**Basic Concepts:**

The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure. This voting procedure is carried out in a parameter space, from which object candidates are obtained as local maxima in a so-called accumulator space that is explicitly constructed by the algorithm for computing the Hough transform.

**Algorithms:**

1. First the input image is loaded as a grayscale, and its Canny edge map is obtained.
2. The accumulator is initialized with all values 0 and dimensions according to the quantization arguments. theta=1 implies 1 vertical bin = 1 degree. Similarly, rho=1 implies 1 horizontal bin is 1 pixel wide.
3. Iterating over all edge pixels, and for each such pixel iterating over the range of discrete angles 0 to 180 deg (in steps determined by theta), rho values are calculated according to rho=x.cos(theta)+y.sin(theta), where x and y are horizontal and vertical distance from center of image, and rho and theta are the polar coordinates. The corresponding bin (theta, rho) in the accumulator is then incremented by 1.
4. The accumulator is now complete. It is normalized by dividing each element by the total sum of votes so that all values are between 0 and 1. This allows the algorithm to work with different sized images using similar range of thresholds.
5. Significant intersections in the parameter space are found by extracting those bins from the accumulator which have higher votes than the threshold provided as an argument.
6. Iterating over the input image pixels again, we map back from parameter space to image space.

**Results:** AccumulatorHough transformed images

 



