Assessment of Autism Spectrum Disorders(ASD)

using speech motor function and sample collection using cloud based android app

Submitted By
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2013EET2369

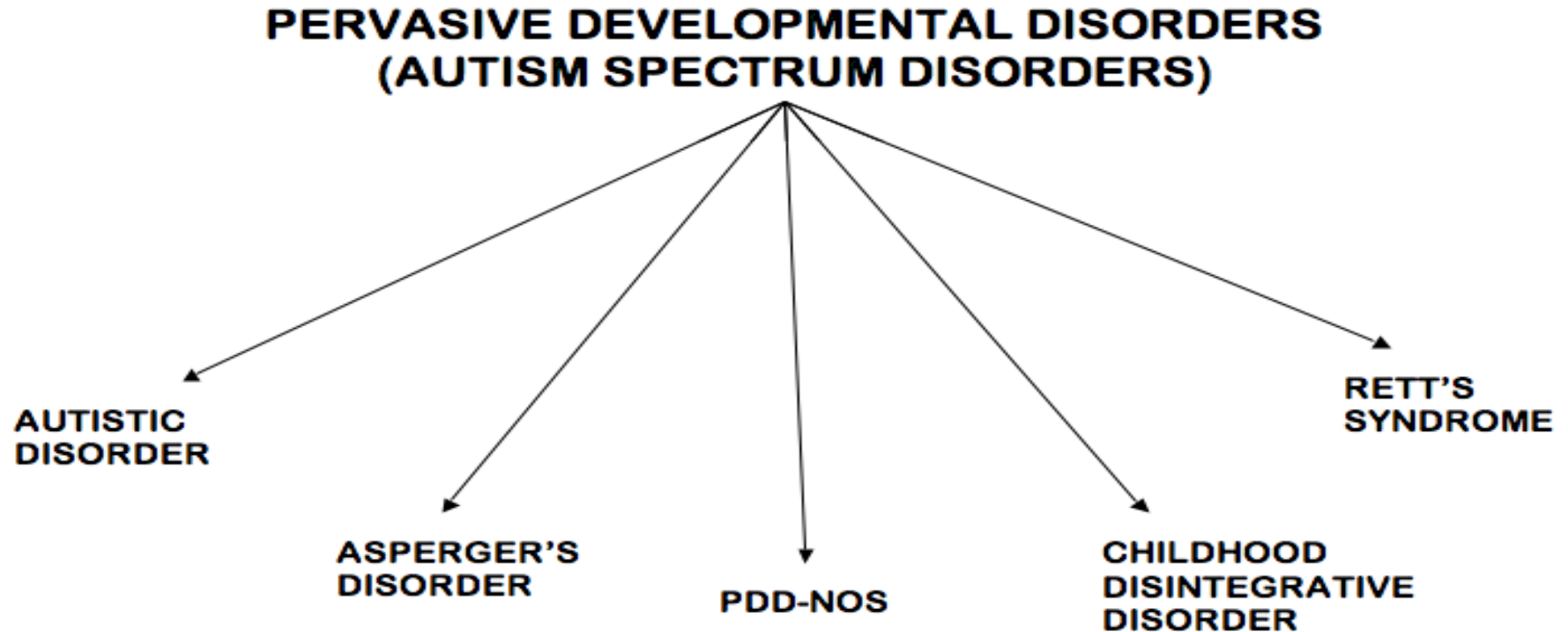Submitted To
Dr. Santanu Chaudhury
Dept. of Electrical Engg.

Introduction

❖   classify toddlers into 3 classes those who are normal, slow in learning and those who have autism.

❖   features based on speech sample.

❖   develop speech motor function for classification which consider features of speech.

❖   no prior well established method to classify using speech.

❖   speech sample collection is also a challenging task.

Characteristics of ASD

❖ Persistent deficits in social communication and social interaction across multiple contexts.

❖ Restricted, repetitive patterns of behavior, interests, or activities.

❖ Symptoms must be present in the early developmental period (typically recognized in the first two years of life).

❖ Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.

Autism Spectrum Disorder(ASD)

PERVASIVE DEVELOPMENTAL DISORDERS
(AUTISM SPECTRUM DISORDERS)

AUTISTIC DISORDER

ASPERGER'S DISORDER

PDD-NOS

CHILDHOOD DISINTEGRATIVE DISORDER

RETT'S SYNDROME

Milestones in Diagnosis of ASD

❖ Speech Sample Collection using Cloud based Android Applications

❖ Feature Extraction from Speech Sample

❖ Analysis of Speech Motor Function

❖ Behavioural And Diagnostic Measures

❖ Classification of speech samples of toddlers

Google Cloud Messaging for Android

- Send data from servers to users' Android powered-devices
- Send "send to sync" messages
- Send messages with Payload
- push back notifications.

GCM Architectural Overview
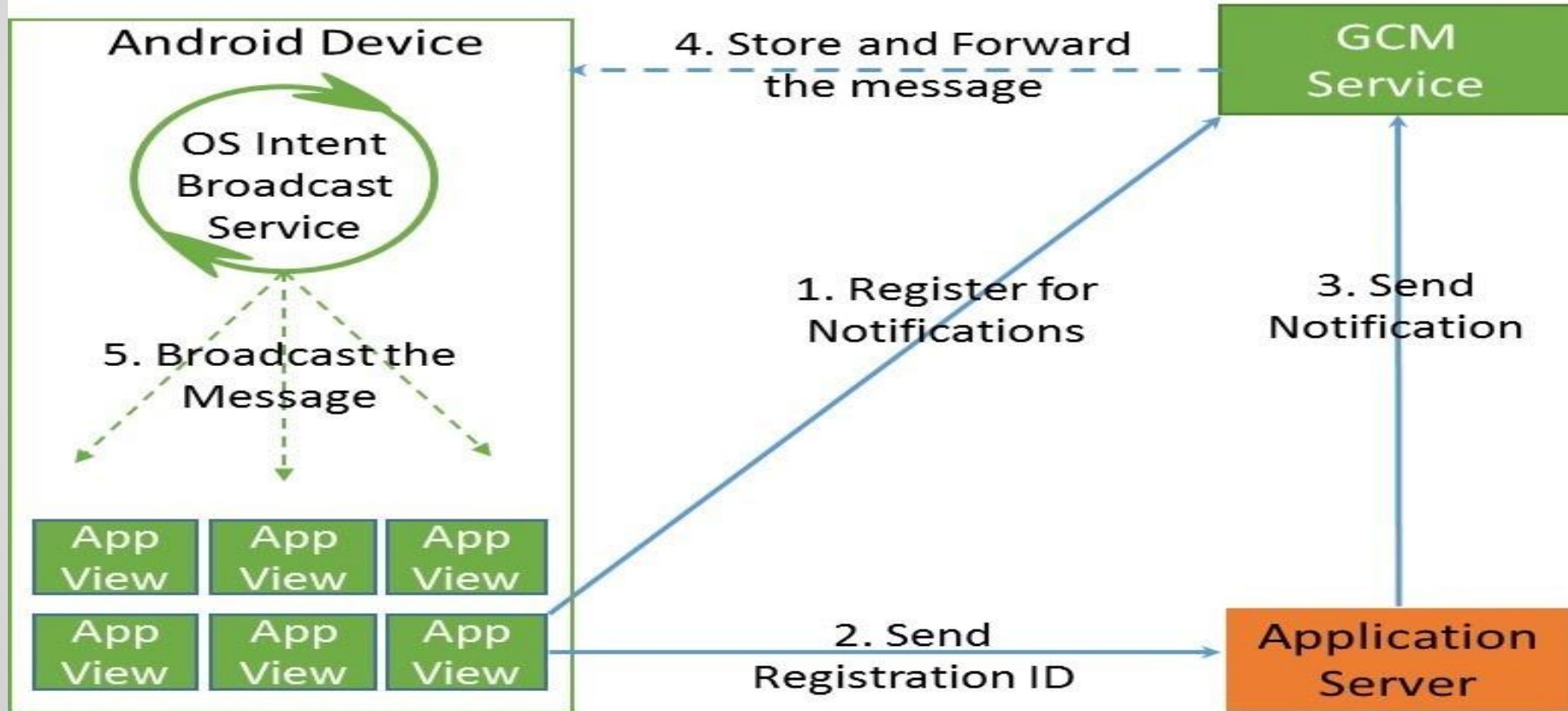
GCM

Full Name:

Internet Connection Error

Please connect to working Internet connection

OK

Full Name:

harshit

Email:

harshit.knit@gmail.com

Login

Your device registred with GCM
Sep 18, 2014 10:00:56 AM

Now You can record your Speech samples using this android app
Sep 18, 2014 10:02:21 AM

You can also Upload your speech samples using this android app
Sep 18, 2014 10:03:30 AM

thanks for uploading speech samples.
Sep 18, 2014 10:03:51 AM

We will notify you with results as soon as we process your speech samples
Sep 18, 2014 10:04:25 AM

Your device registred with GCM

Sep 18, 2014 10:00:56 AM

Now You can record your Speech samples using this android app

Sep 18, 2014 10:02:21 AM

You can also Upload your speech samples using this android app

Sep 18, 2014 10:03:30 AM

thanks for uploading speech samples.

Sep 18, 2014 10:03:51 AM

We will notify you with results as soon as we process your speech samples

Sep 18, 2014 10:04:35 AM

Upload File

Record Speech

Activity to record audio.

To start recording press

Choose Audio Format

MPEG 4

3GPP

Record

Stop

Format (. mp4)

File Upload

Get AudioFile

Uploading files to server. ....

Se
ha

Start Upload

File Upload

Get AudioFile

n Response from server : n The audio file hangouts_message.ogg has been uploaded. your file has been uploaded to your user directory : uploads/hangouts_message.ogg

Selected File paths : /mnt/sdcard/Ringtones/ hangouts_message.ogg

Upload Complete. Check the server uploads directory.

Start Upload

sql33.hostinger.in / localhost / u889539269_gcm / gcm_users | phpMyAdmin 3.5.2.2 − Mozilla Firefox

◀ Im...   Overview ...   GCM Adva...   Google Cl...   Quick Fix: ...   Screensho...   6 Ways to...   How to Ta...   How to Ta...   http:.../gcm/   IEEE - I...   phpMy...   PMA sql3... ▶ ➕ ▶

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phpMyAdmin

🏠 📇 📤 ❔ 📋 📥

(Recent tables) ... ▾

📄 gcm_users

⊕ Create table

🏠 localhost » 🗄 u889539269_gcm » 📋 gcm_users

| 🔲 Browse | 🔧 Structure | 🔍 SQL | 🔍 Search | ➕ Insert | 📤 Export | 📥 Import | ⚙ Operations | 👁 Tracking |

✅ Showing rows 0 - 3 (4 total, Query took 0.0001 sec)

```
SELECT *
FROM `gcm_users`
LIMIT 0 , 30
```

☐ Profiling [Inline] [Edit] [Explain SQL] [Create PHP Code] [Refresh]

Show : Start row: `0`   Number of rows: `30`   Headers every `100` rows

Sort by key: `None  ▾`

⊕ Options

← T →	▽	id	gcm_regid	name	email	created_at
☐ 🖊 Edit 📋 Copy ⊖ Delete		13	APA91bG5B0kgYgFP8NLNUjTfOe-H0orHNnlLEskFhdkhzOAKw0...	harshit	harshit.knit@gmail.com	2014-09-18 04:30:48
☐ 🖊 Edit 📋 Copy ⊖ Delete		4	APA91bH69EPcyOkkUqpAPnzkgUWVRxeNbDs_F0cHMVfrDxzcJx...	mohit	hudda10@gmail.com	2014-09-10 09:26:09
☐ 🖊 Edit 📋 Copy ⊖ Delete		8	APA91bG9rnpbCli7x1jiTEkZiPLtuGEGDdiriD7b1nYgjyz7la...	prateek	prateek@gmail.com	2014-09-11 16:59:10
☐ 🖊 Edit 📋 Copy ⊖ Delete		7	APA91bG9rnpbCli7x1jiTEkZiPLtuGEGDdiriD7b1nYgjyz7la...	prateek	enggprateek.gupta@gmail.com	2014-09-11 16:09:40

⬆ Check All / Uncheck All With selected: 🖊 Change   ⊖ Delete   📤 Export

Show : Start row: `0`   Number of rows: `30`   Headers every `100` rows

Query results operations

Mozilla Firefox ✕

http://disease...n.url.ph/gcm/ +

🔍 diseaseprediction.url.ph/gcm/   G▾ Google

📁 book and novels ▾   📁 coding events ▾   📁 coding tutorial ▾   📁 english ▾   📁 How to ▾   📁 iitd ▾   📁 Interview Que ▾   📁 learn coding ▾   📁 localhost ▾   📁 video courseware ▾   »

No of Devices Registered: 4

Name: harshit	**Name:** mohit	**Name:** prateek	**Name:** prateek
Email: harshit.knit@gmail.com	**Email:** hudda10@gmail.com	**Email:** prateek@gmail.com	**Email:** enggprateek.gupta@gmail.com
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Send Push Notification	Send Push Notification	Send Push Notification	Send Push Notification

Category For Classification

- Autism Spectrum Disorder(ASD)
- Developmental Delay(DD)
- Typical Development(TD)

Speech Sampling

- ADOS
- PCI
- Speech Modulation Spectrum
❖   Spectral Modulations
❖   Temporal Modulations
❖   Spectro-Temporal Modulations

Speech Motor Function

Articulatory feature

- ❖ Syllabic Rhythm - (2-10 Hz)
- ❖ Formant Transitions (25-40 Hz)
- ❖ Place Of Articulations (50-100 Hz)

Number of Vocalizations

- ❖ no of continuous speech sounds

Behavioural And Diagnostic Measure

- Autism diagnostic interview-revised (ADI-R)
- Autism Diagnostic Observation Schedule (ADOS)
- Mullen Scales of early Learning

(RL,EL,FM)

- Vineland Adaptive behaviour Scales:

Receptive Language Subdomain (RL,EL)

Decision Trees

❖ Decision trees are individual learners that are combined. They are one of the most popular learning methods commonly used for data exploration.

❖ One type of decision tree is called CART… classification and regression tree.

❖ CART … greedy, top-down binary, recursive partitioning, that divides feature space into sets of disjoint rectangular regions.

❖ Regions should be pure wrt response variable

❖ Simple model is fit in each region – majority vote for classification, constant value for regression

Random Forest

❖ Classification and regression

❖ Random forest (or random forests) is an ensemble classifier that consists of many decision trees and outputs the class that is the mode of the class's output by individual trees.

❖ The method combines "bagging" idea and the random selection of features.

Random Forest

❖ Bootstrap Aggregation of classification of trees-(Reduce bias of single tree)
❖ Permutation to determine variable importance.
❖ Seek to estimate E[Y|A,W] , i.e. prediction of Y given set of covariates(A,W)
❖ assumption-- all trees are independent draws from an identical distribution, minimizing loss function at each node in a given tree.

Algorithm of Random Forest

❖ Bootstrap sample of data
❖ Using 2/3 of the sample, fit a tree to its greatest depth determining the split at each node through minimizing the loss function considering a random sample of covariates.

For each tree.

❖ Predict classification of the leftover 1/3 using the tree, and calculate the misclassification rate = out of bag error rate.
❖ For each variable in the tree, permute the variables values and compute the out-of-bag error, compare to the original oob error, the increase is a indication of the variable's importance
❖ Aggregate oob error and importance measures from all trees to determine overall oob error rate and Variable Importance measure.
❖ Oob Error Rate: Calculate the overall percentage of misclassification
❖ Variable Importance: Average increase in oob error over all trees and assuming a normal distribution of the increase among the trees, determine an associated p-value.

Advantages using Random Forest

❖ highly accurate.

❖ efficient for large databases.

❖ handling thousands of input variables without variable deletion.

❖ estimates of what variables are important in the classification.

❖ generates an internal unbiased estimate of the generalization error as the forest builds

❖ balance between high variance and high bias.

❖ estimating missing data and maintains accuracy when a large proportion of the data are missing.

Advantages of Random Forest

❖ Random forests have been observed to overfit for some datasets with noisy classification/regression tasks.

❖ For data including categorical variables with different number of levels, random forests are biased in favor of those attributes with more levels. Therefore, the variable importance scores from random forest are not reliable for this type of data.

OOB Error using Random Forest
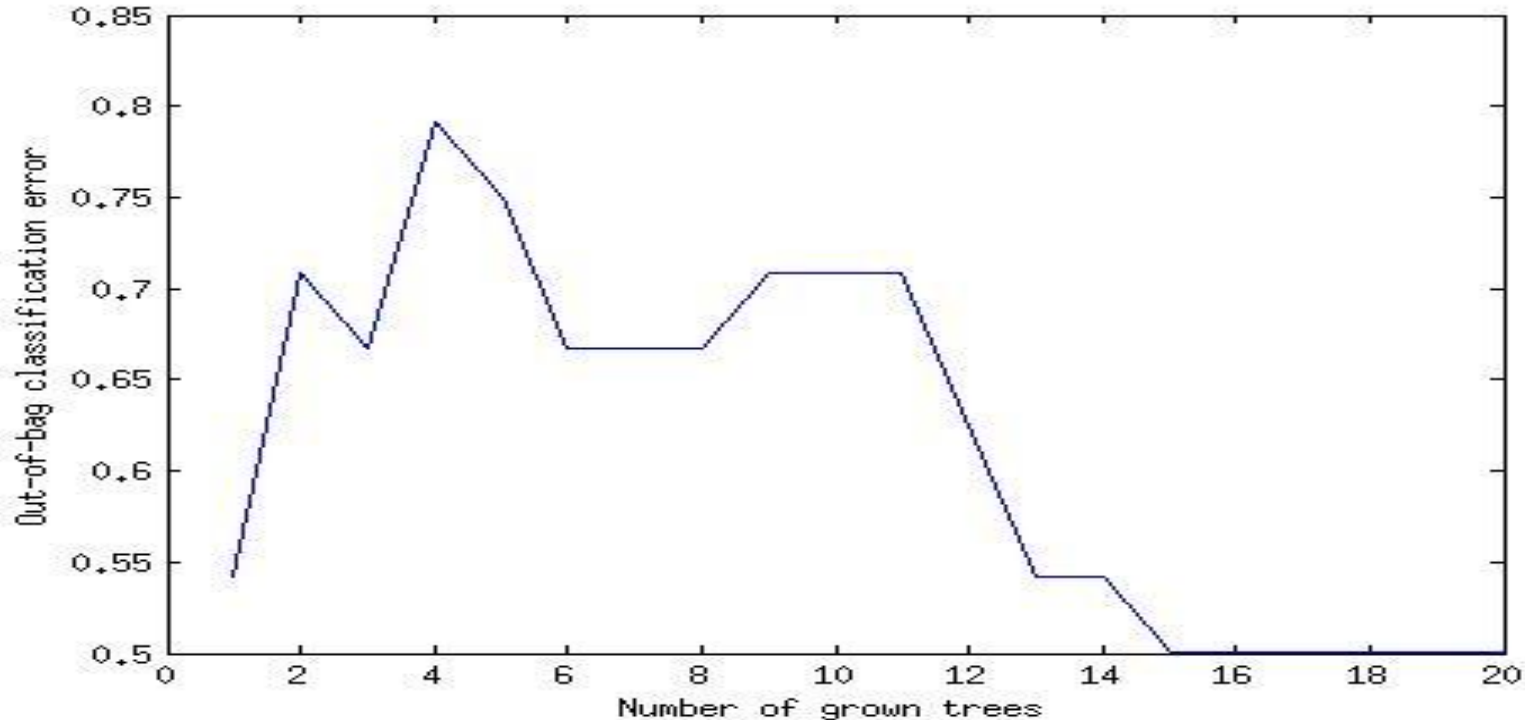
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THANK YOU