# MINOR PROJECT REPORT

| | |
|---|---|
| Name of a student | A. Sai Charan |
| ID Number | R200037 |
| Year and Branch | E3 / ECE |
| College | RGUKT, RK Valley |
| Project Name | Smart Squint Detection |
| Project Guide | Dr. Shaik Mohammand Rafi |

Title : Smart Squint detection - By leveraging the Deep learning for Eye misalignment Diagnosis.


Abstract :

* Squint or strabismus is a misalignment of the eyes that if undetected may lead to visual impairments mainly in growing kids.
* Traditional diagnostic methods are often subjective and having huge equipment.
* This project proposes a deep learning based system for automated squint detection by examining the deviations in pupil positions.
* Our approach integrates computer vision, deep learning and image processing with eye captures and offers a reliable solution that complements tradiational diagnostics.

## Problem Statement

- Strabismus is a misalignment of eyes. causing the deviation from normal, parllel gaze.
- Most cases of strabismus in children are caused by muscle imbalance or refractive roots errors.
- If untreated, a significant number of children with severe strabismus have some amount of vision loss due to amblyopia.
- Strabismus is mostly congential, developing during infancy. It may also be in rare cases, acquired developing after 6 months of life.

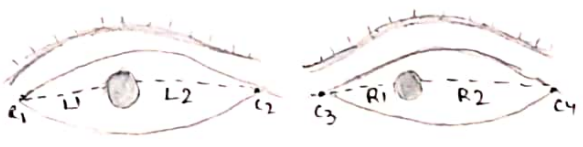
## Work Flow

1:) Research

- Conducted a thorough review of existing research on squint detection, strabismus and related eye tracking technologies. we made a deep analysis on science direct journels for squint detection
- We consulted with an experienced opthamoligist to understand the clinical aspects of squint detection and the common challenges faced during diagnosis
- Investigated deeplearning and computer vision techniques used in medical field for eye alignment detection
- Identified the challenges in current methods for squint detection focusing on area where automation and AI can enhance better diagnosis.

## 2) Model Development

- Data collection i.e to work on eyes, we collected two types of dataset, for healthy eyes and unhealthy eyes with squint
- The training image is directly taken from local machine for easier training and also we made a hardware setup to take data from camera
- Extracting the eyes from a captured image by using dlib facemask dlib provides 68 landmarks around face to detect the eyes
- Applying the data augmentation techniques to avoid lighting conditions
- Extracting the canthus points in both of the eyes using dlib.
- Finding the coordinates of canthus points let. they can be
  $(x_{L1}, y_1)$ $(x_{21}, y_{21}) \Rightarrow$ for left eye
  $(x_{L2}, y_2)$ $(x_{22}, y_{22}) \Rightarrow$ for right eye
- Extracting the iris and pupil centre by using hough circles let the pupil coordinates are $(x_{c1}, y_{c2})$ , $(x_{c2}, y_{c2})$
- Calculating the distances L1 & L2, R1 & R2 by using coordinate geometry $dist = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
- Now we'll use the distances L1 L2, R1 and R2 to find the Symmetry of eyes.
- Based on the value that we obtained from evaluation we'll predict the presence of a squint.




C1, C2, C3, C4 → canthus points

3.) Output generation

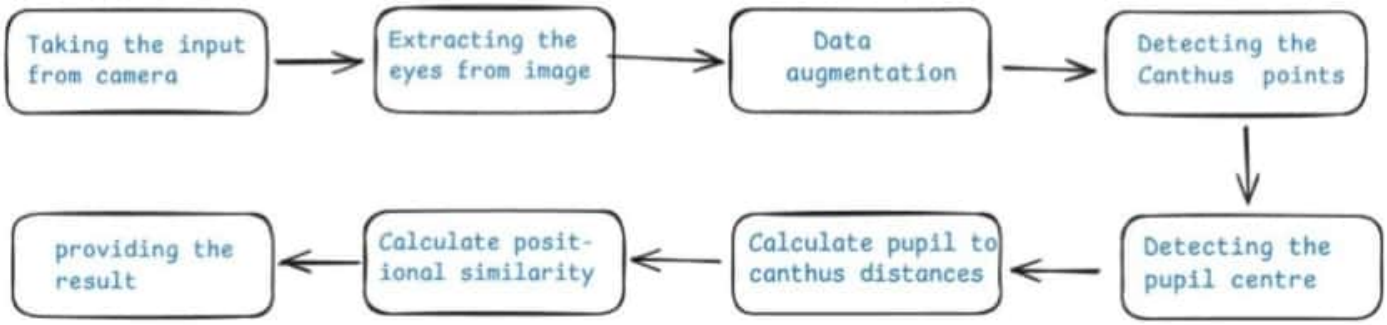
- Symmetry of eyes is evaluated by $S = \frac{\max\left(\frac{L_1}{L_2}, \frac{R_1}{R_2}\right)}{\min\left(\frac{L_1}{R_2}, \frac{R_1}{R_2}\right)}$
- if $S \leq 1.2 \Rightarrow$ Eyes are Symmetrical
  $1.2 < S < 3 \Rightarrow$ Eyes are Asymmetrical
- The pics captured in different positions are passed to model to identify the type of squint

4.) Hardware setup

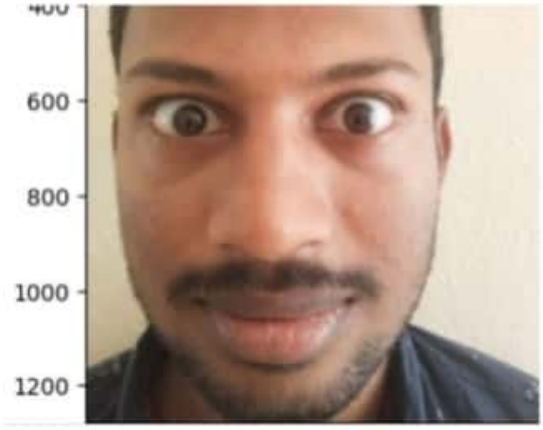
- Model works well only all photos are captured from same position so that we developed an hat to capture the pupil movements in eye
- The hat was developed by using ESP32 webcam, arduino IDE. and Python. the captured visuals are anlyzed and sent to model.

| Limitations in our project | How to overcome them |
|---|---|
| • Model works well on high quality images.<br>• Lighting conditions affects the pupil detection.<br>• can be used a primary test not as a main test for squint detection. | • use good hardware setup with good camera.<br>• use more data augmentation techniques.<br>• ~~Hiring~~ taking doctor consultancy for severe test and it can be used in remote places. |

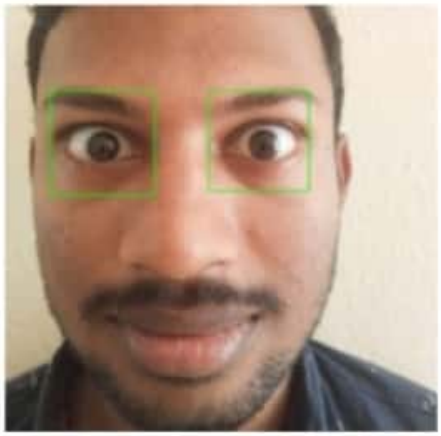
# Process flow of Project




# Outputs of a project



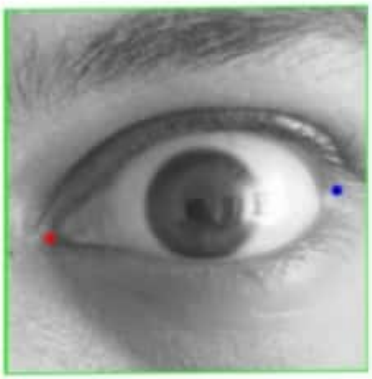

Taking image from camera



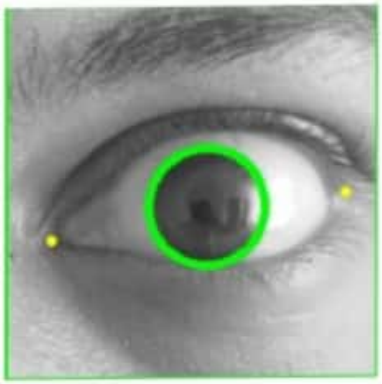
Detecting the eyes from image


Extracting eyes from image

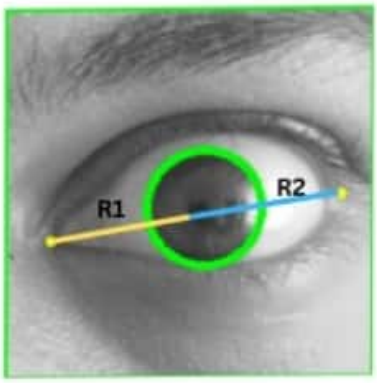

Data Augmentation



locating canthus points



locating iris and its centre




Calculating distance between pupil and canthus

demo of the project


calculating pupil & canthus distance by web cam directly

# Conclusion

This project successfully utilized deep learning and OpenCV to detect and analyze positional symmetry. The approach showed good results, demonstrating the potential of combining AI and computer vision for symmetry detection. With access to better hardware, such as good camera and more powerful GPUs, the system's performance could be significantly improved in terms of speed and accuracy.

Overall, this work provides a solid foundation for further advancements in symmetry detection with applications in fields like robotics and designing.