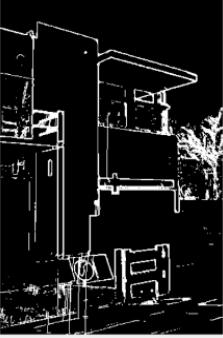
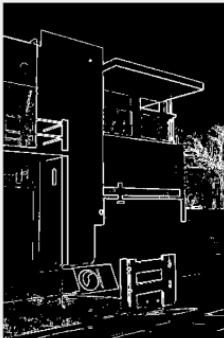


INFOIVB A3: Detecting Lines

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- the visualized line segments for various (at least three) parameter combinations, and a1 motivation for the best set of parameter values on the binary image.

			
(original image)	(image1)	(image2)	(image3)
peak threshold.	5	90	220
Minimum intensity for line pixels (minIntensityThreshold)	10	100	240

In this experiment, three parameter combinations with different values for the peak threshold and edge detection threshold were explored, while keeping minLength at 5 and maxGap at 3. The goal was to find the best parameters, allowing the Hough transform to highlight the most important lines in the image while reducing noise.

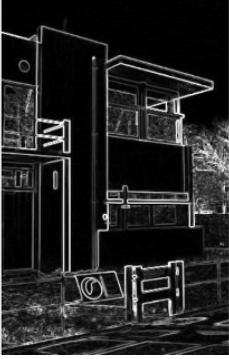
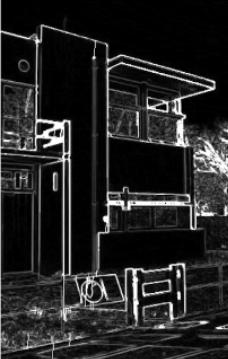
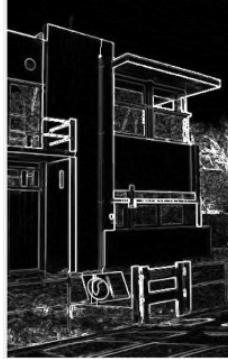
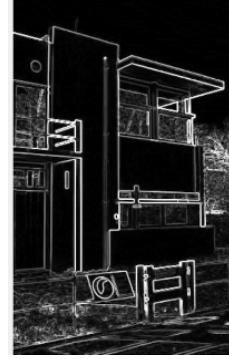
Image 1: A low threshold for edge detection will allow us to detect more edges, including weak and noisy edges. As a result, many disconnected and scattered line segments are present in this image, capturing noise and important features at the same time. While it prevents a lot of detail, the presence of noise reduces the overall clarity.

Image 2: Increasing the thresholds significantly reduces the number of detected edges. Compared with image 1, the lines in image 2 are fewer but also more continuous. Although some details are lost here, this combination filters out much of the noise seen in Image 1. However, noise still remains here.

Image 3: To further filter out the remaining noise, the value of the parameter further increases. The trend is similar to image 2, few lines are present and the details are lost. Yet, the overall image is still clear, and the main structure is still visible and continuous.

After the experiment, we conclude that while the value of the threshold increases, the output will highlight the more prominent lines and reduce noise, in other words, the detail will be lost. The best parameter is the one able to balance between the lost detail and the overall clarity. Therefore, in our experiment, we believe the last parameter set, `peakThreshold = 220` and `minIntensityThreshold = 240`, are the best combination. Some of the details are lost, yet the main structures of the image are captured without unnecessary clutter.

2. motivation for the best set of parameter values on the grayscale edge strength image. Explain differences with the experiment with the binary image.

			
image:	(image 4)	(image 5)	(image 6)
peak threshold.	5	90	220
Minimum intensity for line pixels (minIntensityThreshold)	10	100	240

The only difference between this experiment and task 1 is the use of thresholding on edge detection. Without it, this task results in a grayscale edge strength image, where pixel intensity corresponds to edge strength, which the Hough transform is based on.

The trend of this experiment is the same as in Task 1: noise decreases and the strong lines remain as the value of peakThreshold and minIntensityThreshold increases. The motivation for changing the parameters is also the same as in Task 1—to keep the structure and most important lines in the image while reducing noise. From the table above, Image 6 (peakThreshold = 220 and minIntensityThreshold = 240) retains the overall structure and selects the important lines; it is considered the best set in this experiment. The major difference lies in the original image before the Hough detection. In Task 1, the thresholding process filtered out most of the weaker edges, which remain in Task 2. Thus, more line segments and details are introduced initially. However, after adjusting the parameters, it is still possible to achieve a clean result. Moreover, since no details are lost at the beginning, with the same parameter set, more details are retained in the grayscale version.

3. Choice tasks:

The first choice task is 2: implement a function to normalize the accumulator counts for the maximum number of possible pixels.

Another choice task is 3: implement the Hough transform for circles and visualize circles on a sample image.

