

# Pediatric Perimeter - Gaze Tracking Algorithm

**Step 1:** Face Detection using Viola-Jones algorithm (Haar Cascade Classifier).

**Step2:** Filter out False Faces detected (False Positives) and No Faces Detected (False Negatives) using Largest Blob Analysis.

**Step3:** Apply the Segmented Face Image to Fast Radial Symmetry Transform and get approximate Pupil Centers.

**Step4:** Use Connected Component Analysis to find the most probable Pupil Centers' coordinates (Centroid of two largest blobs).

**Step5:** Use Adaptive Histogram Equalization to improve the Image Contrast and then apply Canny Edge algorithm to detect Edges.

**Step6:** Construct a Binary Mask using results from Step 3, 4 and 5 and apply to the original Image (Grayscale).

**Step7:** Use Delaunay Triangulation method to find the boundaries of the pupil.

**Step8:** Use Haar Cascade Classifier to detect Nose in the Image. Evaluate the Centroid of the Bounding Box defining boundary of Nose. Filter out False Nose detected (False Positives) and No Nose Detected (False Negatives) using Largest Blob Analysis.

**Step9:** Use the Pupil coordinates and the coordinate of Centroid of Nose region to evaluate the rotation and skew of the Facial Plane. Facial Plane is defined by the triangle with the pupils and nose of the face in the Image at its vertex points.

**Step10:** Calculate the change in Area and length of edges of Triangular Facial Plane and calculate the Gaze position of the subject.

**Trick:** Projection of a plane onto a base surface after it rotates always occupies lesser area than the area occupied by it when the plane rests on the base surface, as viewed from a steady point in space (i.e. a camera mounted on the top of Pediatric Perimeter that remains steady).

----- *Indranil Chandra* -----