



- ▶ MOCHA - Minimal Optical Coffee Height Analysis
- ▶ Machine Vision
- ▶ Java

▶ **Digital Image Capture**

Cost v's Quality

Used relatively cheap digital camera

▶ **Image manipulation using filters and operators**

Median, threshold, max, edge detection, skeletonizing, ...

▶ **Inference**

Pulling knowledge from a digital image

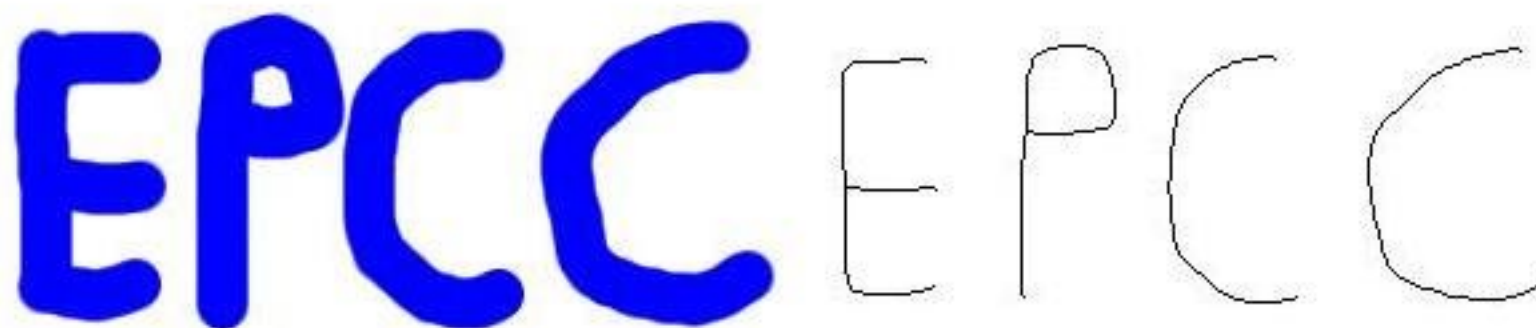
Coffee volume

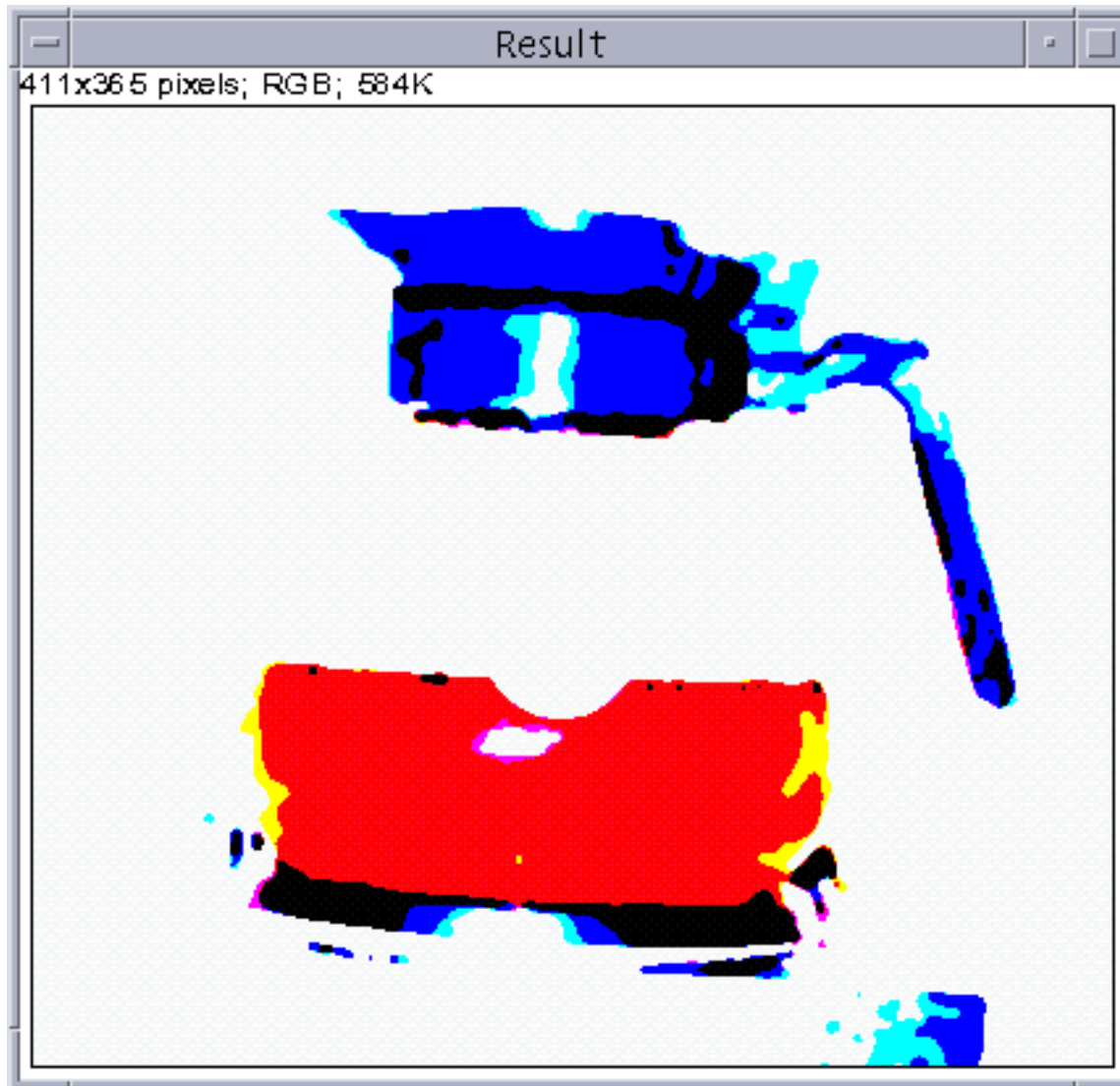
Hough transform

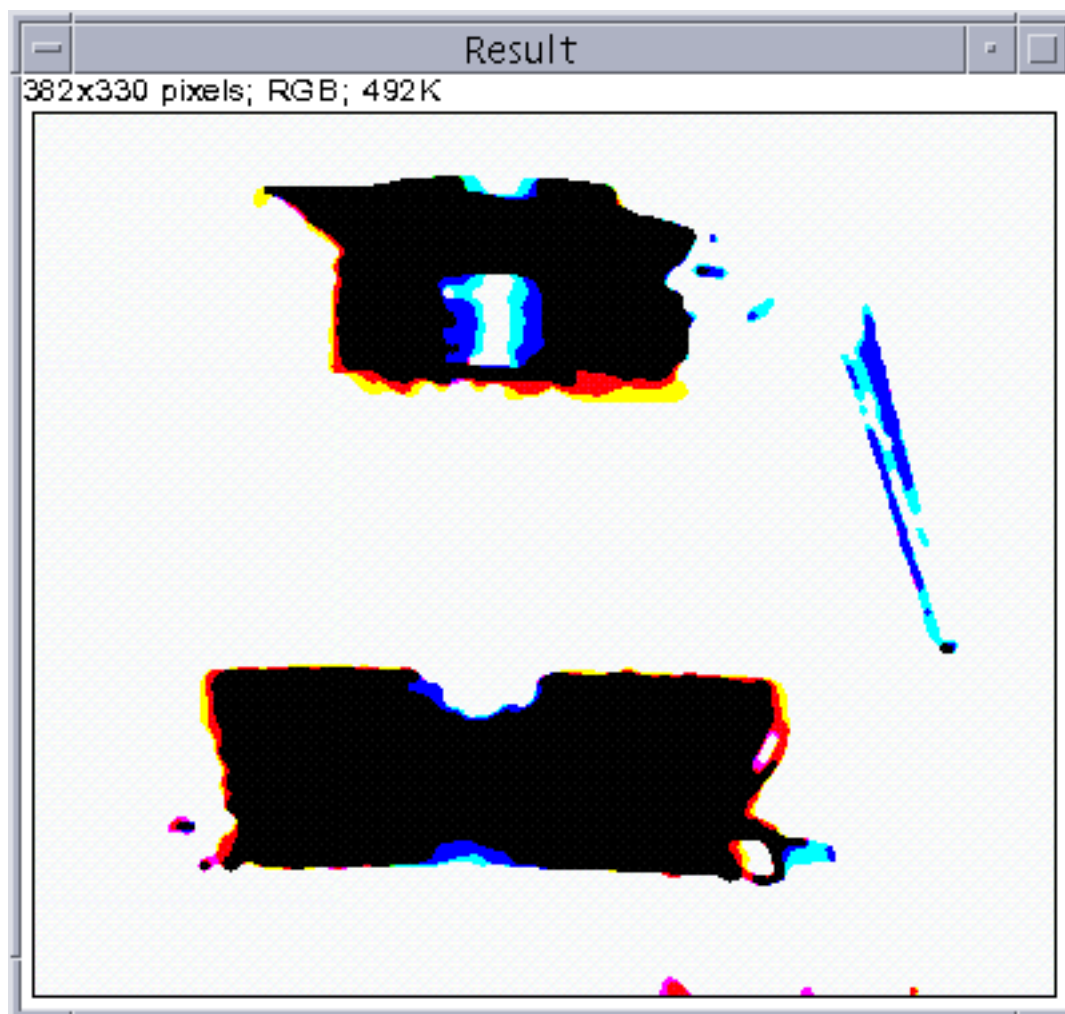
Classic detects straight lines

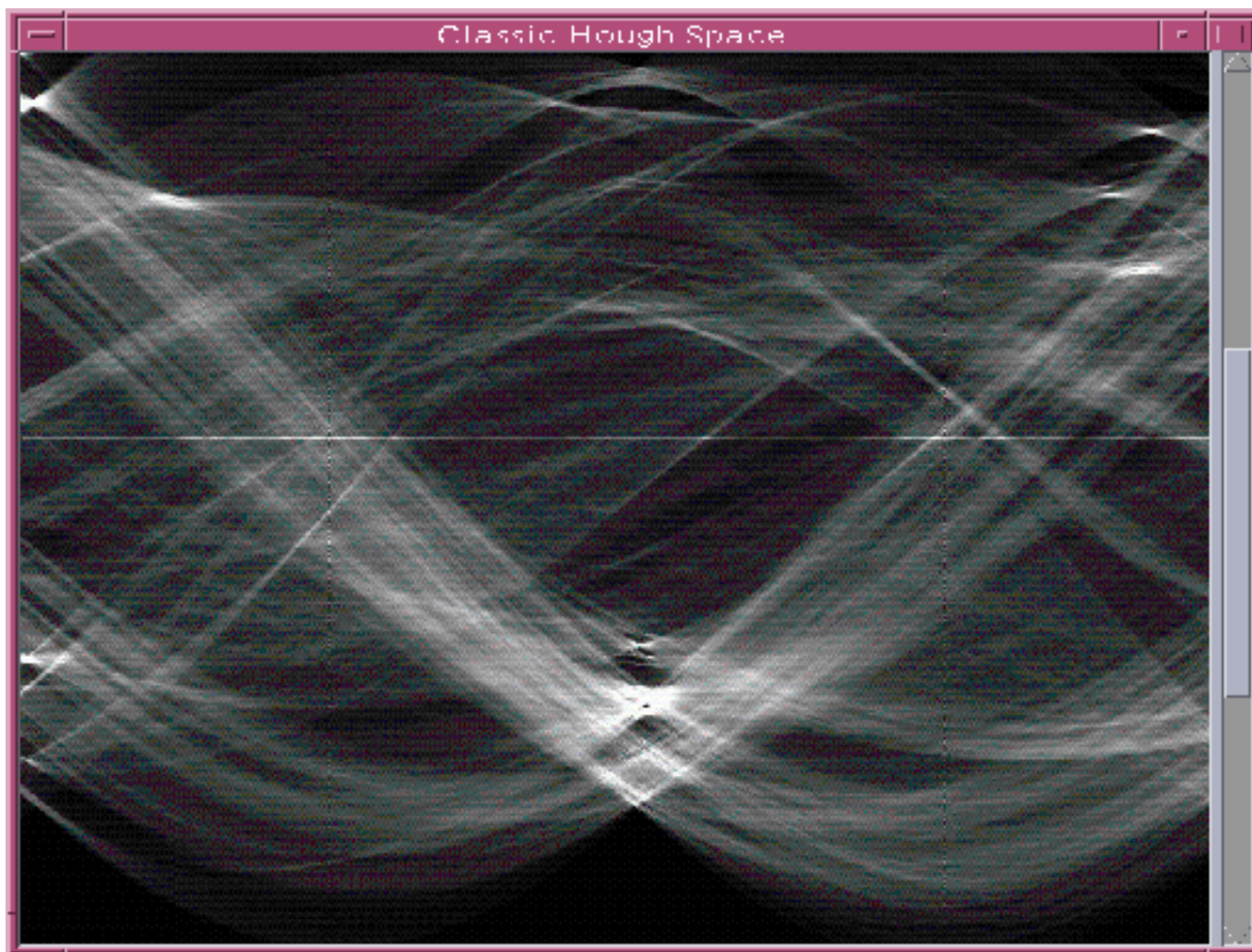
General detects precalculated arbitrary shapes







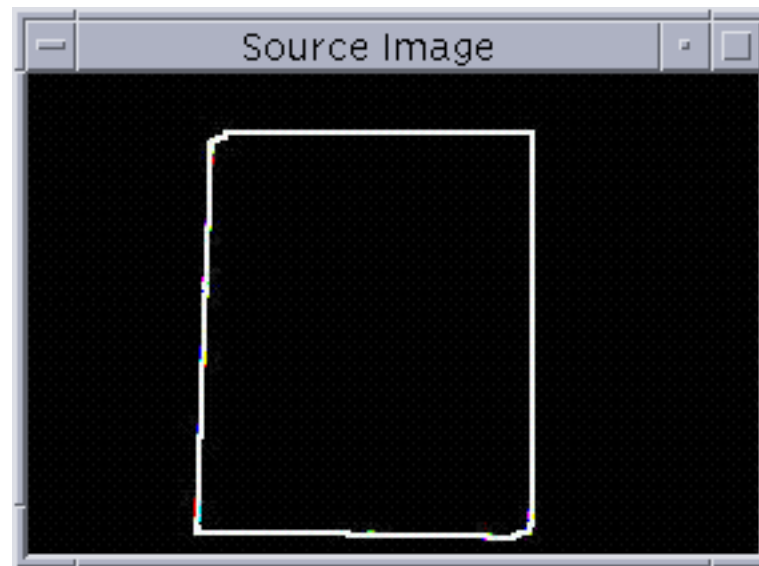




- ▶ Detects straight lines



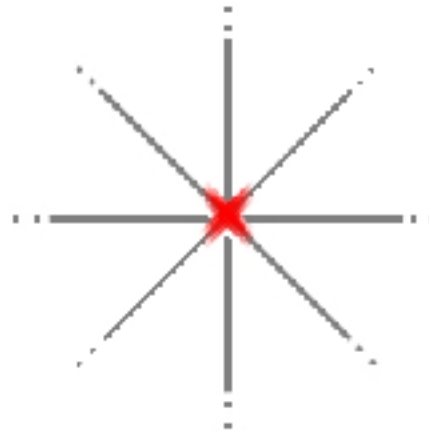
► Find edges



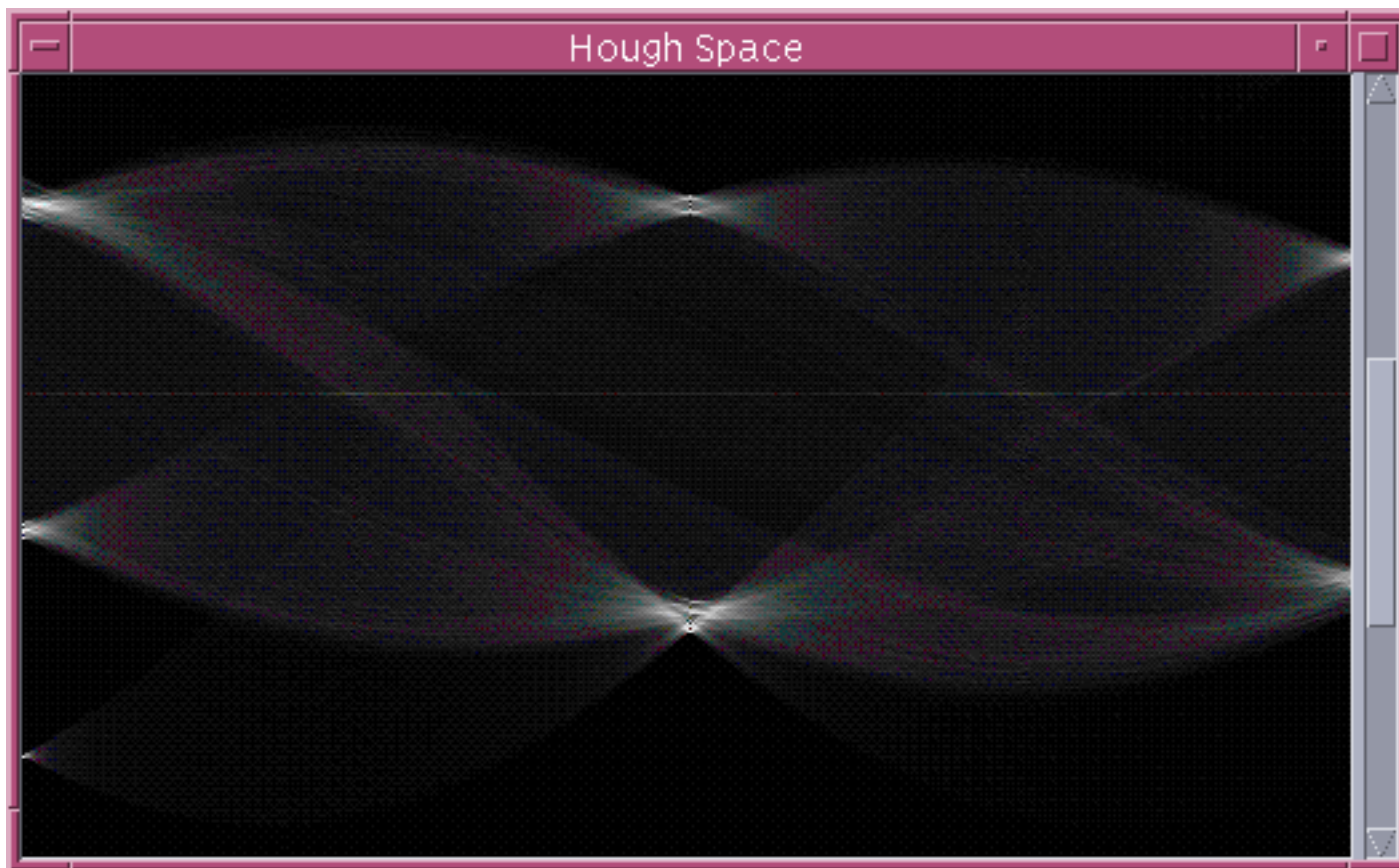
- ▶ Each point in an image votes for all the lines that go through it

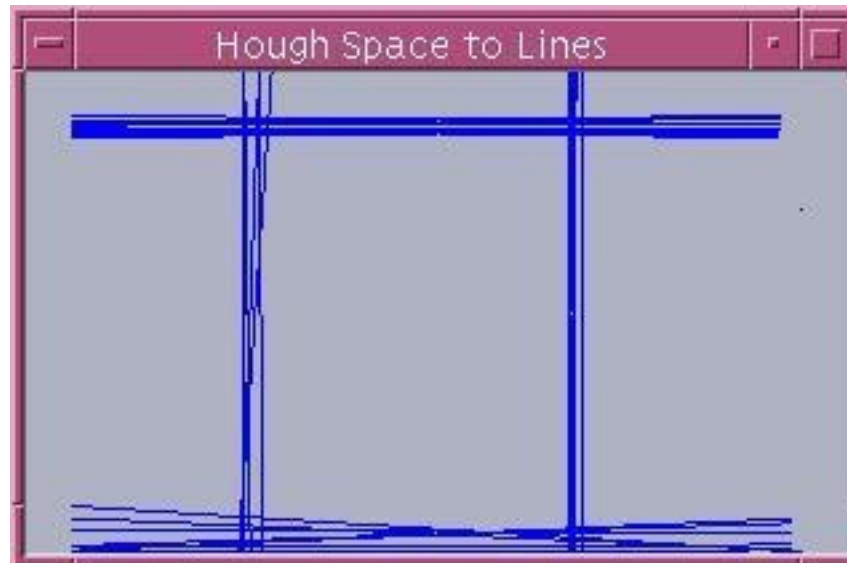
$$y = mx + c$$

$$x \cos(\theta) + y \sin(\theta) = r$$



▶ Hough space



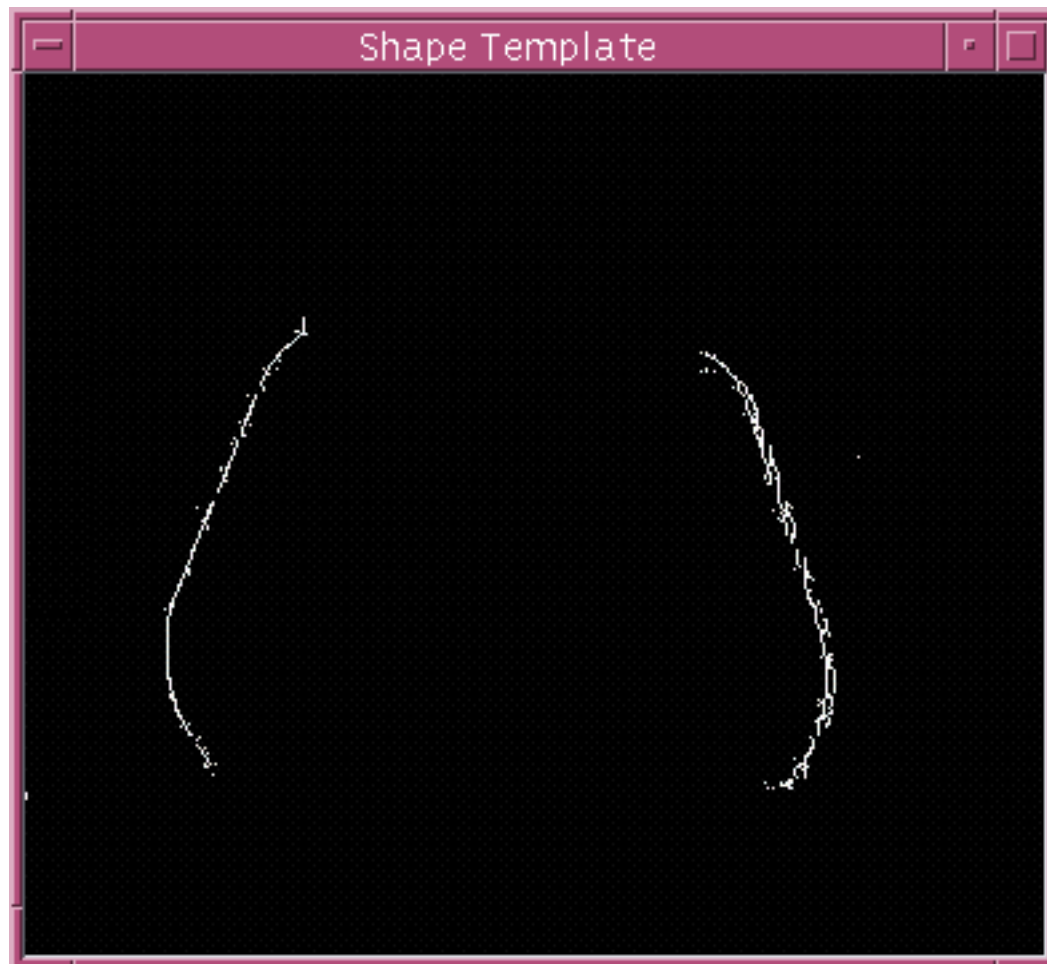


▶ Detects arbitrary shapes

Will add ability to detect rotated and scaled shapes



- ▶ Shapes must be built up from an image
 - Must have a reference point
 - Stores shape as an array of x, y difference pairs
- ▶ Each point in a digital image votes to say that it may be part of a shape





- ▶ Voting array is thresholded
- ▶ Any points remaining above the threshold limit indicate the likely presence of the shape in the original image

They actually represent reference points

These points can be used to map the shape back into image space



- ▶ Image manipulation toolkit in Java
- ▶ Machine vision can be done on the cheap
- ▶ Shape building functions
- ▶ Working classic and general Hough transform implementations
 - Need to play with to determine parameters for successful useage