

Autism Social Alert System

Michael DiBlasio Prof. M Chuah

Computer Science and Engineering Lehigh University Bethlehem, PA 18015

Abstract

Autism currently affects 1 in every 150 American children, impairing social interaction, communication and daily living. Often, parents, educators and researchers need to purchase expensive equipment to help autistic children cope with the difficulties of daily living. The Autism Social Alert (ASA) system uses the advancing and inexpensive technologies of smartphones to facilitate the study of the behaviors of autistic children by recording and analyzing data from embedded sensors within a smartphone. The system is intended for detection of an autistic child's abnormal behaviors so that early interventions can be taken by caregivers or teachers.

Background

The ASA System is divided into two components:

1. An Android based application records and collects continuous data from a user's device, and sends this information to an external server where the data is analyzed in real time using the C4.5 algorithm.
2. The server based software predicts physical behaviors from this information using large amounts of training data while simultaneously mining other environmental variables, such as audio patterns. When abnormal behavior is detected, information is sent back to the phone to alert the user.

Research Thrust

The main research thrust is twofold:

1. Determine which classifiers provide the most accurate behavior predictions.
2. Design an algorithm to correlate multiple sensor streams to identify environmental factors that potentially trigger stereotypical behaviors (future work).

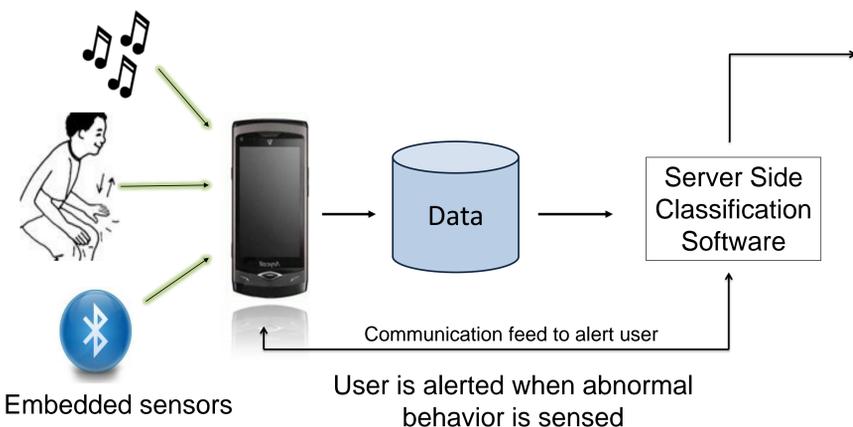
Results

After calculating various statistics from the data, including variance, deviation and mean, 16 decision trees were constructed using the WEKA J48 algorithm.

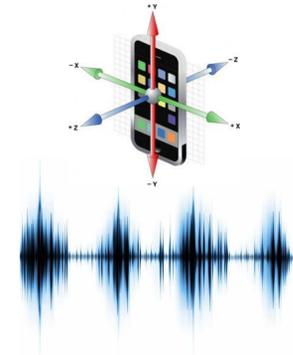
Sample Type	Instances Correctly Classified
Independent Window	91%
Sliding Window	89%

Clear distribution patterns were observed when audio samples were collected from various environments.

Project Overview



Android Smartphone Application



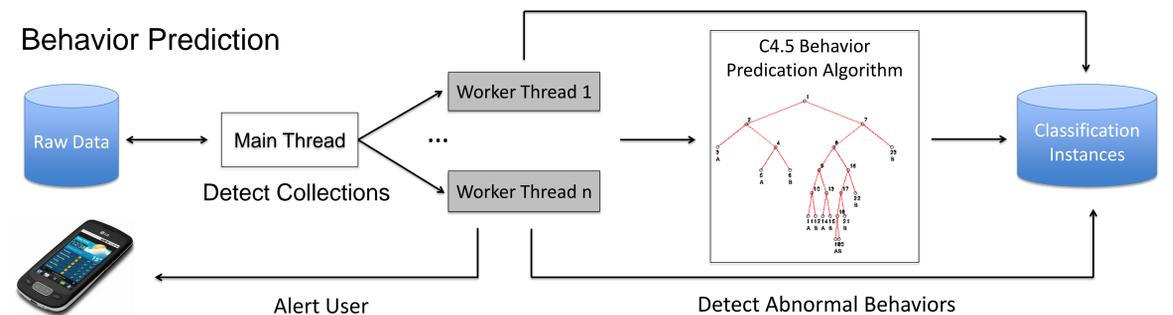
Accelerometer

Background thread records information from the built in accelerometer in the phone at a rate of 4 samples per second. This information is sent to an external data base in real time.

Audio Recorder

Background thread records audio information at a sample rate of 11025 samples per second. This information is periodically preprocessed into 100 distributions "buckets" before being sent to database.

Server Side Software

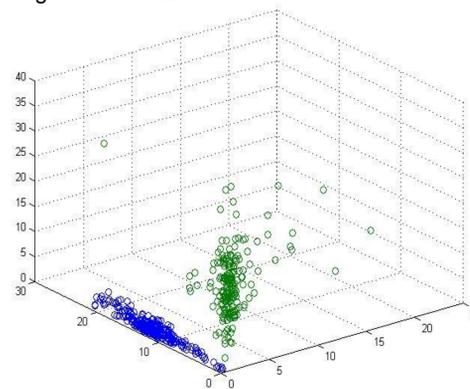


Information is sent from main database to server side software, where the data is preprocessed and classified according to methods described below. When abnormal behavioral changes are detected, the software sends a message back to the smartphone application.

Data Analysis

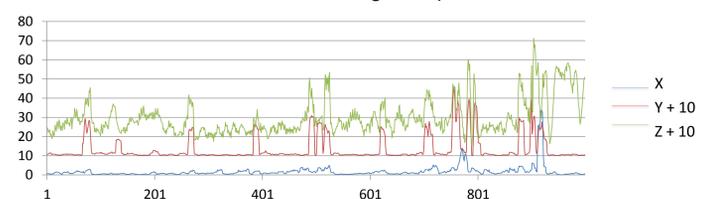
Worker threads collect data in real time and preprocess the information for use with the C4.5 algorithm. The variance from sliding windowed samples of accelerometer data is computed and used for data classification. 3D feature space displays disjoint sample class distributions for two different sample activities below.

Window Size: 16
Sliding Window Size: 4

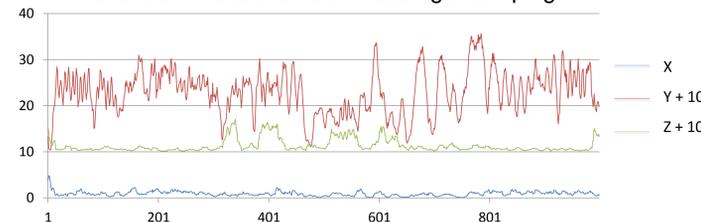


Green – rapid hand movement
Blue – jumping

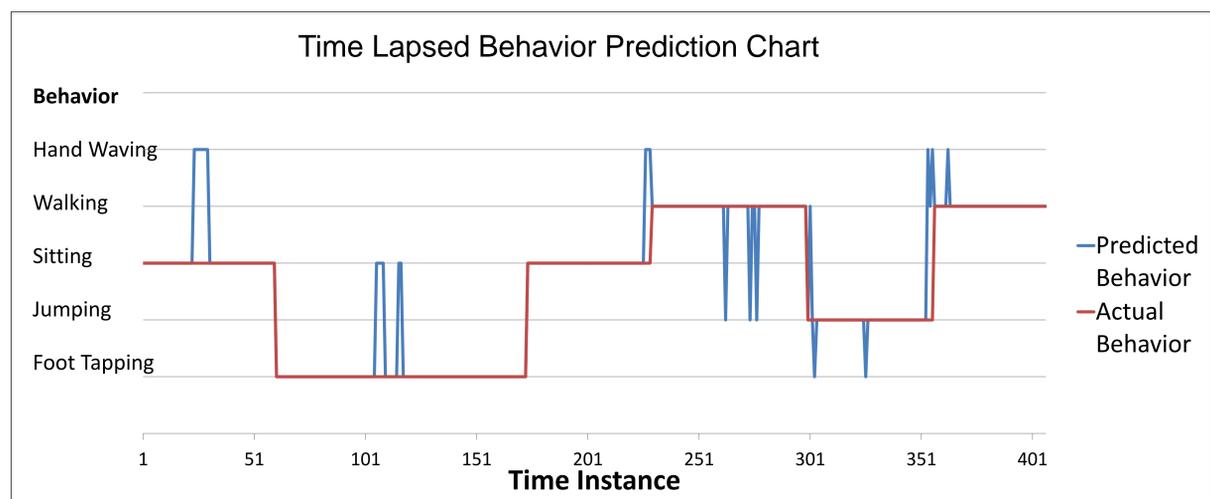
Variance in Accelerometer Readings: Rapid Hand Movement



Variance in Accelerometer Readings: Jumping



Time Lapsed Behavior Prediction Chart



Acknowledgements

We wish to thank J. Barberry, Dr. M. George and Dr. L. Bambara for answering our questions during the early stage of this research.



LEHIGH
UNIVERSITY.