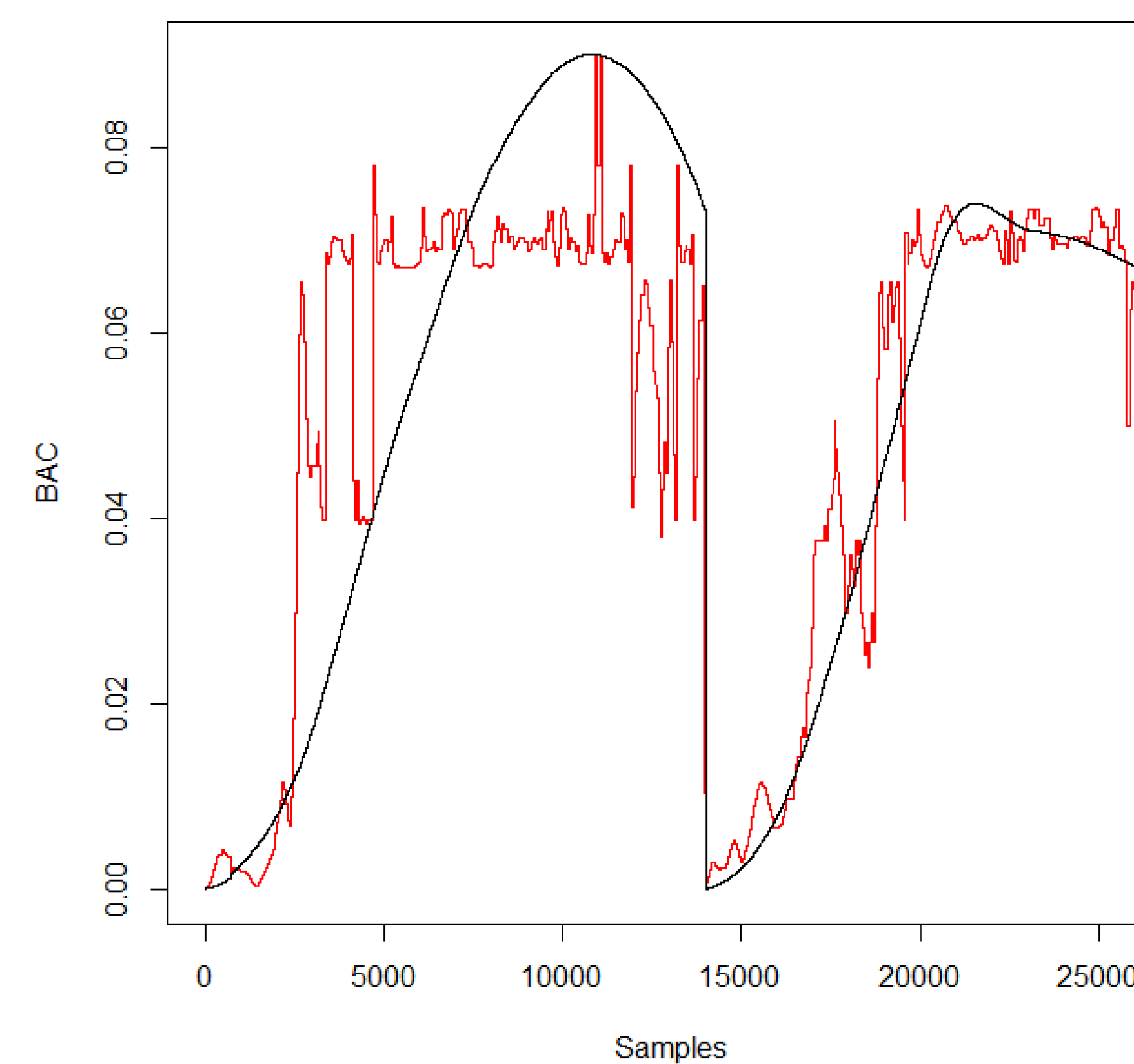
TP	FP	TN	FN	PR	RC	FS
856.3	0	4762.5	5238.2	1	0.14	0.25

Adding heart rate, the result was:

TP	FP	TN	FN	PR	RC	FS
1562.5	88.8	4490.2	4319.5	0.95	0.27	0.41

A neural network model was also trained, but was very slow even with only skin temperature.

In the future several more classification and regression models will be evaluated.



Neural network predicting (red) BAC values (black).

Conclusions

Skin temperature alone produced reasonably good results, though more refinement will be needed outside of a controlled procedure. It may be necessary to either predict a user's current activity or create some features that can predict drunkenness regardless of activity.

A large-scale collection of smartwatch sensor data and display on a web client is useful for many purposes. With an accurate prediction model we may also see the level of drunk driving in different regions or on different roads.

To answer our main question, it is possible to determine if a person is drunk from smartwatch sensor data. Now we can begin looking into finding the best feature sets and models.

Contributions

- Proposed idea of predict drunkenness using smartwatch sensor data.
- Found evidence that drunkenness may be able to be predicted very well with further study.
- Proposed idea of displaying aggregated, live smartwatch sensor data geographically.
- Created prototype of a general, Android-based, sensor gateway.

Acknowledgments

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Related Works

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