

EECS101 Discussion 4

Edge Detection Using Sobel Operator

- ▶ Sobel Operator

$$\frac{\partial E}{\partial x} = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

$$\frac{\partial E}{\partial y} = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix}$$

- ▶ Apply $\frac{\partial E}{\partial x}$ to the image and take the **absolute value**.
- ▶ Output image size: 480 x 640 (assign 0s to borders) or 478 x 638 (ignore borders)
- ▶ Normalize the absolute values to [0,255] to **display**
Normalization: dividing each pixel by the maximum value of the whole image and multiply by 255
- ▶ Repeat the process for $\frac{\partial E}{\partial y}$

Sobel Operator in direction x & border problems

(Details on board in lab)

B1	B1	B1	B1
B1	B1	B1	B1
B1	B1	B1	B1
B2	B2	B2	B2
B2	B2	B2	B2
B2	B2	B2	B2

*	*	*	*
*	0	0	*
*	0	0	*
*	0	0	*
*	0	0	*
*	*	*	*

Squared Gradient Magnitude

- ▶ $SGM = \left(\frac{\partial E}{\partial x}\right)^2 + \left(\frac{\partial E}{\partial y}\right)^2$
- ▶ Use **original** $\frac{\partial E}{\partial x}$ and $\frac{\partial E}{\partial y}$ (values before normalization) to compute SGM
- ▶ **Normalize SGM image to 0–255 for displaying purpose.**
- ▶ **Binary image**
 - Use the histogram of SGM to choose threshold values
 - Edges: **255**(object); Background: **0**

HW4 Submission Guideline

▶ Demo

- 1. Show your working directory without any .ras images.
- 2. Compile and run you code.
- 3. Show your working directory in step 1 with NEWLY generated gradient images in x and y, SGM, and the binary images of the edges.
- 4. Show the 12 newly generated images and **describe** which image you are displaying. E.g., this is the result of the Sobel operator in direction x of image1, this is the image of the SGM of image 1, etc.

Rubric

- ▶ Total 100 points
 - 5 points for submitting your program (in .c)
 - 20 points for the demo
 - 25 points for each of the three images
 - 10 for the two gradient images
 - 10 for SGM image
 - 5 for the binary image