

# The Body Sensor Network

Michael Patterson, Joesph Liu, Georgi Angelov  
Paul Baskett, Yi Shang PhD.  
University of Missouri - Columbia



## Introduction

Excessive alcohol use has many negative health consequences, including higher risk of mortality. In addition, in 2006, the estimated economic cost of excessive drinking was \$223.5 billion when the combined costs of lost productivity, health and health care, and crime are considered. Most of these studies are cross-sectional, rely on retrospective reports and cannot address *within-person, drinking/mood relationships over time*.<sup>1</sup> In order to better understand the physiological effects of substance craving and abuse, we propose, train and test, a model for perceived craving through the use of physiological sensors and an android's internal sensors.

## Background

This project is a merging of two disciplines: Psychology and Computer Science. Smartphone technology has made the monitoring and gathering of behavioral data much more accessible due to the smartphone's widespread appeal and use for so many daily activities. In psychology, smartphones could also replace a wide range of conventional research methods: paper-and pencil surveys, mail surveys, phone surveys, and, if connected to the right peripherals, many lab studies, field studies, and Internet studies.<sup>2</sup> As the demand for smartphones rises so will the demand for people with the skills to make applications for them and those who can make use of the smartphone's multi-functionality

## Application Overview

The program we are developing for the Body Sensor network will have two main functions. In order to monitor alcohol craving we connect two sensors to research participants: the **Q-Sensor** and the **Equivital Sensor**. While the sensors collect data, the application will at random intervals ask the participant questions about their emotional state and levels of substance craving. According to certain physiological and survey data, the program can then be used to forward the user to another program



## Materials

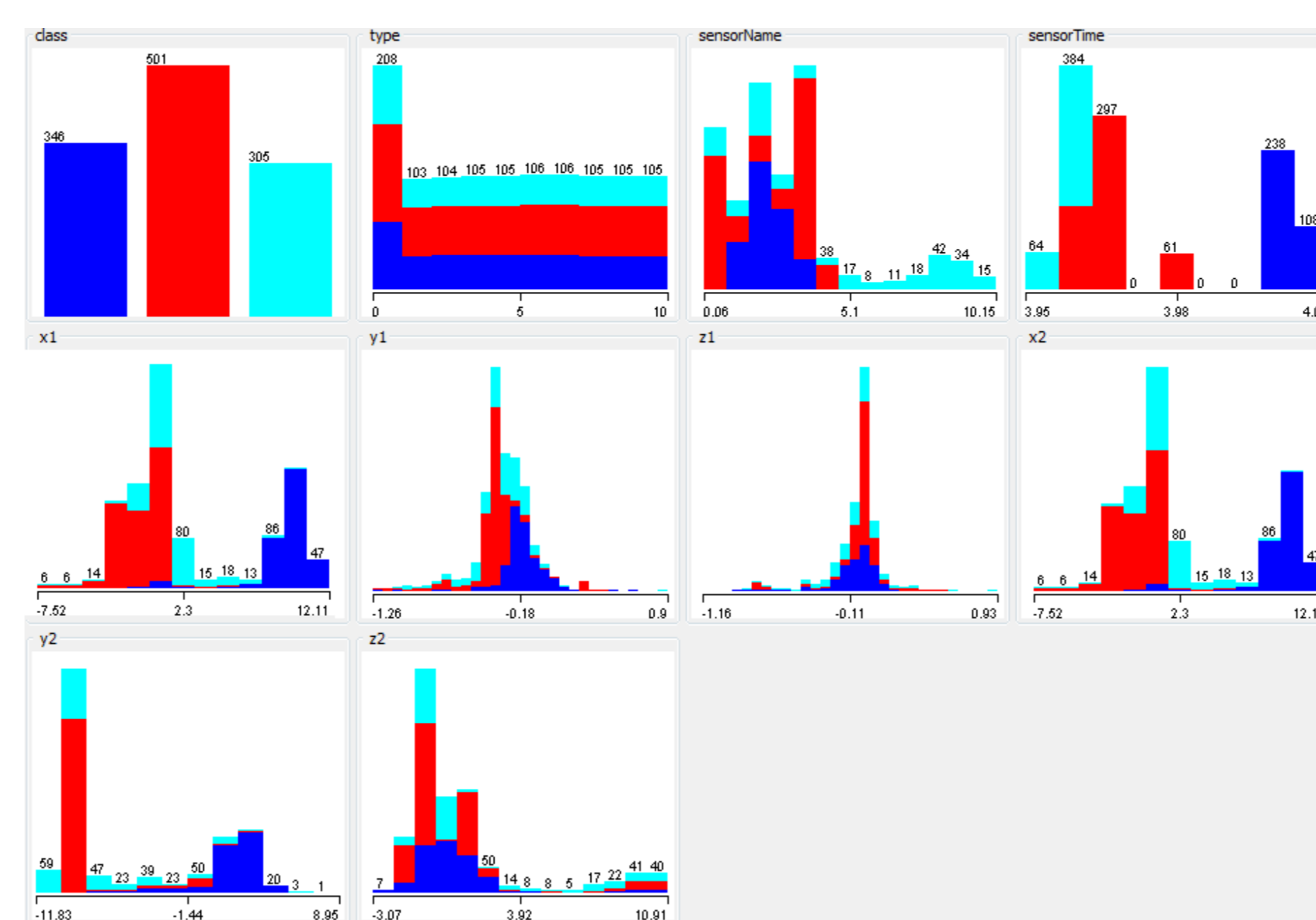
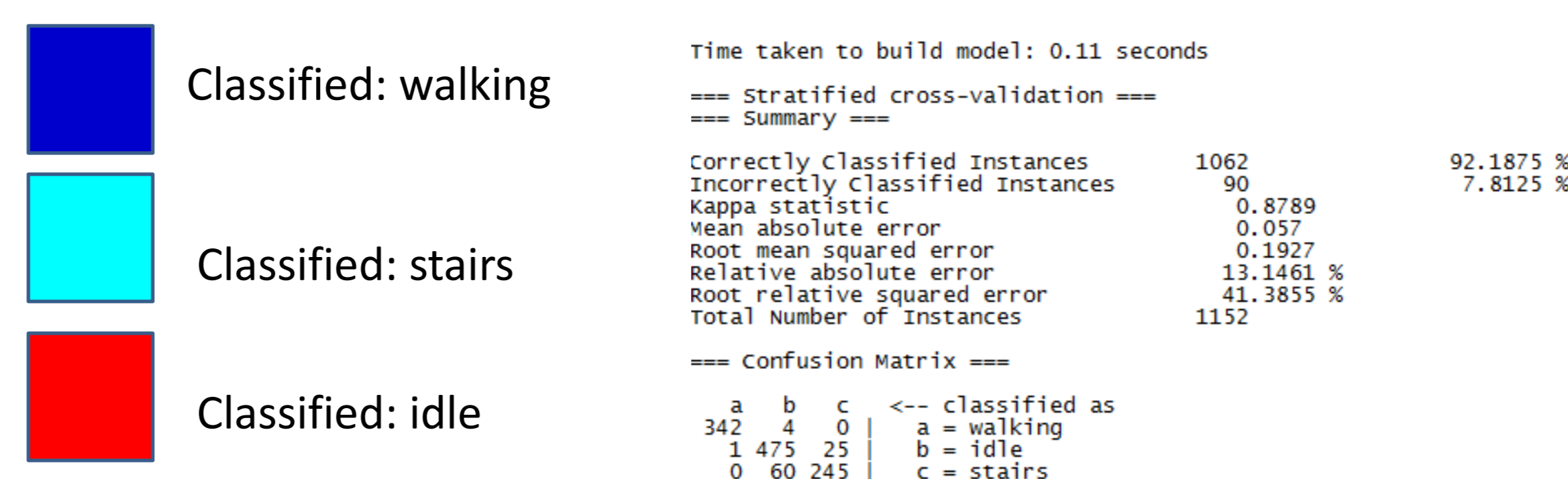
The Affectiva Q Sensor: a wireless biosensor that measures emotional arousal via skin conductance., The sensor also measures temperature and activity.<sup>3</sup>



We are developing our program using the Android platform. The platform was chosen for open source community and application freedom

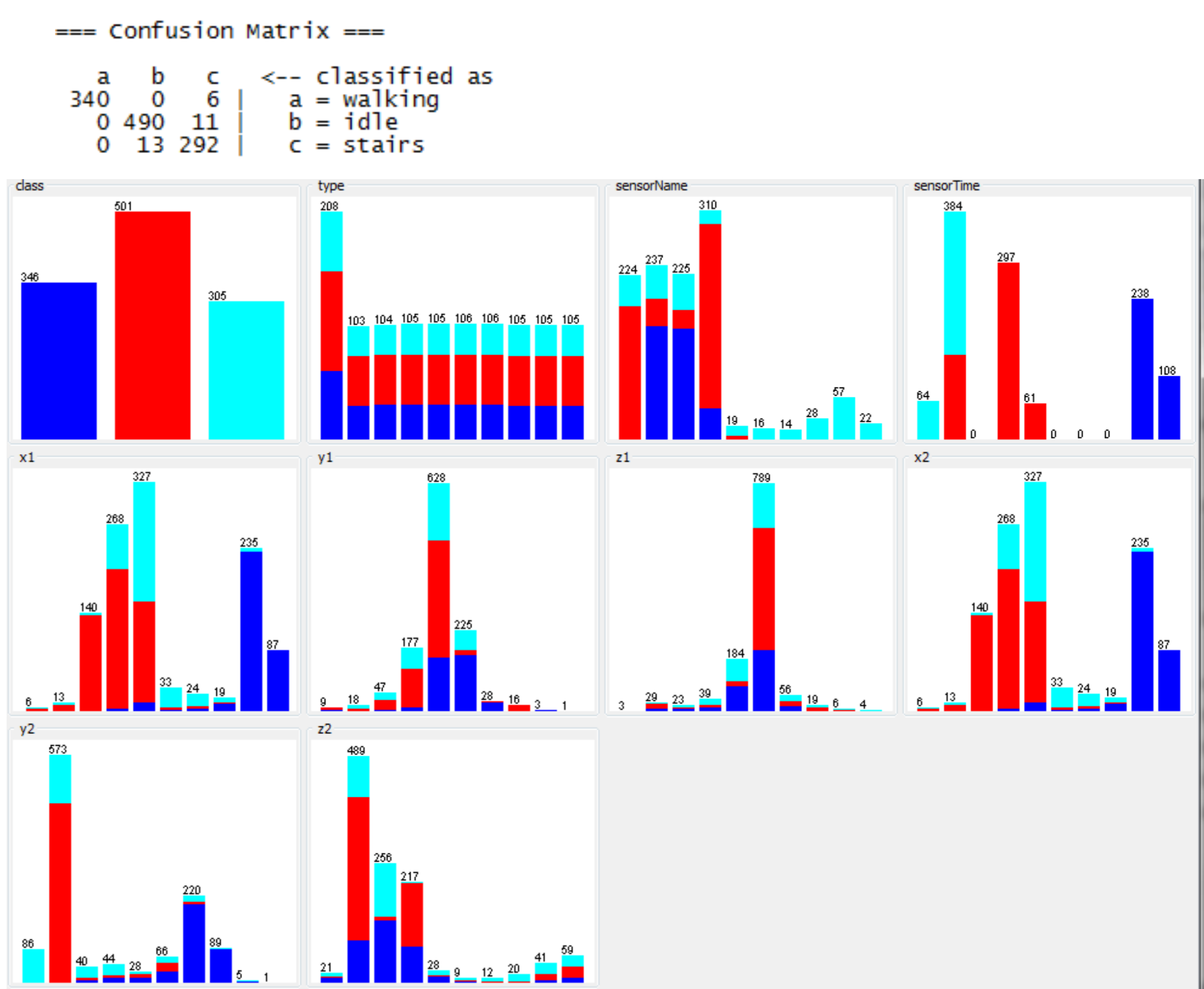
## Results

The following data is collected from the Affectiva Q-Sensor. Weka machine learning software was used to differentiate between three states of activity: idle, walking, and climbing stairs. The naïve-Bayes model was used to classify the data.



Time taken to build model: 0 seconds

```
==== Stratified cross-validation ====
==== Summary ====
Correctly Classified Instances      1122      97.3958 %
Incorrectly Classified Instances    30         2.6042 %
Kappa statistic                    0.96
Mean absolute error                 0.024
Root mean squared error             0.1185
Relative absolute error              3.5268 %
Root relative squared error         25.4542 %
Total Number of Instances          1152
```



Continuous Data (left is correctly classified approximately 92% of the time. Discretized data (above) has approx. 97%

## Conclusions

In the information age, smartphones have become a way of life. We have only begun to tap into the true potential of this smartphone technology. This project's experiment will see the use of participants answering survey questions about their daily activities while wearing the physiological sensors. This way we can identify the physiological and emotional states of emotional dysregulation as well as alcohol craving and use.<sup>1</sup>

## References

1. Trull, T. Grant Proposal *Remote wireless sensing network for the assessment of emotion dysregulation and craving for substance use*. 2012
2. Miller, G. *The Smartphone Psychology Manifesto Perspectives on Psychological Science* 2012.
3. Affectiva Inc. 2012 *Q-Sensors*.  
<http://www.affectiva.com/q-sensor/>.