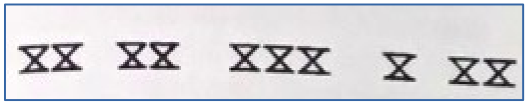
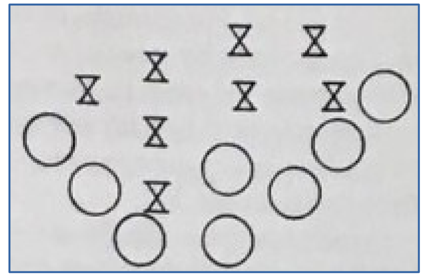
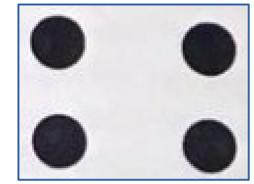
Seven Rules From Psychology



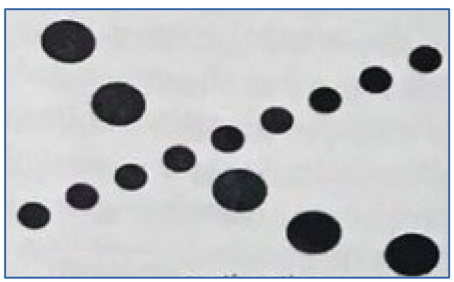
Rule 1: Proximity



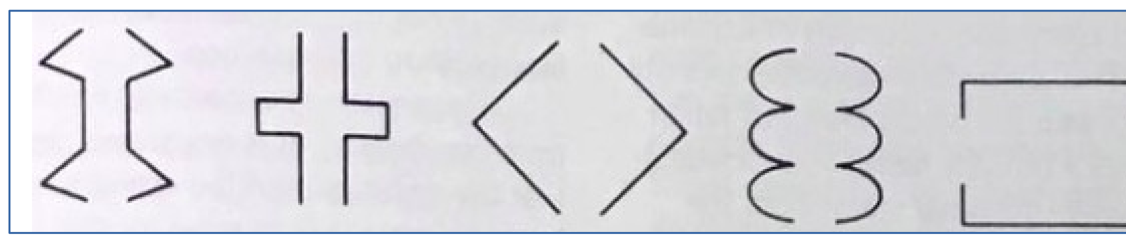
Rule 2: Similarity



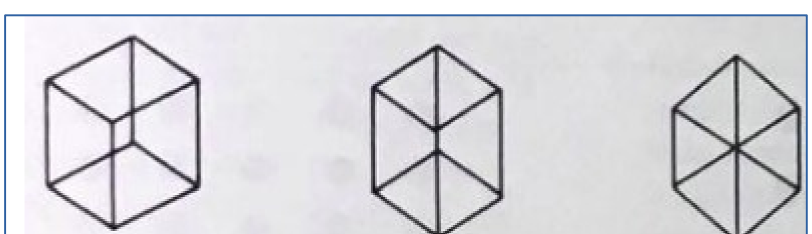
Rule 3: Closure



Rule 4: Good continuation



Rule 6: Symmetry



Rule 7: Simplicity

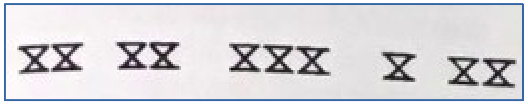
First Where To Get Shapes Information

From the boundary information

What is boundary?
   Color?
   Edge? Intensity change among homogeneous intensity regions?

How to compute the above information based on OpenCV?

Rule 1 Proximity



Rule 1: Proximity

OpenCV programs:

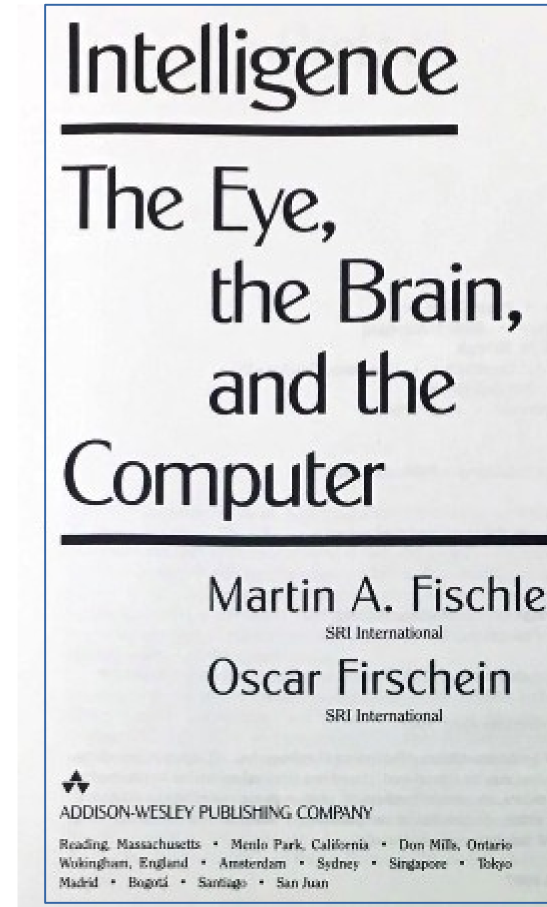
Step 1. Image Enhancement, to get rid of noise and to get better characteristics of the pattern or patterns to be detected.

$\boxed{\text{Filter2D( )}}$

$\boxed{\text{GaussianBlur(src, dst, Size(i, i), 0, 0);}}$

Step 2. Feature Detection, e.g., to extract patterns of crosses

Step 3. Grouping based on certain common attributes, in this case, all “crosses”



Intelligence

The Eye, the Brain, and the Computer

Martin A. Fischler
SRI International

Oscar Firschein
SRI International

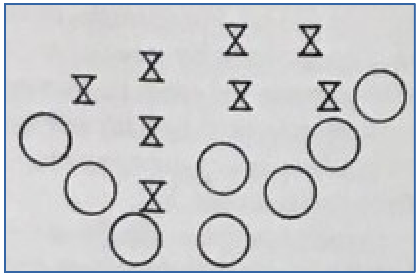
ADDISON-WESLEY PUBLISHING COMPANY

Reading, Massachusetts • Menlo Park, California • Don Mills, Ontario
Wokingham, England • Amsterdam • Sydney • Singapore • Tokyo
Madrid • Bogotá • Santiago • San Juan

General reference on Vision Psychology

Rule 2 Similarity

Write an OpenCV program to compare similarity. See OpenCV "sample" folder,



Rule 2: Similarity

OpenCV programs:

1. Use contours as the starting point to find boundaries

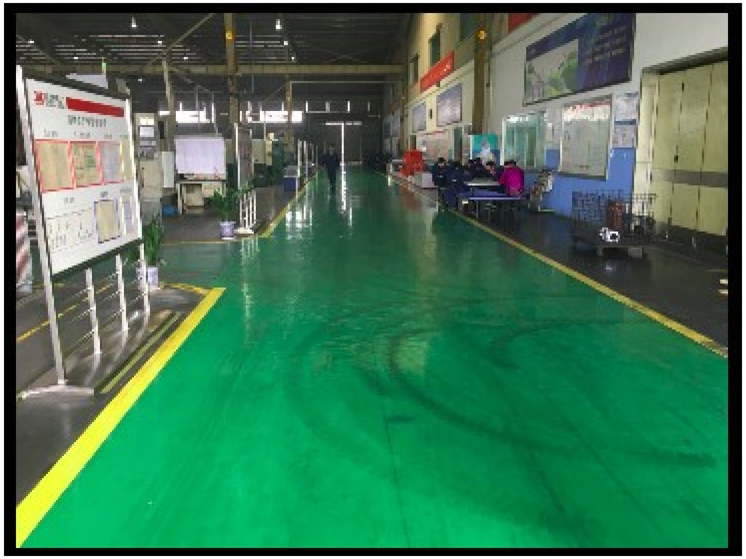
2. Use contour analysis with boundaries information to define shapes

3. Then use 7-rules to realize pattern recognition tasks

/home/harry/Documents/3-project/3-2-Path/3-2-0-VideoPathLines/3-2-0-1-utility /3-2-1-1-9-bestMatch

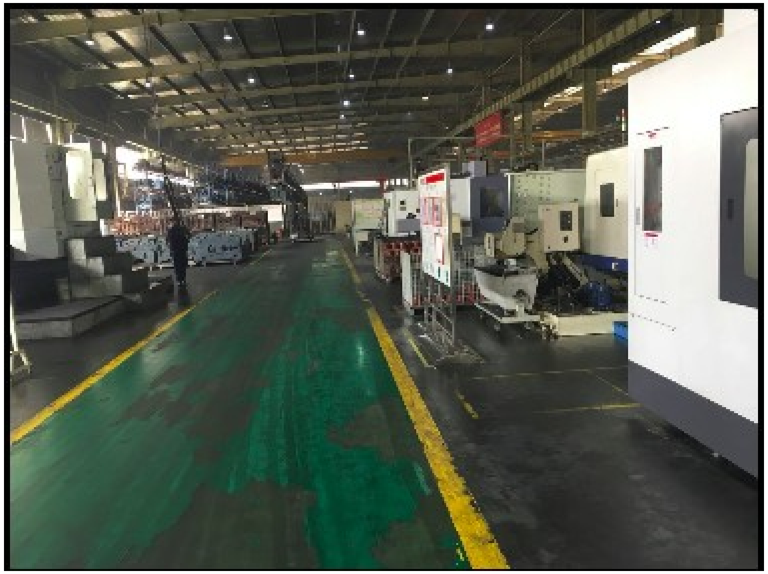
Use This Photo To Compute As An Example

CAT I Green Path + Reflection



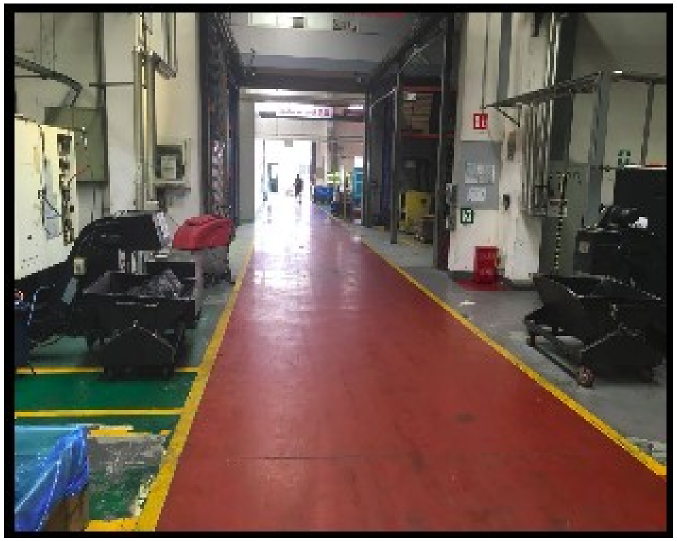
/home/harry/Documents/3-project/3-2-Path/3-2-0-VideoPathLines/3-2-0-1-utility /3-2-0-1-1-video/photos/5744.jpg

/home/harry/Documents/3-project/3-2-Path/3-2-0-VideoPathLines/3-2-0-1-utility /3-2-0-1-1-video/photos/1428.jpg



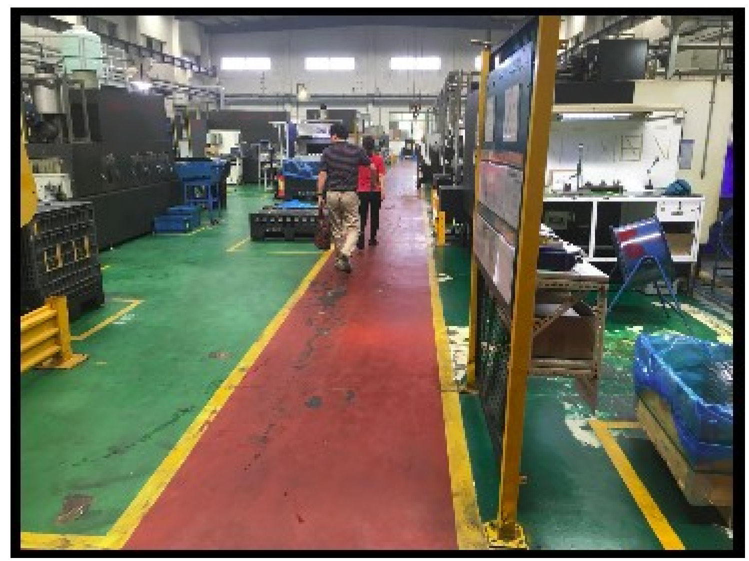
/home/harry/Documents/3-project/3-2-Path/3-2-0-VideoPathLines/3-2-0-1-utility /3-2-0-1-1-video/photos/1580.jpg

CAT II Non Green Path + Reflection



/home/harry/Documents/3-project/3-2-Path/3-2-0-VideoPathLines/3-2-0-1-utility /3-2-0-1-1-video/photos/ 7827.jpg

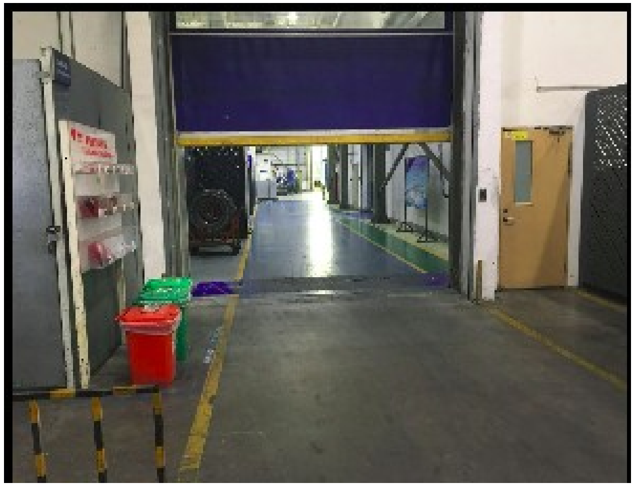
/home/harry/Documents/3-project/3-2-Path/3-2-0-VideoPathLines/3-2-0-1-utility /3-2-0-1-1-video/photos/9021.jpg



CAT III Belt With No Green Path + Reflection Or Belt With All Green (Or Colored) Floor

/home/harry/Documents/3-project/3-2-Path/3-2-0-VideoPathLines/3-2-0-1-utility /3-2-0-1-1-video/photos/2850.jpg

/home/harry/Documents/3-project/3-2-Path/3-2-0-VideoPathLines/3-2-0-1-utility /3-2-0-1-1-video/photos/5856.jpg



/home/harry/Documents/3-project/3-2-Path/3-2-0-VideoPathLines/3-2-0-1-utility /3-2-0-1-1-video/photos/5932.jpg

Seven Golden Rules For Vision Cognition

IP110 Jun 27th, 2018.

Computer Vision. Harry LI 1/.

Today's Topics: 1° Histogram Equalization.

2° Binary Image Analysis.

github/hualili/opencv/IP110-Summer18

1° Mat; 2° filter2D( ); 3° GaussianBlur( );

4° Sobel Edge Detector; f lowCase 5°. Laplacian( );

Background Cognition of 3D Environment via Vision System.

7 Rules Derived from Human Visual System:

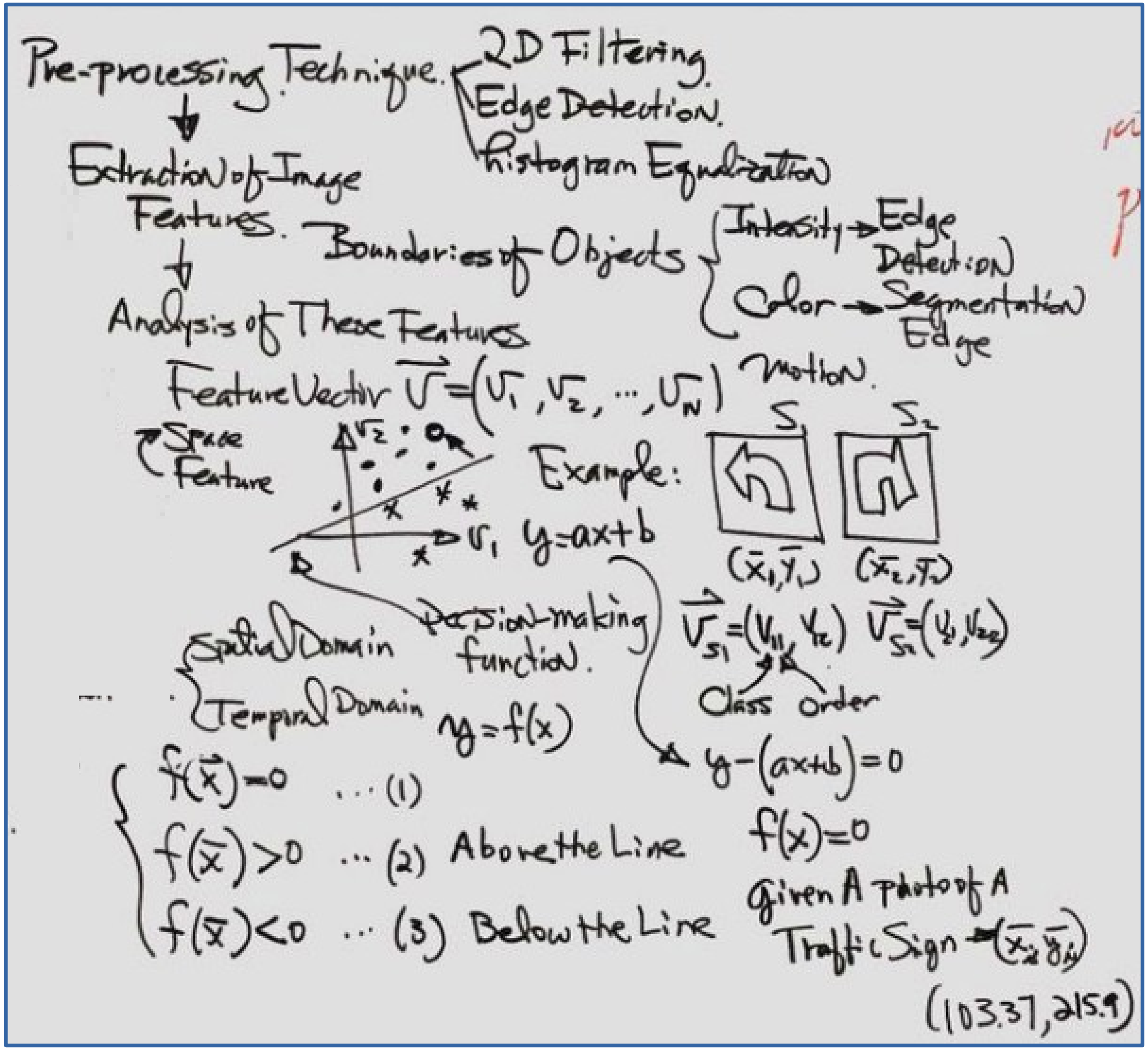
1° Proximity, 2° Similarity. 3° Closure 4° Good Continuation

"X" O

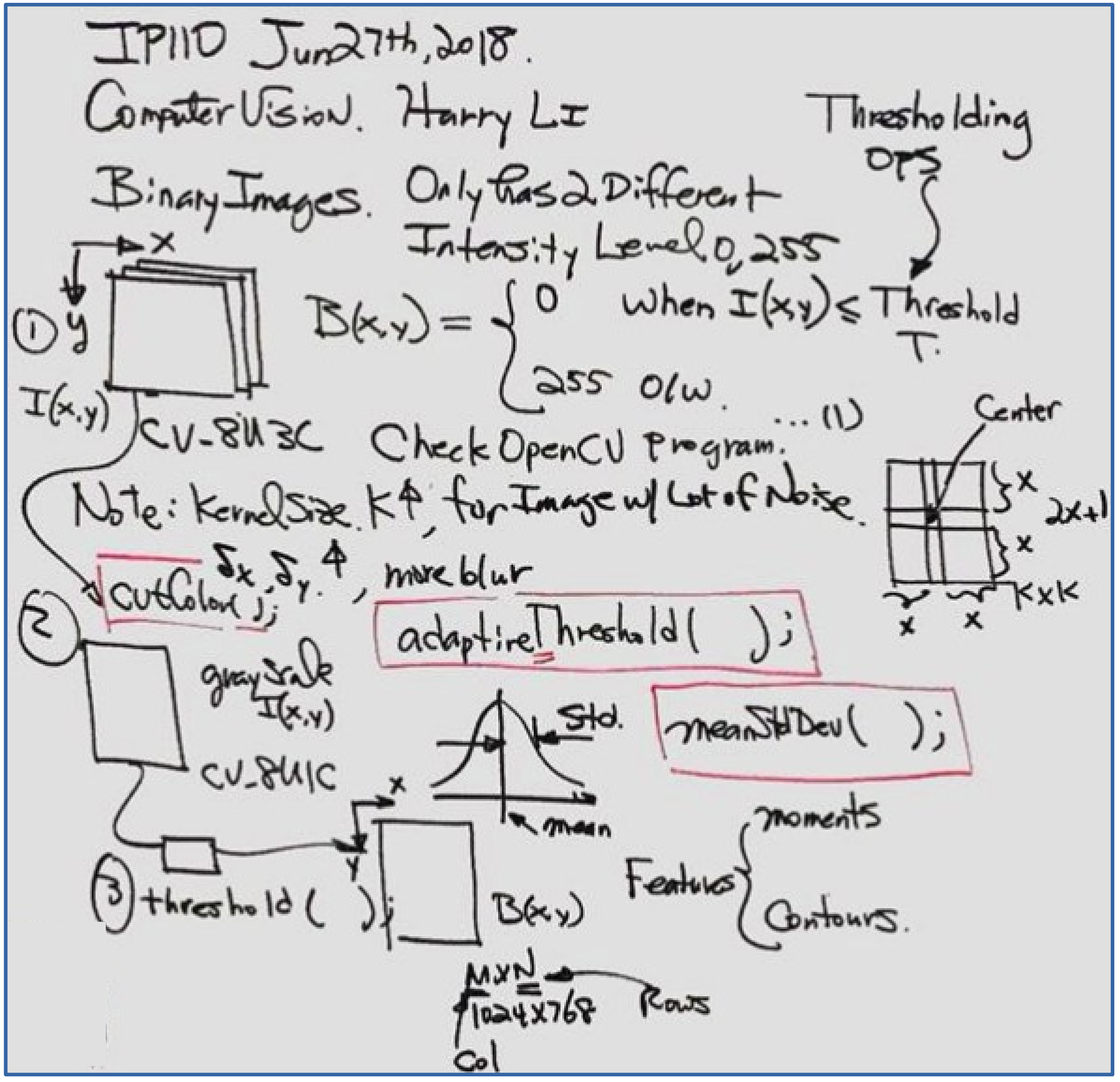
5° Symmetric Property. 6° Simplicity.

Boundary { Edge. Intensity Region. Color motion.

Feature Vectors And Decision Making Functions



Threshold Function And Binary Image



X-bar Y-bar And Moment Functions

moments

$$\bar{x} = \frac{\iint_\Omega x\, B(x,y)\,dx\,dy}{\iint_\Omega B(x,y)\,dx\,dy} \quad \cdots (1)$$

$$\bar{y} = \frac{\iint_\Omega y\, B(x,y)\,dx\,dy}{\iint_\Omega B(x,y)\,dx\,dy} \quad \cdots (2)$$

Example:

$Y \downarrow \; \rightarrow X$

$$B(x,y) = \begin{bmatrix} 0 & 255 & 0 \\ 0 & 255 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$\bar{x} = \sum_{y=1}^{3}\sum_{x=1}^{3} x B(x,y) \Big/ \sum_{y=1}^{3}\sum_{x=1}^{3} B(x,y)$$

where $\sum_{y=1}^{3}\sum_{x=1}^{3} B(x,y)$

$$= \sum_{y=1}^{3}\left(B(1,y) + B(2,y) + B(3,y)\right)$$

$$= \sum_{y=1}^{3}\left(0 + B(2,y) + 0\right) = \sum_{y=1}^{3} B(2,y)$$

$$= B(2,1) + B(2,2) + B(2,3) = 255 + 255 + 0$$

$$= 255 \times 2 \Rightarrow \frac{1}{255}(255 \times 2) = 2 = \text{Area}_{(size)}$$

Then, $\sum_{y=1}^{3}\sum_{x=1}^{3} x B(x,y)$

$$= \sum_{y=1}^{3}\left(1 \cdot B(1,y) + 2 \cdot B(2,y) + 3B(3,y)\right)$$

$$= \sum_{y=1}^{3}\left(1 \cdot 0 + 2B(2,y) + 3 \cdot 0\right)$$

$$= \sum_{y=1}^{3} 2 \cdot B(2,y)$$

$$= 2 \cdot \sum_{y=1}^{3} B(2,y)$$

$$= 2 \cdot 2 = 4.$$

Hence,

$$\bar{x} = 4/2 = 2$$

Moment Functions