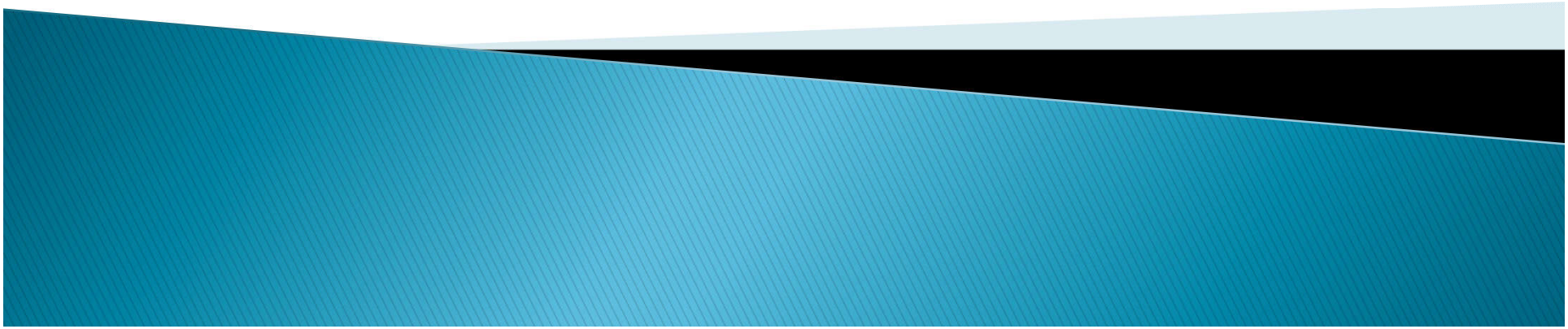
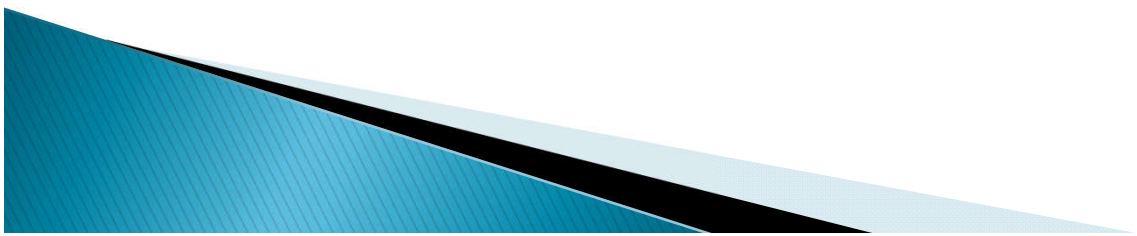
EECS101 Discussion 5

Feb 10, 2017



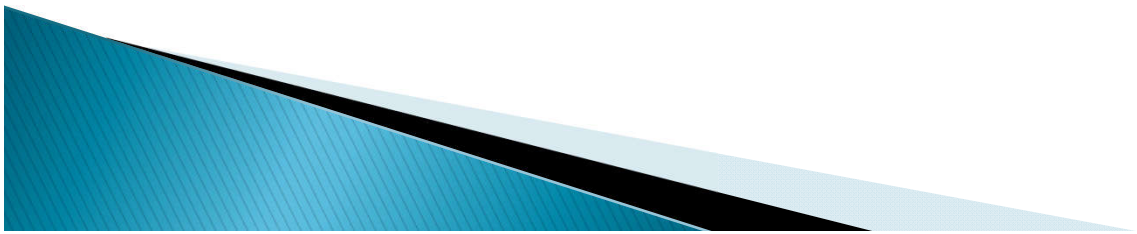
Binary SGM Image

- Compute the SGM image
  - $\text{SGM} = (\frac{\partial E}{\partial x})^2 + (\frac{\partial E}{\partial y})^2$
- Use a threshold to create a **binary image.**



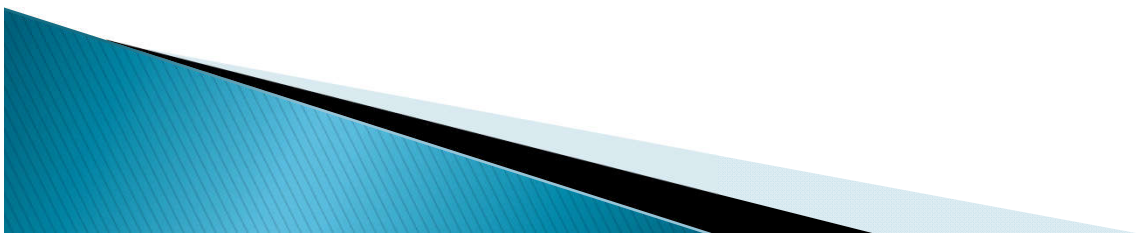
Hough Transform

- Hough transform for lines
  - $xsin(\theta)$−ycos(θ)+$\rho = 0, \theta \in [0, \pi]$,$\rho \in$R
- Pixels on the edges satisfy the equation. In other words, given (x,y), use the equation to solve for (θ, ρ)
- One equation, two unknowns
  - $Uniformly\ sample\ \theta\ in\ the\ value\ range\ and\ solve\ the\ equation\ for\ \rho$



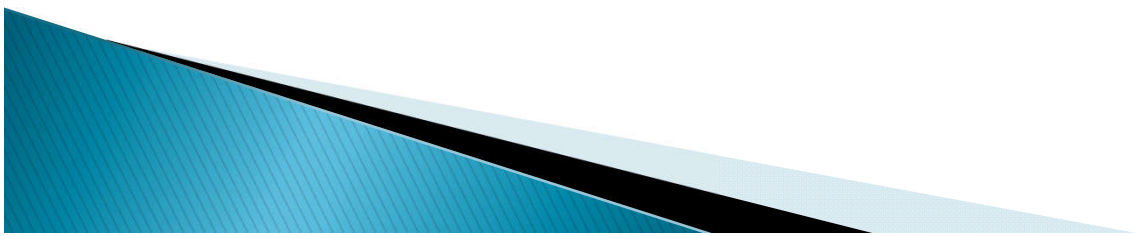
Hough Transform

- Quantize (ρ, θ) parameter
- Initialize accumulate function A(ρ, θ) to zero for each bin in (ρ, θ) space
- For each edge pixel in the edge map, compute ρ, θ corresponding to the edge from its position & direction. Set A(ρ, θ)=A(ρ, θ) + 1 for computed (ρ, θ)
- Large Local Maxima in A(ρ, θ) correspond to detected lines in the image.



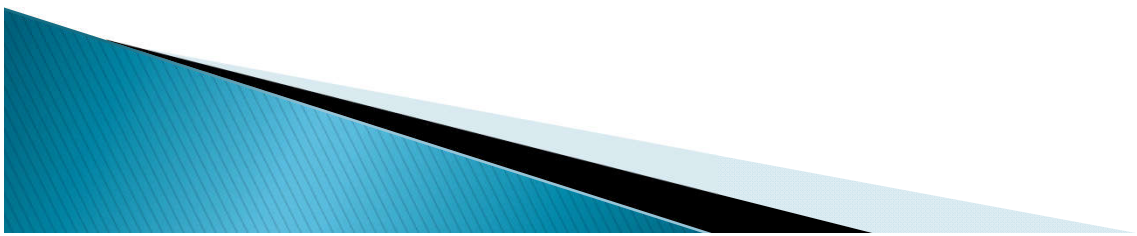
Construct a Voting Array

- After (θ, ρ) is found out, cast a vote at (θ, ρ) in the voting array
  - What data structure to use to represent the voting array [Best one is the 2D array since you are going to represent it as an image]
  - How large is the array [Keep track of the maximum and minimum]
  - How fine is the array [It is best to use increments of 1 for theta between 0 and 180 degrees (convert from radians to degrees first) and for rho from smallest value to largest value.]
  - ρ might be negative, how to use it as an index



Reconstruct an Image from the Array

- If you output your voting array as an image, you may see some noise in it.
  - Use a threshold such that it keeps the lines that are present in the original image and eliminates noise as much as possible
- Reconstruction from the array
  - Another application of the line equation. This time the opposite direction.
  - $xsin(\theta)$−ycos$(\theta)+\rho = 0, \theta \in [0, \pi], \rho \in$R
  - Given (θ, ρ), find out all the (x,y) that satisfy the equation and assign them value 255.



Submission Guideline

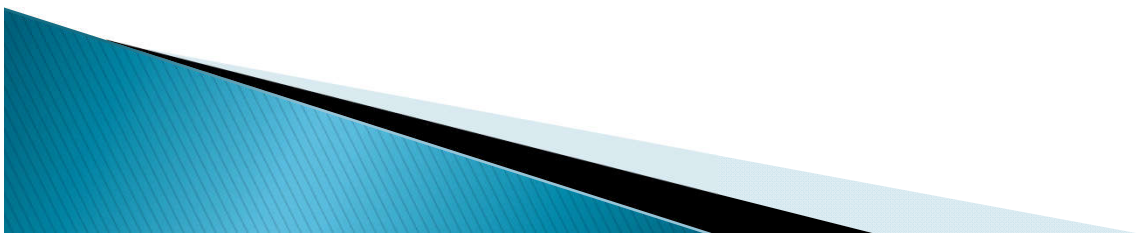
- Demonstrate your program by 3 pm, Feb 17.

  -show your binary image, local maxima and reconstructed image

  -we will see your code this time and ask you to explain random part of the code

- Submit your program and report (including the two images and comments) to EEE by Feb 17 midnight

  -After submission, please double check to make sure that you have submitted your homework successfully



Grading Criteria

- Total 100 points
  - 5 points for submitting a program
  - 10 points for demonstrating your program
  - 85 points for generating the two images and describing your approach
    - 15 points for the binary SGM image
    - 10 points for describing how you find out (θ, ρ)
    - 10 points for describing how you implement the voting array, i.e., what data structure you use, how large it is and why you make these decisions
    - 5 points for reporting the threshold used in thresholding the voting array
    - 15 points for reporting (θ, ρ) and corresponding votes selected by the threshold
    - 10 points for describing how you use the voting array to reconstruct the image
    - 20 points for the reconstructed image