Assignment 3

Submission Deadline: 04.06.25, 11:00 pm

Straight line detection based on Hough-voting

A) **Implement a function** that detects lines in an image based on **Hough-voting**.
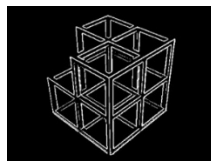**Do not use** the built-in OpenCV function *cv2.HoughLines()* (you may use it for comparison only). You are free to use the provided image (*input_ex3.jpg*) or your own photos containing visible straight lines. All utility functions mentioned below can be found in Moodle.

  a. Read the input image and convert it to a grayscale image with a value range $[0, 1]$. Plot the result image.

  b. Apply a GoG filter (from assignment 2) to derive gradient images in *x*- and *y*-direction and compute the gradient magnitude.

  c. Find and apply an appropriate threshold on the gradient magnitude to extract representative edge pixels. Plot the binary edge mask.

  d. Implement a function for Hough line detection:

     i. Input: Binary edge mask (from c) and gradient images (from b)

     ii. Output: Hough voting array H, index arrays for the ranges of θ and ρ

     iii. Hints:
       1. Use the polar line representation.
       2. Incorporate information about the gradient direction to speedup processing.

  e. Plot the resulting Hough voting array H. For better visibility, use the provided *imadjust* function.

  f. Find local maxima of H. You may use the provided utility function **houghpeaks**.

  g. Plot the found extrema on top of your figure in step f.

  h. Use the provided utility function **houghlines** to derive the corresponding line segments.
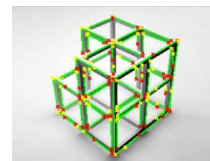
  i. Plot the lines on top of the figure of step a.

Sample results based on `input_ex3.jpg`:

input image   *binary edge mask*   *final overlay*

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