



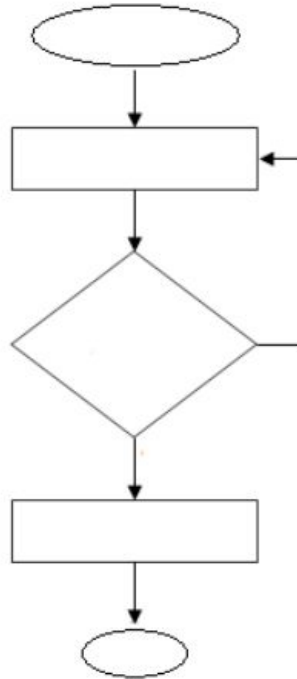
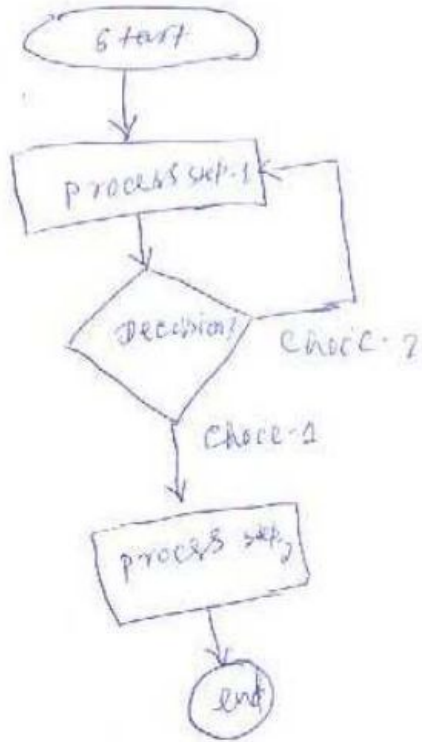
# *Recognition and Aestheticization of Offline Hand Drawn Flowcharts*

*Abhay Kumar Singh [UG201310003]  
Deepshi Garg [UG201313008]*

*Mentor : Dr. Gaurav Harit*



## *Problem Statement*



- ◆ Drawing flowcharts for formal presentations like this one is an inevitable overhead.
- ◆ Thus, we wish to develop an interface which takes the image of a flow chart drawn with free hand as an input, and outputs a refined version with minimal distortion and straightened lines.

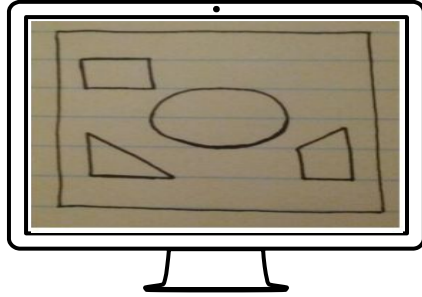


## *Deliverable*

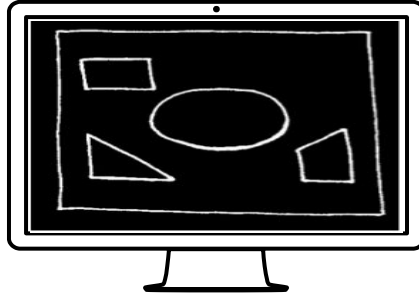
- ◆ A Python based desktop application with :
  - **Input** : Offline free hand image of a flowchart
  - **Output** : Aestheticized and refined image of the flowchart
  - \* This semester, we will work mainly on shape detection of hand drawn images and digitalize it.
- ◆ State the salient features
  - Easy GUI will be developed in Python Flask.
  - Algorithms of image processing implemented using OpenCV to remove errors and noise.



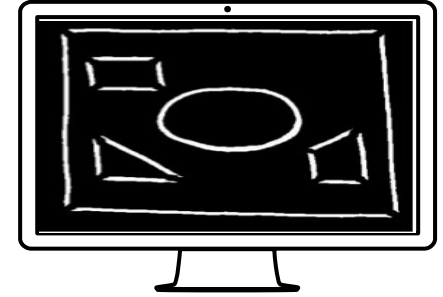
## *Process*



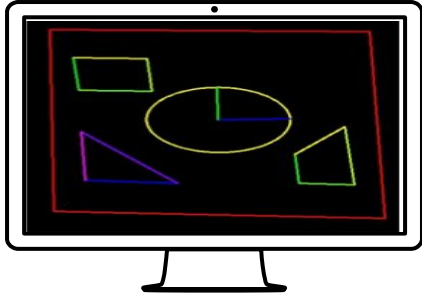
1. Input Image



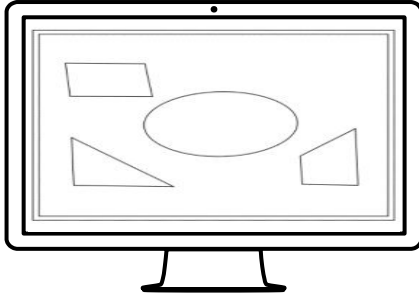
2. Binarized, Inverted, thinned and noise free dilated image



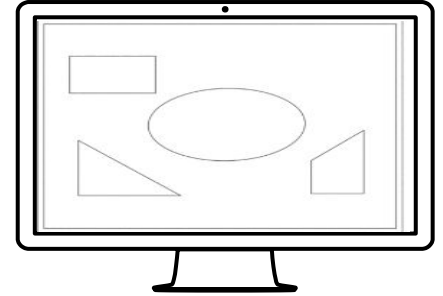
3. Corner detection and removal in polygon



4. Shape detection



5. Homography w.r.t bounding box.



6. Now image given to Shape detection algorithm



## *TimeLine*

**31st August** : Study Algorithms and existing literature, and narrow down the approach to be followed

**5th October**: Remove noises from the image and use hough transform to detect the lines.

**10th November**: Homography of the image with respect to the bounding box.

**20 September** : For non-arcng shapes, detect the corners and remove it.

**25th October**: Extend the detected lines for intersection and creating a polygon with straight edges

**20th November**: Polygon detection of the image generated and some other shapes like circle and arrow.

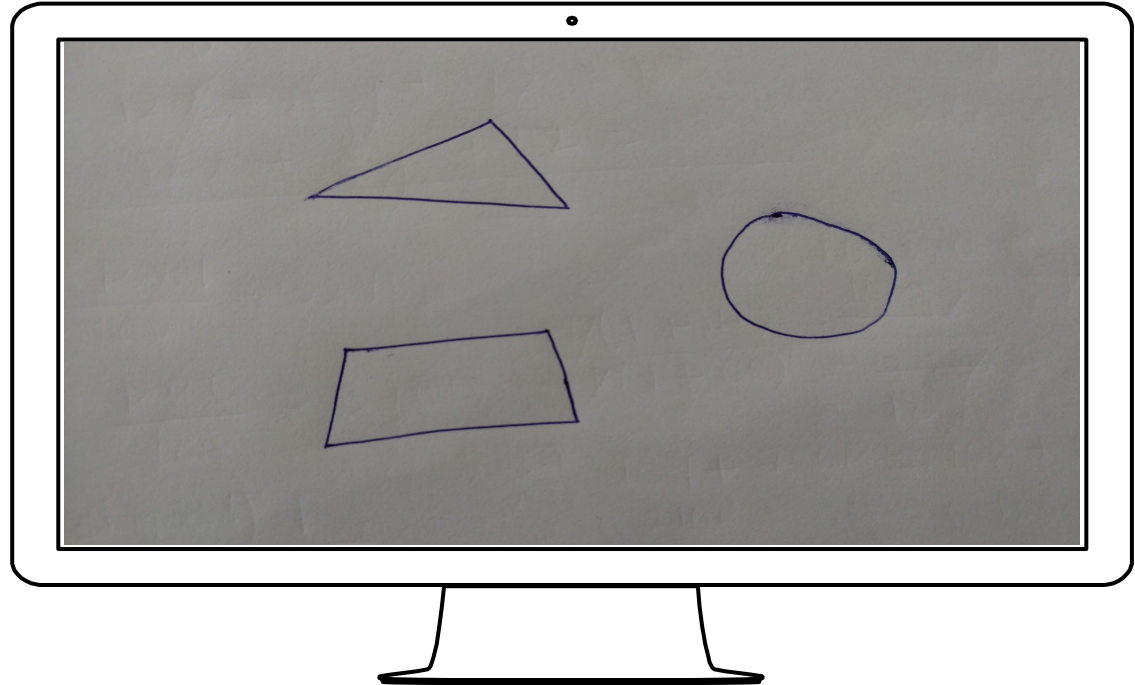
**24th September 2016** : 1st Presentation



## *Work Done so Far!*

### *1. Input Image*

A hand drawn image of polygons with noises, variable thickness and distorted edges.

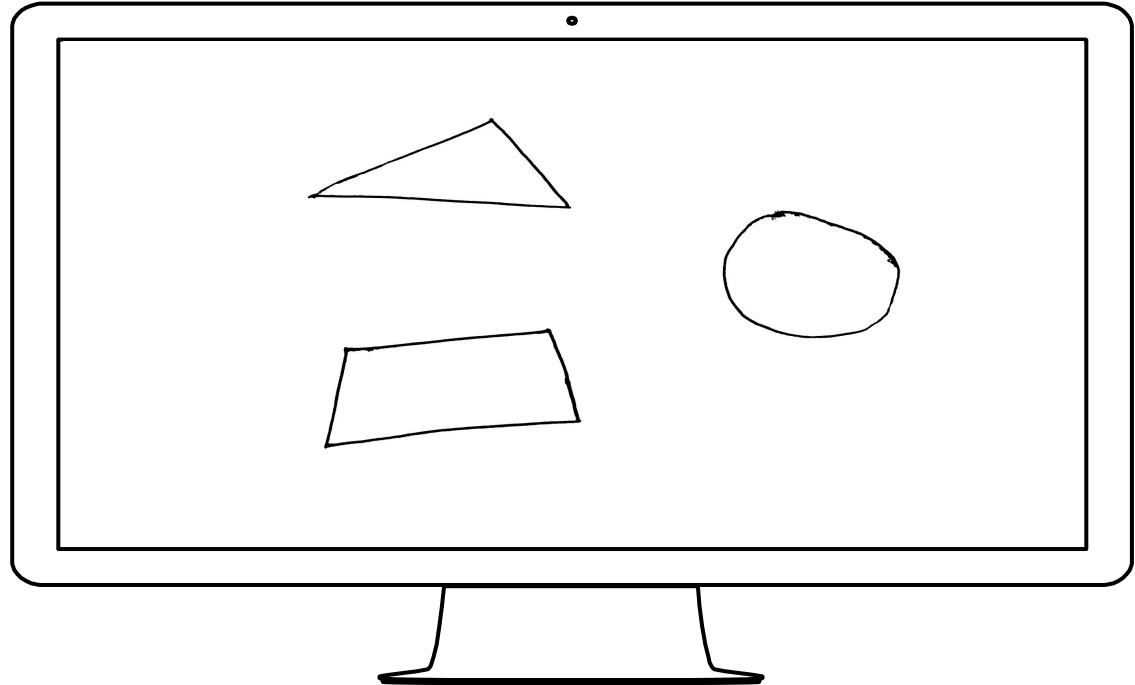




*Work Done so Far!*

## 2. *Binarized Image*

Image is binarized using  
OTSU Binarization

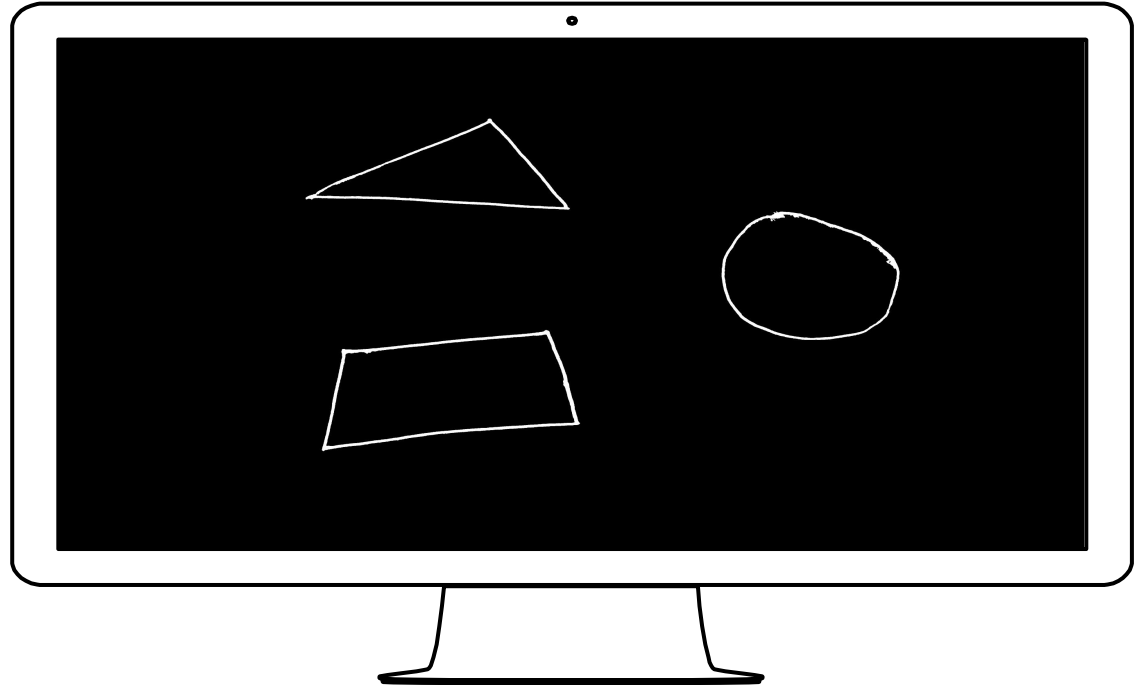




## *Work Done so Far!*

### *3. Inverted Image*

Image inverted so that it can be thinned. It is easy to remove noises in thinned image than a dilated image



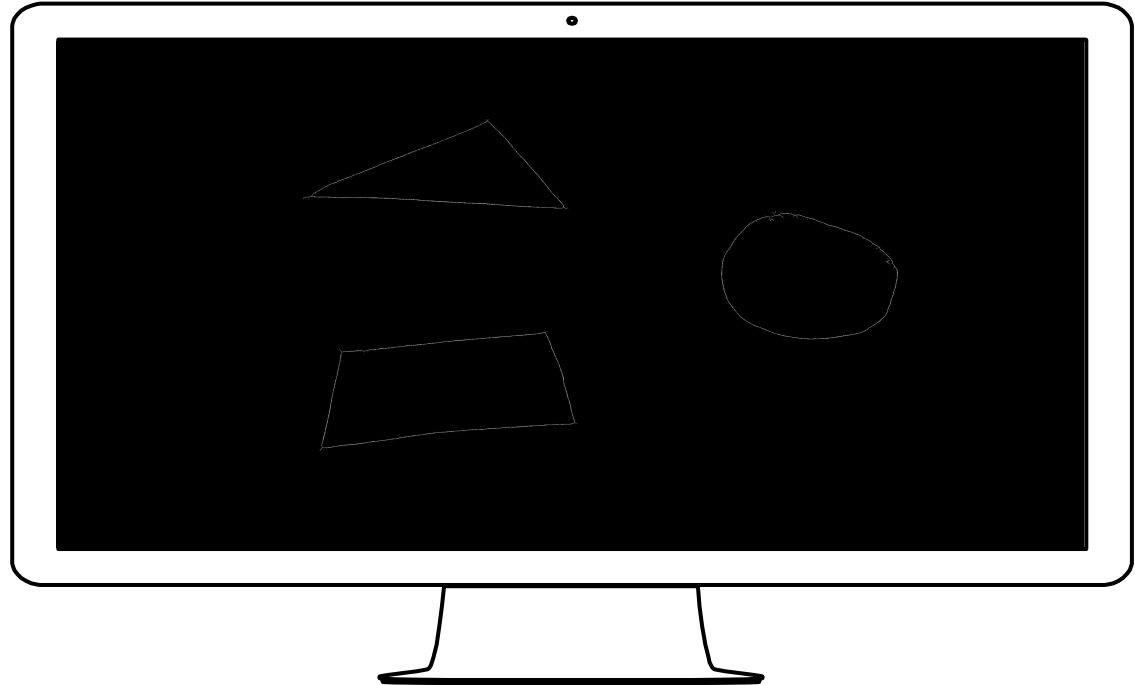




## *Work Done so Far!*

### *4. Thinned Image*

Now noise is removed from it using close morphology.

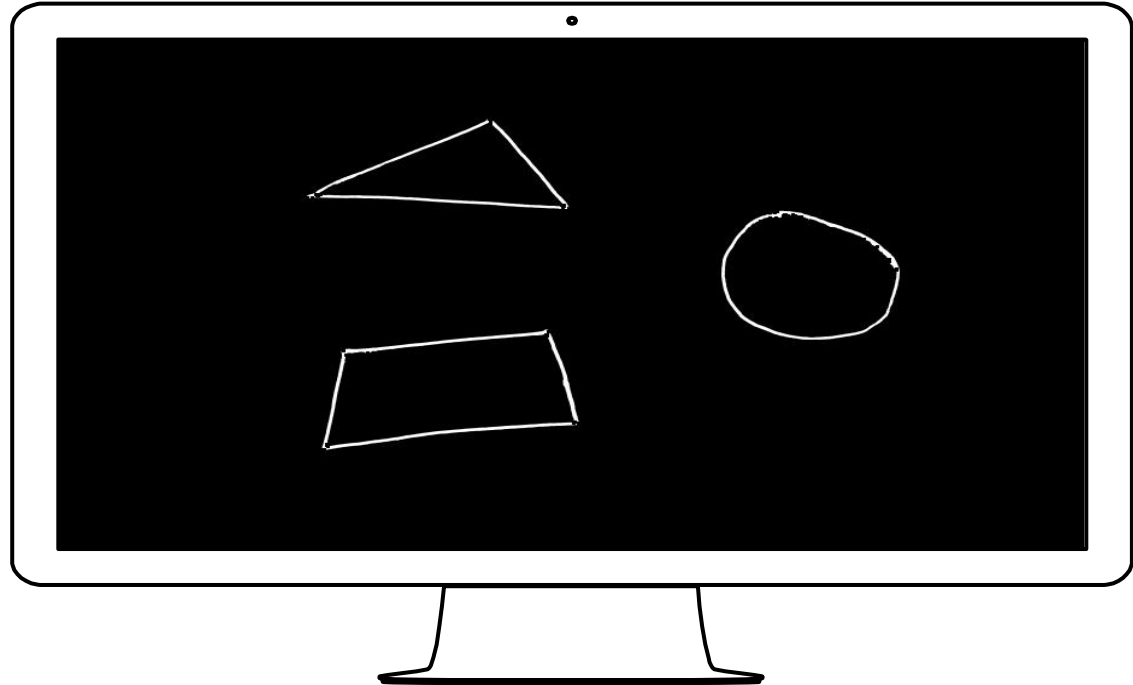




## *Work Done so Far!*

### *5. Dilated Image with corners removed*

Image is dilated for getting smooth edges and actual corners could be detected easily. After detection, corners are removed, image only left with distorted lines.





## *Work Distribution*

- Image Binarization using OTSU threshold. Thinning of images and use of morphology to clear noise. - **Deepshi Garg**
- Corner detection using Harris corner detector and its removal. Use of Hough Transform to detect the lines and generate it's end points to draw a straight line - **Abhay Kumar Singh**
- Line extension to detect first intersection and thus making a polygon out of it. - **Deepshi Garg**
- Homography of Image with respect to the bounding box. - **Abhay Kumar Singh**
- Polygon detection in result image. - **Deepshi Garg**
- Some other shapes detection like circle & arrow. - **Abhay Kumar Singh**



## *References*

- Following some of the research papers used as reference
  - Ahmed, M. & Wheeler, J., Generation of Slides from Hand-drawn Sketches,, *Stanford University*
  - Mishra, A.K., Eichel, J.A., Fieguth, P.W., and Clausi, D.A., VizDraw: A Platform to Convert Online Hand-Drawn Graphics into Computer Graphics, *University of Waterloo*
  - Wu, J., Wang, C., Zhang, L. and Rui, Y. Sketch Recognition with Natural Correction and Editing, *Shanghai University*. In *Proceedings of the Twenty Eighth AAAI Conference on Artificial Intelligence*
  - Rojas, R., Mobalegh, H., and Hansch, R.,. Digitization of Hand-drawn Diagrams



*Thank You!*

**Any questions?**