

# **An Opencv Method for Monitoring Attendance in Specialized Children School to be implemented in Bangladesh**

**BY**

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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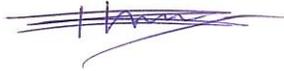
**MAY 2021**

## APPROVAL

This Project titled “An Opencv Method for Monitoring Attendance in Specialized Child School to be Implemented in Bangladesh”, submitted by **Ariful Haque Sarkar Fahim, Rabiul Islam** and **Md Ibrahim Saikat** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering (BSc) and approved as to its style and contents. The presentation has been held on 31 May 2021.

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## DECLARATION

We hereby declare that, this thesis has been done by us under the supervision of **Dr.Fizar Ahmed, Associate Professor, Department of CSE** Daffodil International University. We also declare that neither this thesis nor any part of this thesis has been submitted elsewhere for award of any degree or diploma.

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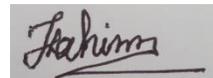
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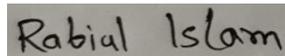
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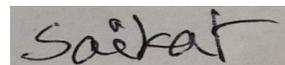
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## ABSTRACT

Autism Spectrum Disorder (ASD) is neurocognitive disorder which has been on rise worldwide. A person with such condition have difficulties in responding to speech, social interaction and unable to utter words. The learning activities for them revolves around inanimate structures, objects and pictures handling. With such condition it becomes improbable for children with such condition to recognize a face and respond to it. Taking attendance for such specialized children become a time consuming task. So in this paper we have proposed a methodology of automated attendance of such specialized child to ensure the security of each child and time which is saved by such automatic technology is spent in concentrating on teaching them activities to get acquainted with social interaction capabilities. The proposed methodology is done in three stages. First is detecting Face from a video using dlib library based on Histogram of Oriented Gradients (HOG) and then classifying using Support Vector Classifier(SVC).In the next stage, face detected is aligned using FaceAligner and facial features are extracted based on 68 landmark point face detector and trained into database. In final stage, faces from live feed webcam is detected, its feature being extracted and compared with database to record attendance.

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# CHAPTER 1

## INTRODUCTION

Autism Spectrum Disorder (ASD) is a developmental condition related to brain that involves how a person perceives and socializes with others, causing persistent challenges in social communication and interaction. Repetitive patterns of behavior is found in such patients [1]. The cases of ASD has been on rise in last one decade that it is estimated that 1 in every 270 people suffers from it. Other studies have found that it is worse than this estimation, especially in low and middle income countries, mostly due to not enough awareness of it. Another study in US hold that 1 in every 54 person is suffering from it and of which 60% are having verbal impairment[2].Having such condition means extra sensitive to everything and specially unknown objects and situations. The nerve receptor being slow and lack in intelligence causes early staged child to react violently. Extra sensitivity to social gathering, bright and disco lights, varying sounds as more variance in data they receive, the brain mixes it up and cant conclude to meaningful information. But if trained from very early age, helps to develop overcoming the problems that have been mentioned. In lower income countries research has shown that the parents not being aware of such condition leading to children's ASD being matured, leaving improbable chances for improvement.

### 1.1 Face Technology

The advancement of technology has aided in special cases. With fingerprint authentication to be the superior of all technologies for identification. But same can't be implemented for special children. Facial recognition is an efficient and productive technology to be implemented here as no effort is needed from special children.

A PC and webcam would be sufficient to be implemented such technology in special school. A live webcam captures the video of a new children, which is then trained and then eachtime the child is live the time is recorded using universal time system and is integrated into the server. From where a superadmin can monitor the attendance of all the children.

## 1.2 Motivation

According to a report of “The Daily star” in 2018, approx. 17 per 10,000 babies in Bangladesh are diagnosed with ASD [3]. The statistic is already an underestimate, as it only shows an estimation taken from special child schools. Many are the cases where these children aren’t admitted to any special school. The data is too scarce in rural part of the Bangladesh. With very low number of organizations working in such remote areas. But there is a boost in cases which has caused the instructors having tough time managing, teaching them while ensuring the security of the childrens. A child may wander into another class room. Instructors with a room full of children, can’t attend such delicate situations which can be monitored by a superadmin. With ever increasing cases of ASD and time consumption in taking attendance, this proposed system would help special school to operate in more productive way.

## 1.3 Objectives

- Interacting with the autism children to capture video
- Building a web based system to check in and out for attendance
- System that will allow to see weekly report of each children

Some issues that followed with objectives-

- The children were violent, reacted while capturing video, to the extent they cried and lack of eye contact caused difficulty to capture video.
- They were reactive to the flashlight and hence switching the light off caused lesser clarity of video capture.

Lighting condition and occlusion, angling face away from the webcam, along with children closing eyes, delayed recording the data

## CHAPTER 2

### Background

#### 2.1 Related Work

Nataliya Boyko et. al [4] described how the dlib library is used based on HOG method for detection has been production and shows better performance and deduced that it is good enough to be used in IOT platforms. Giuseppe Amato et. al [5] compared between face landmarks method and deep feature method for verification of a person in real time video. The paper showed that average mean precision was unarguably higher in Deep feature compared to landmark method. And has concluded that for video footage based evidence should be run through deep features in forensics lab. Viola and Jones [6] invented and revolutionized face detection procedure. They invented method which could detect face 15 times faster than any other method invented before them, while reducing the computational time. They did this by boosting cascade of simple features.

Suleman Khan et. al [7] researched face recognition through smart glass using CNN and concluded how occlusion, illumination problems could be cancelled out ensuring a very high face recognition rate. Kaipeng Zhang et. al [8] proposed a MTCNN based framework for face detection and alignment and has showed result that has outperformed previous method showing the results in prominent benchmarking(FDDB,WIDER FACE) for detection and used AFLW benchmark for alignment. Hurieh Khalajzadeh et. al [9] used combination of CNN and regression method for feature extraction using Yale dataset. And had found in his study that both SimpleLogistic and LMT had maximum accuracy of 86.06% between these algorithms.

Oya Çeliktutan et. al [10] has surveyed on recent landmarking techniques and concluded model based method are the best, which includes two tier process of extracting facial feature and then using this data to predict. Yue Wu et. al [11] done literature review on face detection and followed “the holistic method, the constrained local methods, and the regression methods” to criticize on existing face detection method and proposed for collection of millions of images under condition if fed to deep learning will show better landmark detection. Akib Mohi Ud Din Khanday et. al [12 ] has done review of Principal Component Analysis, Independent Component Analysis, Linear Discriminant Analysis, Simple Geometry, Line Edge Map, Local Binary Pattern, Gabor Wavelet and Elastic Bunch Graph Matching and predicts that combination of two recognition method might show better accuracy in recognition. Suyash R. Dhabre et. al [13] had described automated attendance system and how the system could avoid proxies given by other student and avoided time consumption.

## **2.2 Bangladesh Perspective**

Md. Shahriare Satu et. al[14] proposed a method by which screening of autism could be done early age, but faced lots of limitations too as data gathered wasn't enough to reach a conclusion. The sole purpose was to detect autism early so that higher chances of development is seen in specialized children if trained early.

Upol Ehsan et. al [15] how the cultural challenges are faced in urban areas and lack of prevalence is also the cause. And suggested that mobile technology that causes improvement of social development for autism child to be developed.

## CHAPTER 3

### Research Methodology

The data gathering had been difficult, specially when collecting from rural areas. Parents were reluctant to allow capturing of data. It was unwelcoming from the parents and of few who allowed, difficulty of capturing due to sensitivity of affected children. Yet, concentrating each child to look into laptop and capturing was a task hard to continue. Finding interest of each children for them to keep looking at laptop screen was challenging.

### 3.1 System Architecture

#### 3.1.1 Back end Tools

Back end structures webpages and converts them into an interactive website where data can be saved, sent and received making the application dynamic. This proposed system is built using python using Django framework. Django has been used because of its built-in admin interface which allows CRUD (create, read, update, delete) operations to be accessed by superadmin and greatly secured and also because of maintainability and portability. Sqlite3 is used as a database to store all the data. This is an auto choice database as it is built into Django, which stores data by using structured query language.

#### 3.1.2 Front end Tools

HTML, CSS and JS are used to create front end UI. Hypertext Markup Language is used to make webpages and to decorate them with colors, fonts and layers –Cascading Style Sheets had been used. JavaScript combines the pages to make one interactive website.

### 3.2 System Algorithm

**3.2.1 HOG** is an algorithm that detects face in a video or picture. This method was invented in 2005 by Navneet Dalal and Bill Triggs [16].First the data to be captured is converted to grey image. Each pixels of the image is looked onto such that a darker pixel is selected and its surrounding pixels are looked into. Then an arrow from light to dark pixel is indicated for every pixels of the trained pics. These arrows are called **gradients**.

Dlib library has been trained and analyzed with lots of face images by Convolutional Neural Network through deep learning.

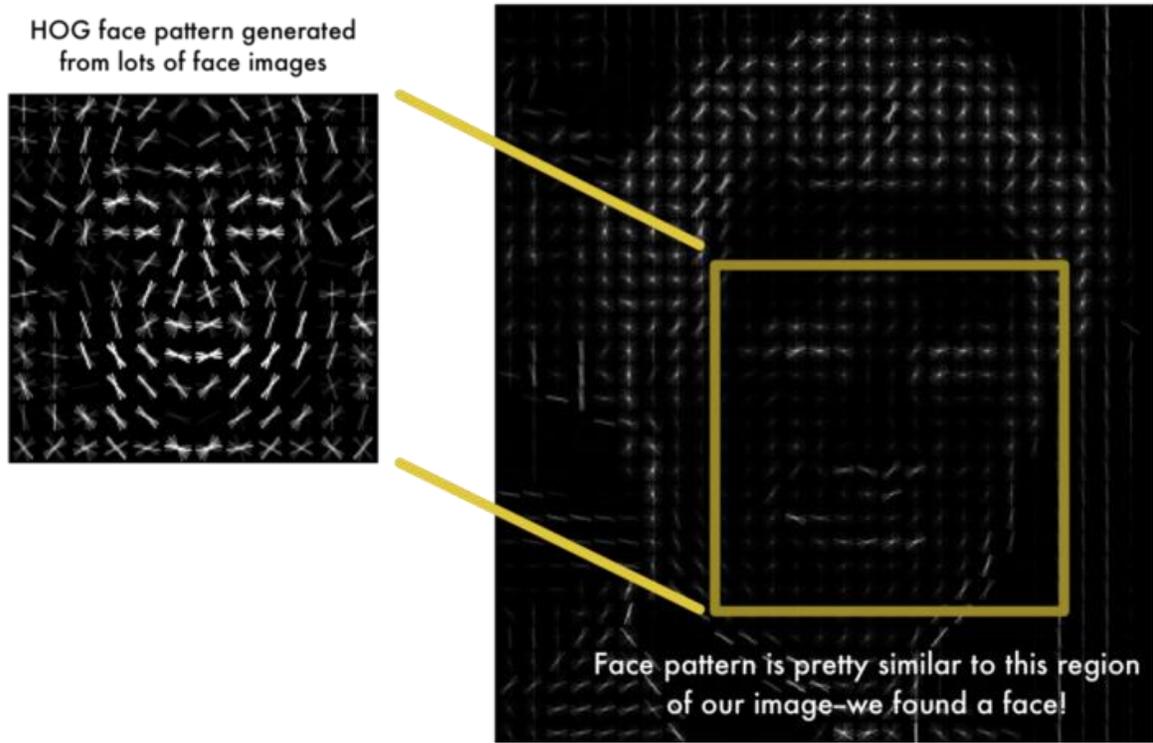


Figure 1 HOG principle

3.2.2 **Face Aligner** is a method by which each pictured facial features are centered even when they are angled. This is done by ensemble of regression trees method invented by Vahid Kazemi and Josephine Sullivan[17]. Their study lead to face landmark estimation with 68 landmark points with eyes, eyebrows, nose, lips, mouth, chin, jaw and shape of face to be extracted.



Figure 2 68 Face Landmark Points

### 3.3 System Implementation

The proposed methodology is implemented in three stages of- A. Video capturing each children by detecting face and generating images to be trained, B. The images are then trained to find Euclidean distance and C. Detecting face from live camera feed and match it with data saved in database.

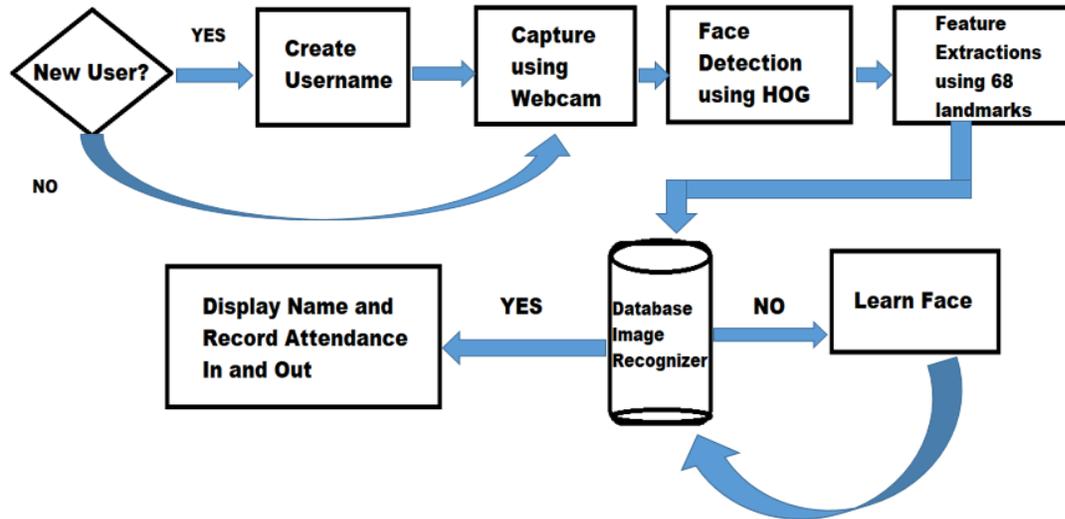


Figure 3 The proposed Methodology Flowchart

#### 3.3.1 Detecting face from video capture

For a face to be detected, an username unique to child name to be created and then added to database, then the step of capturing starts in which 301 picture of that child is framed and dlib() library based on Histogram of Oriented Gradients detects the face from each image.

Classification of each children is done using Support Vector Machine (SVM) based classifier SVC(Support Vector Classifier).The username distinction and classification is done by this machine learning classification algorithm.

#### 3.3.2 Training the images by feature extraction

Dlib.get\_frontal\_face\_detector is called for alignment of pictures including those of which are tilted to center 5 facial features (center of eye of both left and right, tip of nose, two point for mouth).This 5 point landmark detector has been used to eliminate noise from background and concentrate on the face only. FaceAligner along with 68 point facial landmark estimation model generates features from each face to be trained. The Euclidean distance are calculated. The Euclidean distance between two points in one dimension is simply the absolute value of the difference between their coordinates. All these features are being stored.With core i5 processor and amd 2 gb graphics card the training time for 4 subjects took about 11 minutes.

### 3.3.3 Recording Attendance

The data now being trained is stored into the database (sqlite3). Special children are then forwarded to webcam and webcam detects the face and shows username onto the screen in less than a second due to the dlib () algorithm based on ensemble of regression tree.

## 3.4 Algorithm Selection and Comparison

### 3.4.1 Selection of HOG for detection

HOG is integrated into dlib library which has accuracy of 99.38%. According to C.Rahmad et. al [18], has shown complete comparison between HOG and Viola-Jones algorithm which used HAAR cascades. The research considering of test cases of occlusion, makeup, posing, illumination has concluded that HOG had 79% accuracy against 71.11% using V-J.

With the perspective of female special children, some were seen wearing hijab and some of the child wearing glasses and some were having gazing expressions. Not to mention flashlight sensitivity caused illumination factor to be strongly considered. Hence HOG was selected.

Techniques	Accuracy %
[Viola-Jones Algorithm and Artificial Neural Networks] by Fernandez	88.64%
[Viola-Jones Algorithm , Neural Networks] by Mohammad Da'san	90.31%
[HOG , 68 Facial Landmark] used in this proposed method	96.33%

Table 1 Comparison between Algorithms

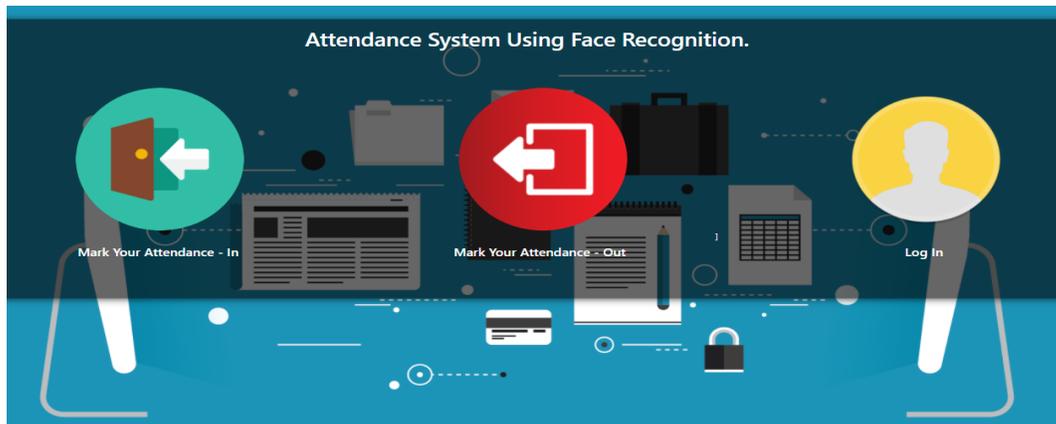
### 3.4.2 Selection of 68 facial landmark for extraction

The advancement of technology has seen many facial landmark algorithm to be invented. Advance algorithm such as Dense Face Alignment (DeFA) used for 3D deformable face mesh uses very high processing and GPU power which are expensive to setup. Special school funds are always limiting, there to implement such model is practically unviable. Considering the system for whom to be developed, face landmark model based on dlib is both productive and efficient.

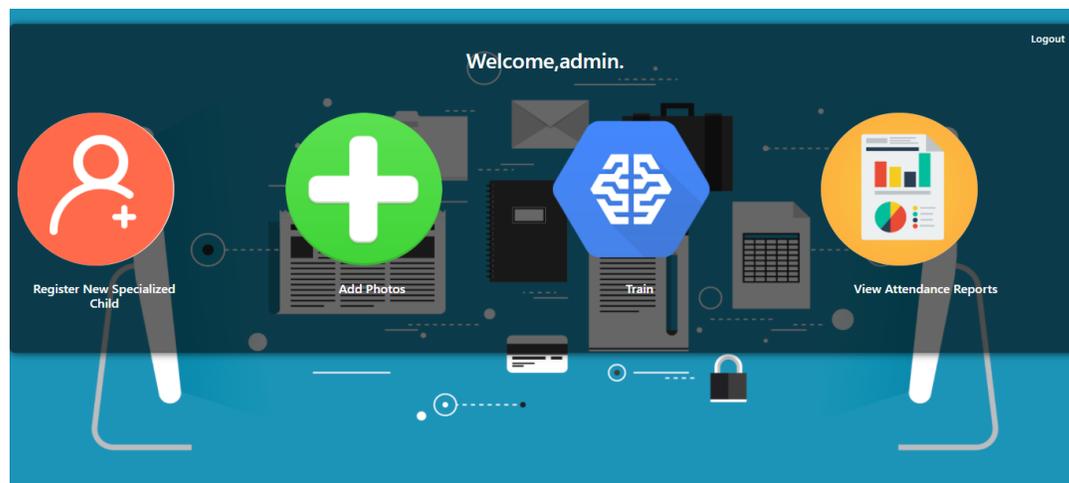
After a thorough experiment by dimming lights at varying angles, below table has been drawn.

Face Angles	Bright Illumination Recognition	Low Illumination Recognition
0	99%	94%
25	96%	88%
45	85%	72%
90	5%	0%

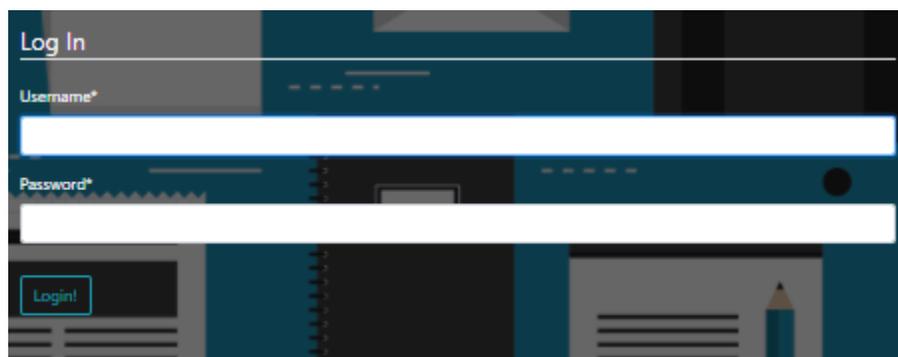
Table 2 Recognition Rate



**Figure 4** The Landing Page of Autism Attendance Website



**Figure 5** The admin access webpage



**Figure 6** The Admin Login page

## CHAPTER 4

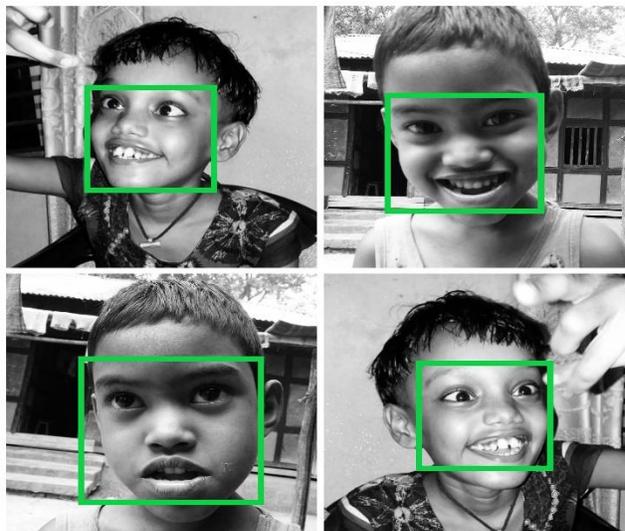
### Result and Analysis

The data collection was partially taken from Institute of Paediatric Neurodisorder and Autism (IPNA) website. Few data was checked against all procedure and result was satisfactory.



**Figure 7** Grey Image conversion from Colored Photo

This data was fed into HOG algorithm which resulted in bounding box to be generated around the face.



**Figure 8** Face Detection Bounding Box Sample

96\*96 pixel is captured which is then converted to black and white image. Then by ensemble of regression tree method based 68 face landmark implemented to find facial feature which are then stored in the database.

The feature extraction visualization is also delivered and shows that how the feature of 5 faces differ from one another. There is an orange point close to the green points in the scattered diagram in Figure 9, as orange and green points belonged to same family members.

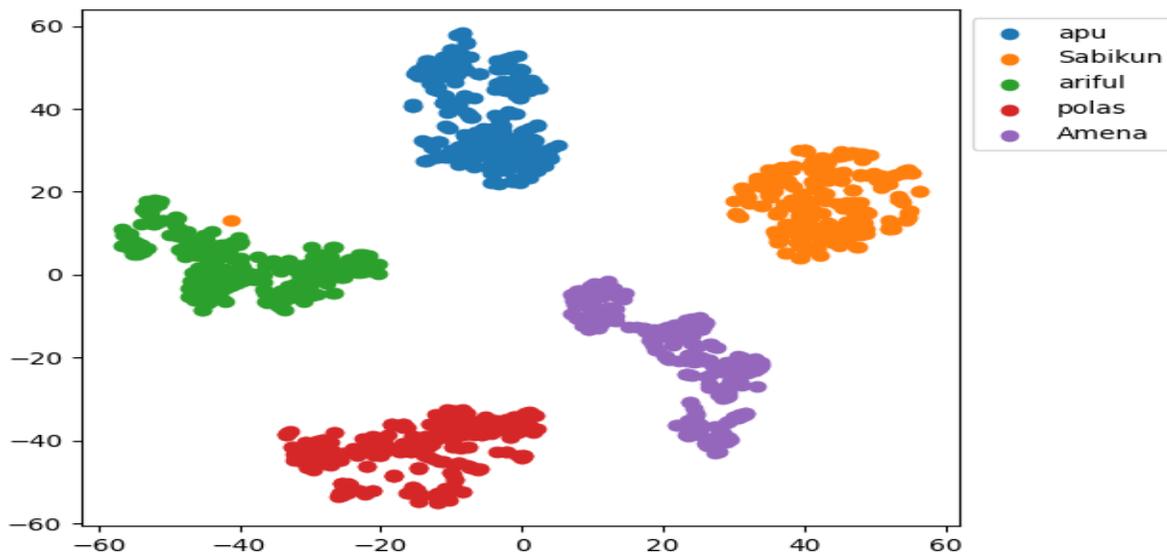


Figure 9 Data Training Visualization

Date	Special Children	Present	Time in	Time out	Hours	Break Hours
May 30, 2021	ariful	P	May 30, 2021, 3:08 p.m.	May 30, 2021, 3:10 p.m.	0 hrs 3 mins	0 hrs 0 mins
May 4, 2021	ariful	P	May 4, 2021, 3:39 p.m.	-	0 hrs 0 mins	0 hrs 0 mins
May 3, 2021	ariful	P	May 3, 2021, 2:51 p.m.	May 3, 2021, 4:31 p.m.	1 hrs 41 mins	0 hrs 0 mins
May 1, 2021	ariful	P	May 1, 2021, 12:39 a.m.	May 1, 2021, 1:04 p.m.	12 hrs 26 mins	12 hrs 11 mins
April 18, 2021	ariful	P	April 18, 2021, 8:47 p.m.	April 18, 2021, 8:47 p.m.	0 hrs 1 mins	0 hrs 0 mins
Feb. 27, 2021	ariful	P	Feb. 27, 2021, 8:15 p.m.	-	0 hrs 0 mins	0 hrs 0 mins
Feb. 22, 2021	ariful	P	Feb. 22, 2021, 12:02 a.m.	Feb. 22, 2021, 12:04 a.m.	0 hrs 3 mins	0 hrs 0 mins

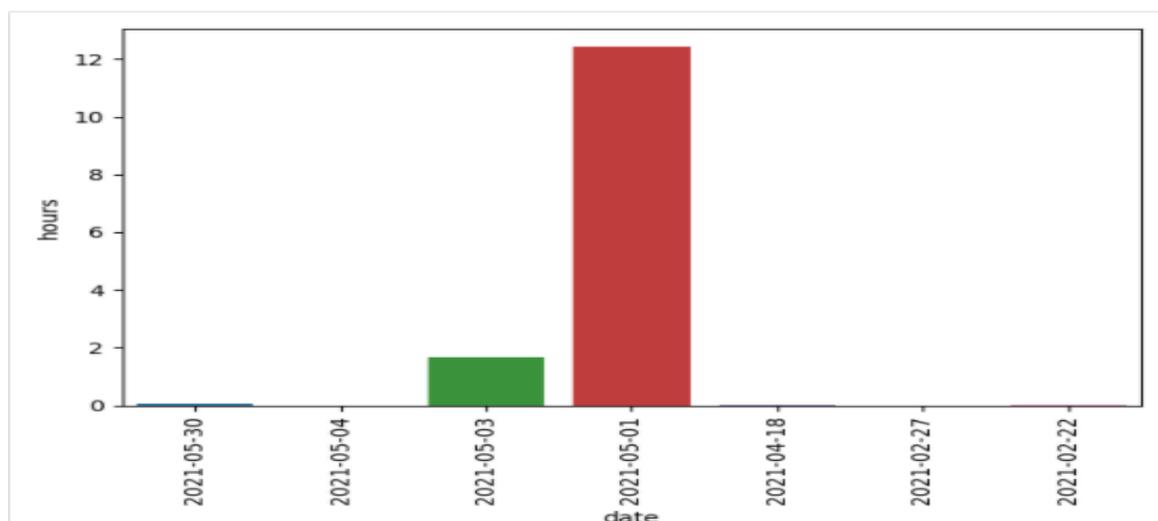


Figure 10 Number of hours of sessions by one student

Figure 10 shows the hour of session by a child over a period of time. Hours against date Bar chart graph shows duration of time spent by each bar.

The recognition model was tested under different occlusion of wearing clear glass, head cap, to which the accuracy wasn't affected much. But the algorithm found difficulty if the face is facing 45 degree away from the camera, leading to either showing "Unknown" or correctly displaying name for fraction of second. Though, fraction of second was enough to record attendance in and out. Greater than 45 degree showed no detection.

## **CHAPTER 5**

### **Conclusion and Future Work**

The proposed method has performed basic operation with strong library dlib () and has successfully recorded the duration children in the premises. The “attendance in” interface is opened by superadmin for the first half time of the school activities and changing the interface to “attendance out” for the other half of the school time. Compared to Viola-Jones algorithm implemented by many researcher earlier, this proposed method proves to be an one step ahead in managing occlusion, angle variance, lighting conditions and showed result fair enough to conclude that this methodology overcome these problems.

With result still showing not fully accurate, there is always chance of improving. Feeding the algorithm with more and more data, the reliability of accuracy is supposed to increase. We would like to implement the data captured using this method to study expressions of these child over a prolonged period to check whether time spent in the schools show positive growth analyzed from their facial expression. And to invent a methodology to screen autism detection based on expressions. Only if a child with positive ASD is detected earlier, substantial improvement in social behavior can be made.

#### **5.1 Limitation**

The covid scenario and restriction of staying at home has caused much difficulty in arranging data. Few data was collected from Chandpur Village. So, we had to work with data at home and comparison result was drawn. In the future, we want to collect data from specialized children school around major towns to draw better conclusions.

## Appendix

Data has been collected from Institute of Paediatric Neurodisorder and Autism (IPNA) website due to the covid scenario, but initially data was to be collected from Autism School. Nevertheless, since autism is a neuro disorder, hence face detection remains similarly accurate as average person with no such condition.

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# PLAGIARISM REPORT

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