

## Advanced Topics in Digital Image Processing

### AULA 4 – Hough Transform

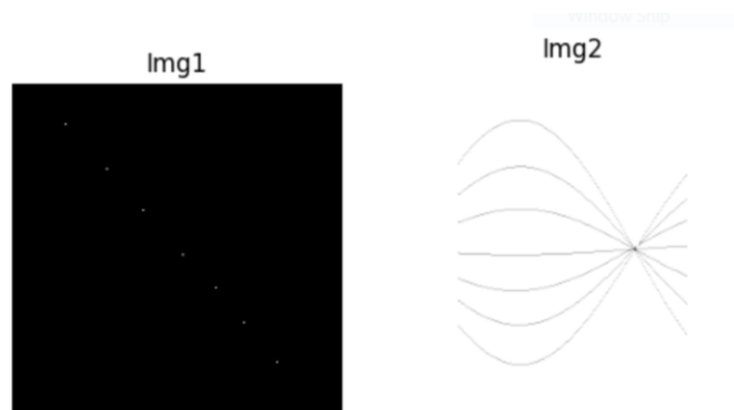
#### Objective:

With this class it is intended that students become familiar with the Hough transform and evaluate some of its potential for image processing.

#### Procedure:

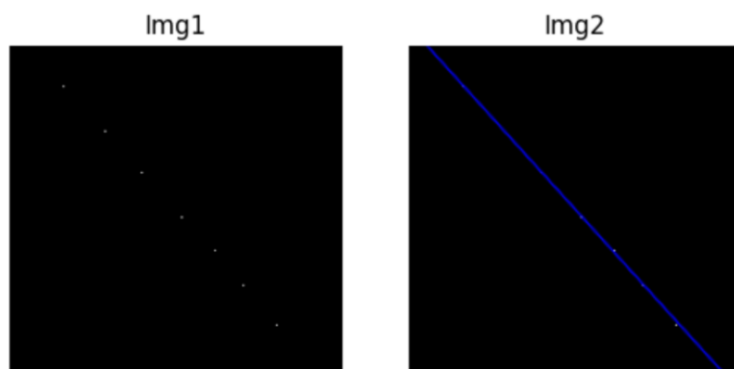
0 – Preparation – download and copy to the project folder the python and images files from Moodle website.

1 – Calculate the Hough transform of a synthesized image. Run the Hough Plane function (*HoughPlane*) on a 200x200px image (aula4-3.bmp), containing 7 white pixels more or less collinear on a black background, and show it side by side with the Hough plane (x100 to be more contrasted).



2 - Draw the straight line passing through the previously defined white pixels. Use the function *ShowHoughLines* and configure OpenCV *HoughLines* function. Note that:

- *cv.HoughLines* selects the lines whose accumulator values are higher than the threshold, defined as parameter;
- the values returned by the *cv.HoughLines* are points  $(r, \theta)$  of the Hough plane and need to be converted to the form:  $Y = mX + b$ .



3 - Calculate the Hough transform of a real image. The Hough transform is usually based on images whose edges are highlighted. To emphasize the lines, follow these steps:

3.1 apply the Sobel operator, to obtain the vertical contours

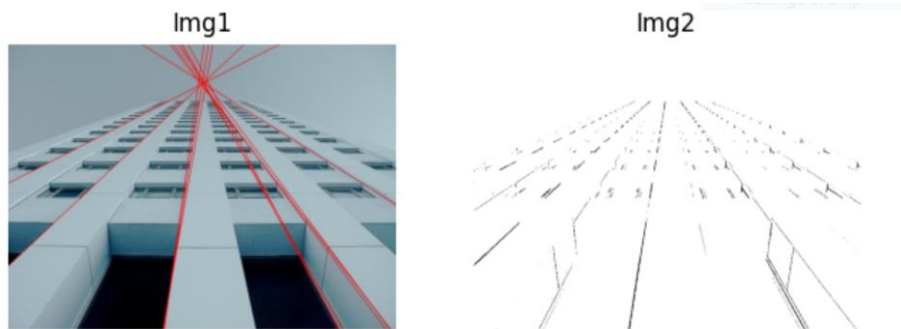
```
imgSobel = cv.Sobel(imgGray,cv.CV_8U,1,0)
```

3.2 binarize the sobel image so it has white lines on black background.

```
cv.threshold(imgSobel, 255, 255, cv.THRESH_OTSU + cv.THRESH_BINARY, imgSobel)
```

3.3 calculate the Hough transform and draw in the image the most voted lines.

Example: threshold = 120



4 - Test the line segments version of the Hough transform. For preprocessing use the Canny Edge detector instead.

```
imgCanny = cv.Canny(imgGray,100,50)
```



5 - Test the detection of circles version of the Hough transform. Note that this function does not require preprocessing, as it uses internally the Canny edge detector.



6 - Apply the Hough Transform (lines or line segments) to a video of a road to detect the lanes. Use the function ShowVideo.

1 - Open video. Use the Capture of the OpenCV library to acquire images from the recorded video.

2 - Acquire frames - Develop a routine/cycle that shows the video in continuous mode by applying the Hough Transform.