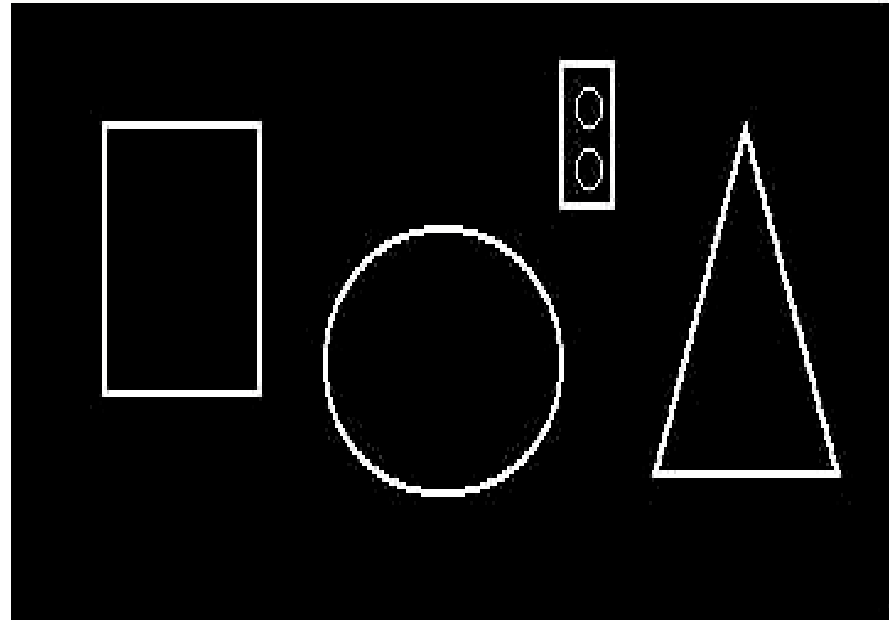


Hough Transform

- It locates straight lines
- It locates straight line intervals
- It locates circles
- It locates algebraic curves
- It locates arbitrary specific shapes in an image
 - **But you pay progressively for complexity of shapes by time and memory usage**

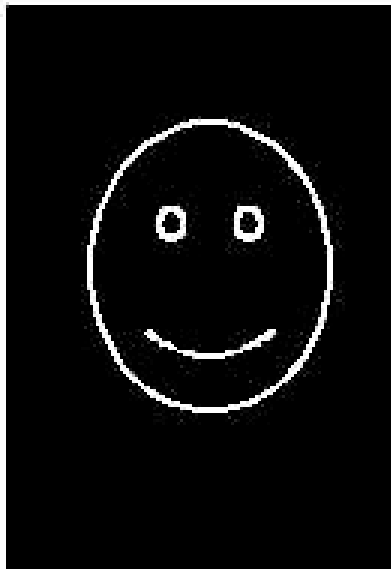


Hough Transform

- How does it do it?

- Works in 2 domains
- Votes possible representations of object you are looking for in Hough Space

Edge Detected Image



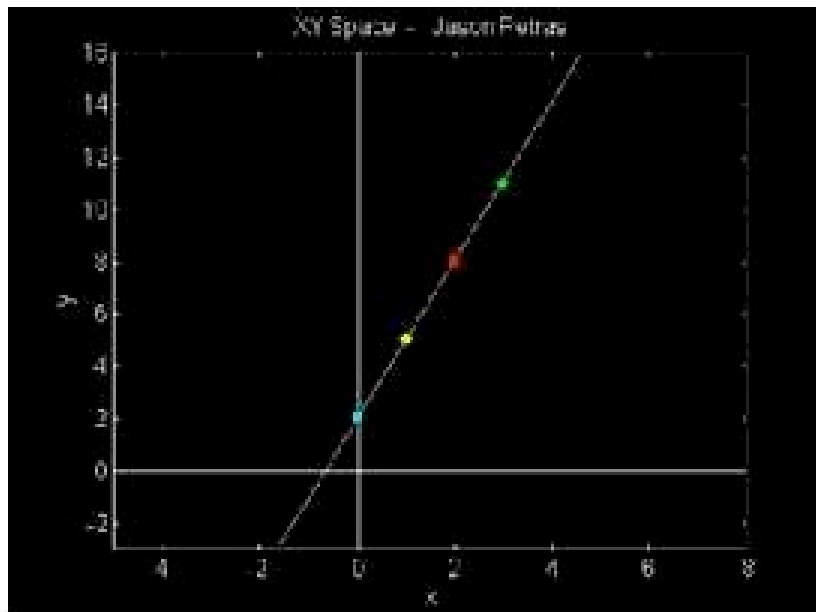
Hough Space / Vote Space



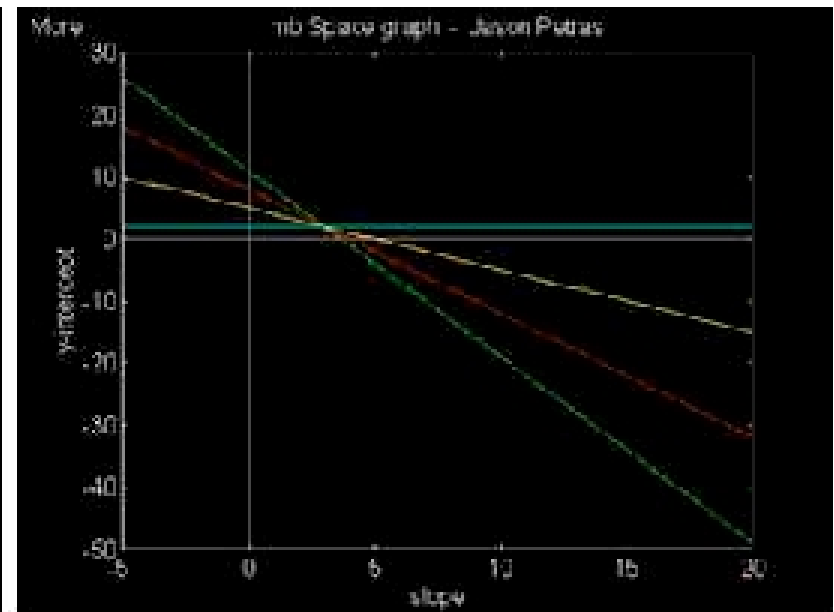
Hough Transform

- An Edge Pixel in Real Space would vote into Hough Space all possible lines that contain that point. $y = mx + b$
- Continue to Add Votes for different Edge Pixels
- Intersection Gives Equation for line

Edge Detected Image (Real Space)



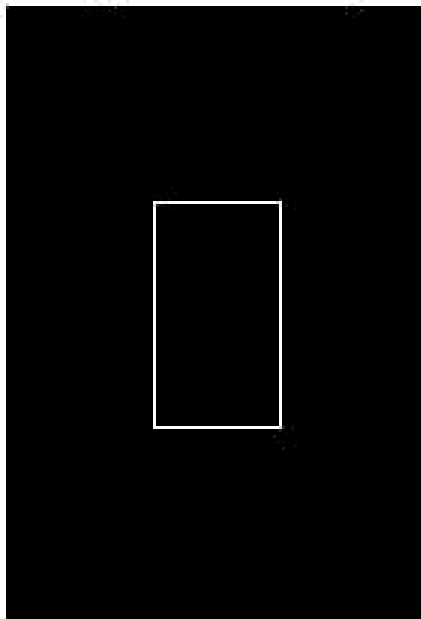
Hough Space



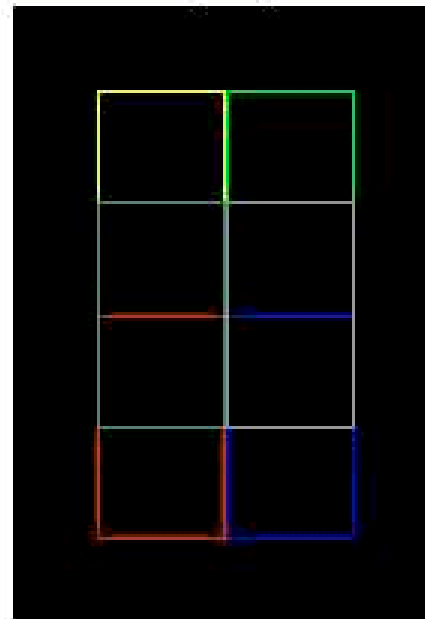
Hough Transform for Rectangles

- Same idea with a twist
 - Vote in Rectangles of shape and size you want.
 - Hough Space acts like just like an accumulation table.
- Votes will accumulate highest in center of rectangle!

Edge Detected Image



Hough Space



Voted Rectangles are produced from the pixels in the corners of the Edge Image and the middle of the two vertical sides.

Object Recognition

- A wise robot sees as much as he ought, not as much as he can
- Search for objects that are important
 - lamps
 - outlets
 - wall corners
 - doors
 - wall plugs

A mobile robot should be self-sufficient in power finding

Overview

- Framework of research
- Introduction to Images and Image Capturing
- Image Processing
 - *Canny Edge Detection*
 - *Hough Transforms*
- Putting it all together

Why?

- Monitor power level in robot's batteries
- When power goes low, interrupt actions
- Search for the wall plug
- Traverse over to it
- Plug itself to it in.

Image Processing, How's

- Currently there are many, many ways to approach this problem

Segmentation	Band Pass filtering	Mesh Warping
Edge Detector	Morphologic Filtering	Morph Dilator
alpha filtering	Contrast	Morph Close
DPC Compression	Skape	Thinning
Euler	Least Squares Restoration	Growing
Perimeter	Hex Rotate	FFT
Fractal	Haar Transform	IFFT
Gaussian filter	Mean Filtering	DFTs

- Personally divided into two groups:
 - Reduction
 - Interpretation

Image Processing, How's

- Reducing the amount of information
- Small in size, Huge in information

Before.....

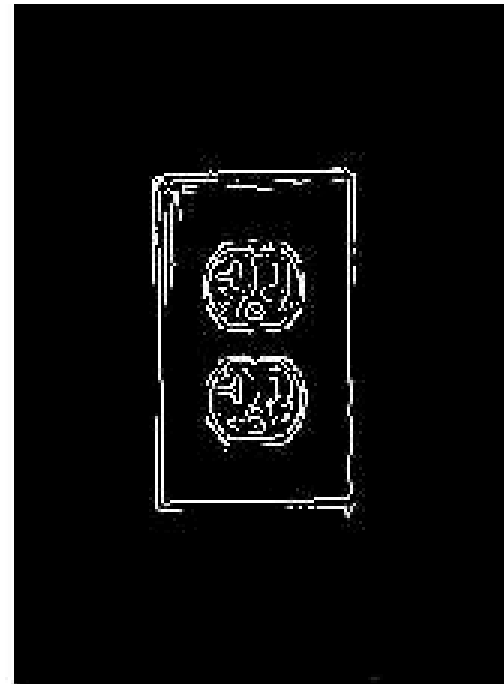
197	42	101	8	58
6	235	185	219	97
79	188	145	115	29
210	154	58	33	103
97	189	28	172	201
233	137	228	30	88
190	7	144	78	147
139	209	197	48	116
142	90	53	2	71
18	148	113	31	214
91	99	48	93	88
117	149	211	225	239
89	89	202	78	145
62	161	14	55	99
75	12	93	96	199
106	136	208	169	18
194	91	63	190	189
3	35	101	42	23
227	2	35	180	170

.....After

0	0	0	0	196
0	0	0	0	162
0	200	0	186	111
0	201	0	11	0
0	142	0	138	0
0	210	0	90	0
0	225	0	81	0
0	0	195	250	0
0	0	72	0	0
0	0	83	0	0
0	0	72	0	0
0	0	22	0	0
0	0	0	0	0
0	0	0	0	0
181	0	0	0	0
39	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

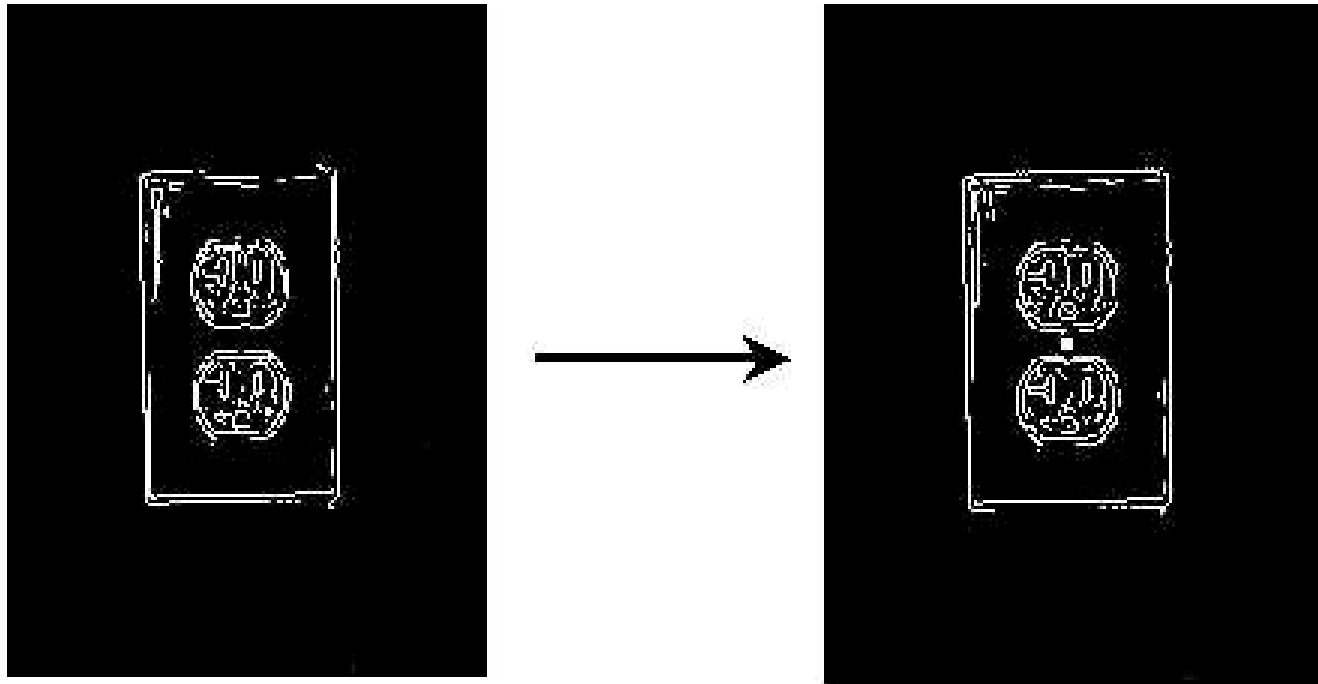
Canny and Hough Together

■ Image -> Canny



Canny and Hough Together

- Canny -> Hough for Rectangles



Canny and Hough Together

- Hough -> Finding the Rectangle!

