PROJECT REPORT

Road detection by radon transform and it's approximation

K RaghuChandra
20161305
Nitin kandpal
20173004

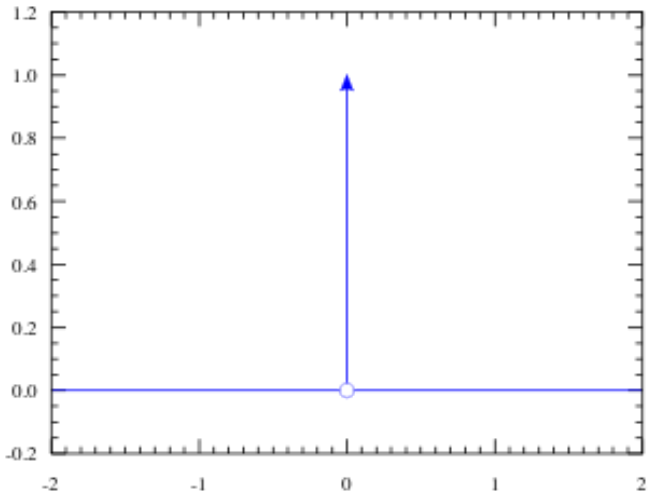
RADON TRANSFORM:

$$x = \mathcal{R} = \int_{\mathbb{R}^2} y(s_1, s_2)\delta(\rho - s_1 cos(\theta) - s_2 sin(\theta))ds_1 ds_2)$$

Here $y(s_1, s_2)$ is input image.

$\mathcal{R}$ is the radon.

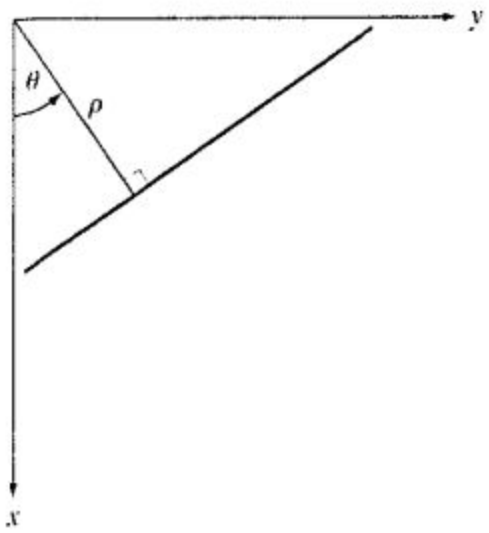
$\rho - s_1 cos(\theta) - s_2 sin(\theta)$ is representing a line .



this is the dirac function so for all

$\rho - s_1 cos(\theta) - s_2 sin(\theta)$ = 0 we get $\delta(\rho - s_1 cos(\theta) - s_2 sin(\theta))ds_1 ds_2)$ = 1.So what we are doing is integrating all the gray levels along the line $\rho - s_1 cos(\theta) - s_2 sin(\theta)$=0.

So what we do in the discrete image is that as we cant have all θ so we considered θ from 0 to 179 and draw all the lines θ = 0 and all possible values of *ρ.* And we sum them all to get radon R(*ρ,*θ) values.



Radon transform approximation:

$$y = Cx$$

x is radon approximation.
y input image.
C weight.

$$(y_1, y_2, \cdots, y_N) = C(x_1, x_2, \cdots, x_N)$$

J is Mean square error.

$$J = \| Y - CX \|^2$$

Below is the closed form solution.

$$C = Y\left(X^T X\right)^{-1} X^T, \text{ when } pq > N;$$

$$C = YX^T\left(XX^T\right)^{-1}, \text{ when } pq < N;$$

$$X = C^{-1}Y$$

$$J = \| Y - CX \|^2$$

$$X = \left(C^T C\right)^{-1} C^T Y, \text{ when } mm > pq;$$

$$X = C^T\left(CC^T\right)^{-1} Y, \text{ when } mm < pq.$$

$$X = \left(C^T C + \alpha I\right)^{-1} C^T Y, \text{ when } mm > pq;$$

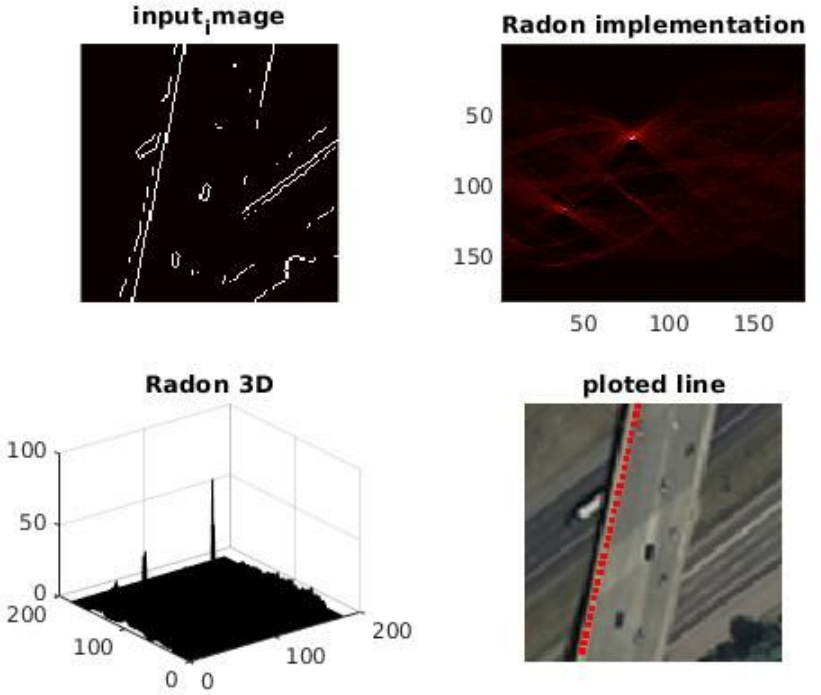
$$X = C^T\left(CC^T + \alpha I\right)^{-1} Y, \text{ when } mm < pq;$$

$$(\boldsymbol{x}_1, \boldsymbol{x}_2, \cdots, \boldsymbol{x}_N) = \left(C^T C + \alpha I\right)^{-1} C^T (\boldsymbol{y}_1, \boldsymbol{y}_2, \cdots, \boldsymbol{y}_N), \text{ when } mm > pq;$$

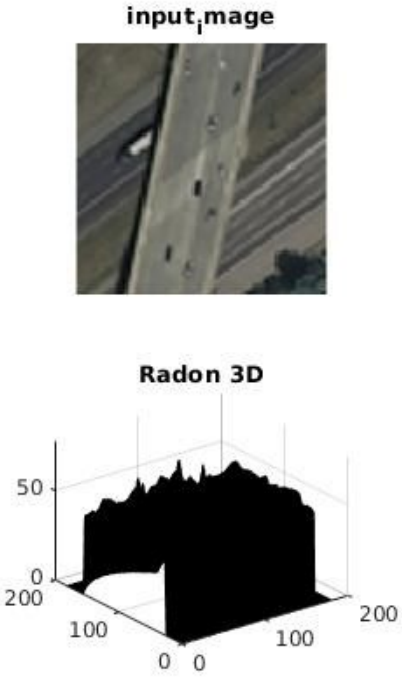
$$(\boldsymbol{x}_1, \boldsymbol{x}_2, \cdots, \boldsymbol{x}_N) = C^T\left(CC^T + \alpha I\right)^{-1} (\boldsymbol{y}_1, \boldsymbol{y}_2, \cdots, \boldsymbol{y}_N), \text{ when } mm > pq;$$

$$\hat{x} = \underset{x}{\operatorname{argmin}} \|y - Cx\|^2 + \alpha^2 \varphi(x)$$

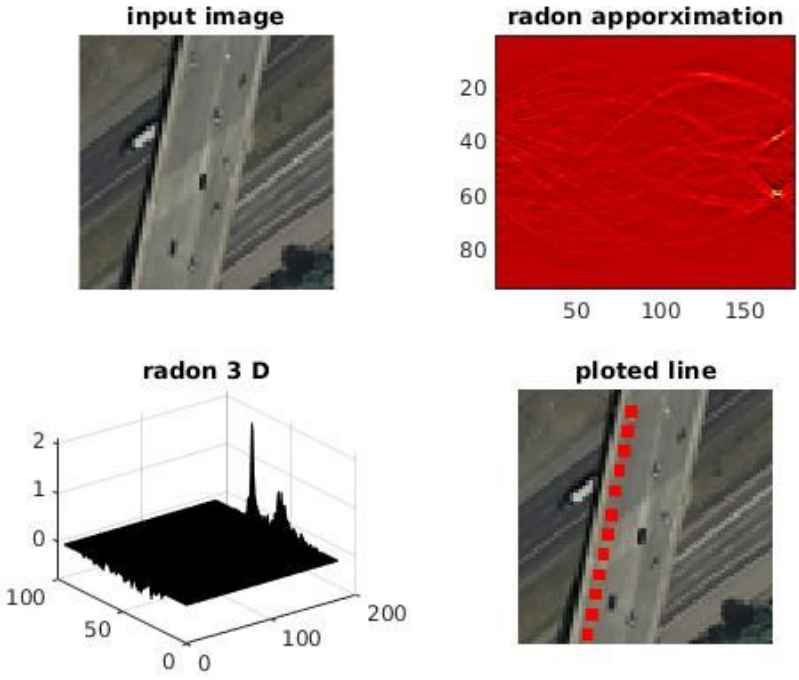
RADON TRANSFORM AND APPROXIMATION RESULT



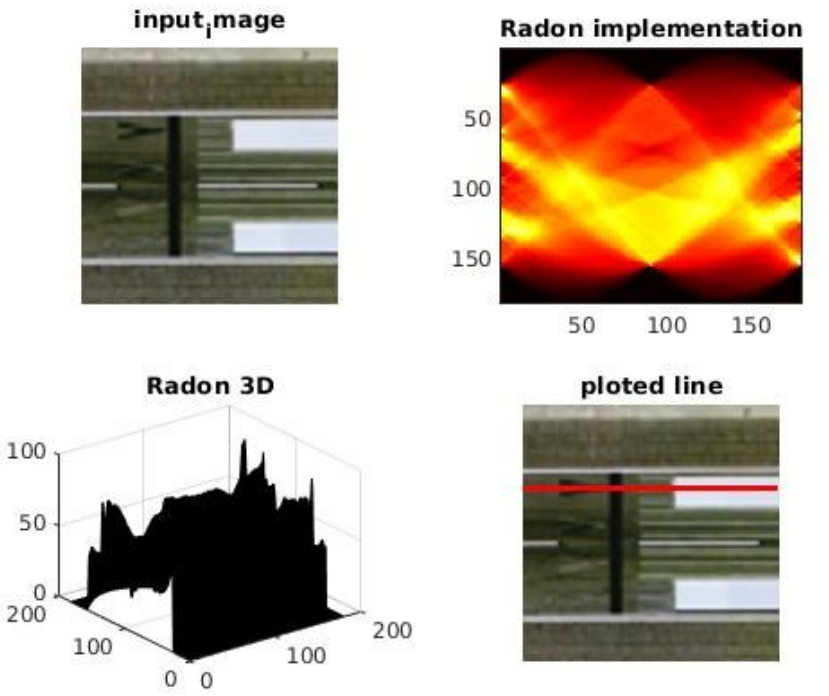
RADON TRANSFORM FOR EDGE IMAGE



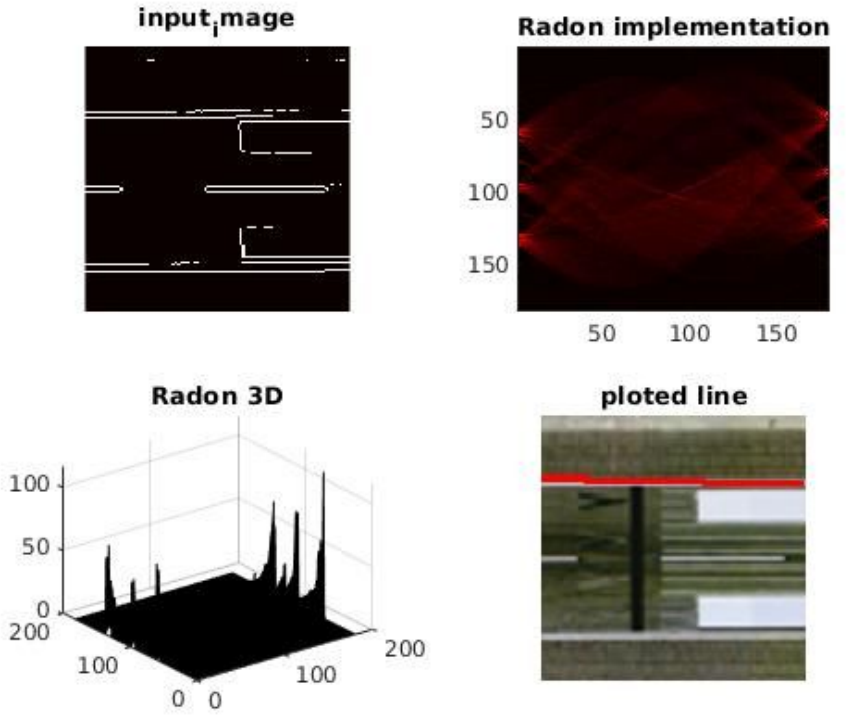
RADON TRANSFORM OF GRAY IMAGE



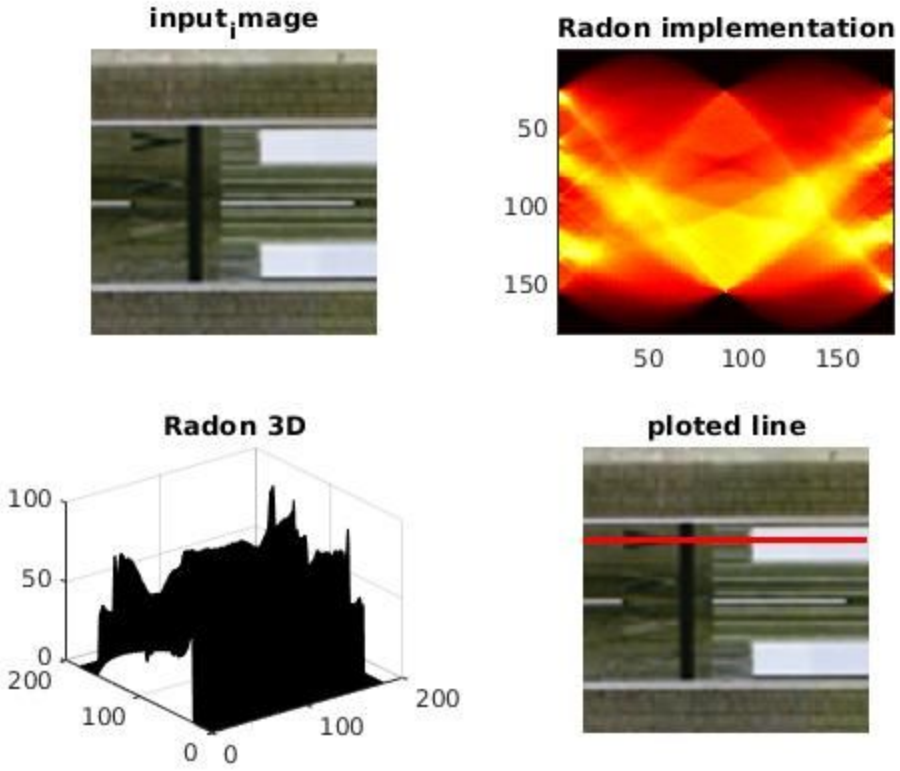
RADON APPROXIMATION RESULT



RADON TRANSFORM OF GRAY IMAGE



RADON TRANSFORM OF EDGE IMAGE



RADON APPROXIMATION RESULT

CODE

RADON TRANSFORM:

Step 1 : read the image.
Step 2: convert to gray scale or edge detected image.
Step 3: rotate from 0 to 180 and those rotated image along the columns
And join all those 180 columns to get radon transform.
Step 4:Sort all those values in the radon transform while preserving the ρ,θ values.
Step 5: get Maximum value of ρ,θ and draw the line on the image.

RADON APPROXIMATION:

Step 1: We used 1200 flatten edge images as training data and their radon transform as label.

Step 2: We applied closed loop MSE solution to get the weights coeffieent.
Step 3: To get the radon approximation of images we multiply edge image to weight coefficients.