



# Edge enhancement using wavelet transform

Siddharth Khandelwal - 190070062

Parin Senta - 190070042

Aniket Gupta - 190070007

Manideep Vudayagiri - 190070074



## Problem Statement

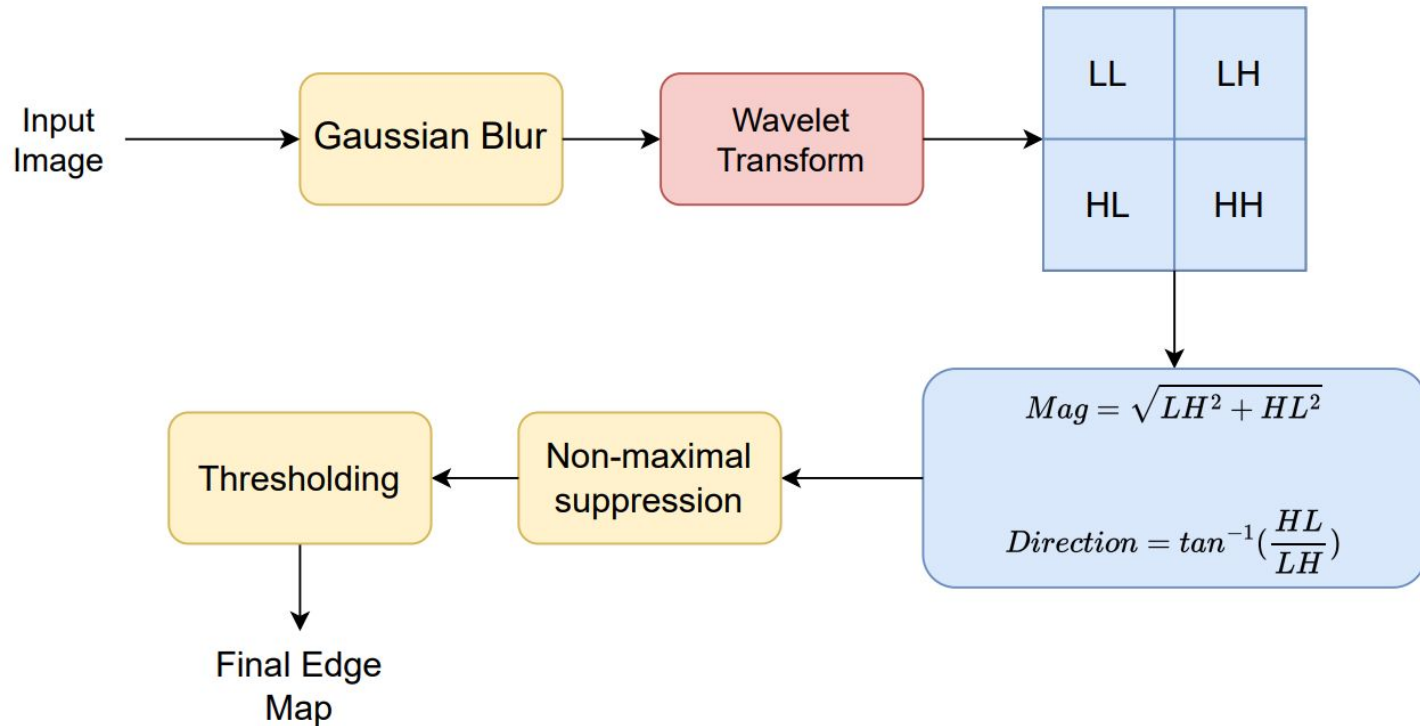
- Edge enhancement is a technique used to highlight and enhance the edges of an image.
- The edges in an image represent regions where the intensity of the image changes abruptly, which can be due to object boundaries, contrast changes, or noise.
- Edge enhancement techniques aim to improve the visibility and sharpness of the edges by emphasizing the high-frequency components of the image while suppressing the low-frequency components.
- In this project, we aim to perform this operation using wavelet transform with the Daubechies wavelet as the mother wavelet



# Wavelet transform

- Wavelet transform is a mathematical technique used to analyze signals and images by decomposing them into different scales and frequencies.
- Unlike traditional Fourier transform, which decomposes the signal into a set of fixed frequency components, wavelet transform decomposes the signal into a set of time-frequency components that are adaptive to the signal's characteristics.
- This makes wavelet transform a powerful tool for analyzing and processing signals and images with irregularities and discontinuities, such as edges and spikes.

# Algorithm used





## Steps used in the algorithm

1. **Gaussian blur** : The image is smoothed using a Gaussian filter to smoothen out the noise.
2. **Wavelet transform** : The transform is performed using the Daubechis wavelet as the mother wavelet. The LH and HL frequency components (horizontal and vertical direction) are combined and this information is used to perform Non-maximal suppression.
3. **Non-maximal suppression** : It is used to suppress the weak magnitude edges and only keep the strong ones.
4. **Thresholding** : Thresholding the image, to create the final edge map

# Results



Original Image



Edge Enhanced Image



Edge Map

## Results Contd.



Original Image



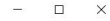
Edge Enhanced Image



Edge Map



Edge Enhancement



### Choose Image



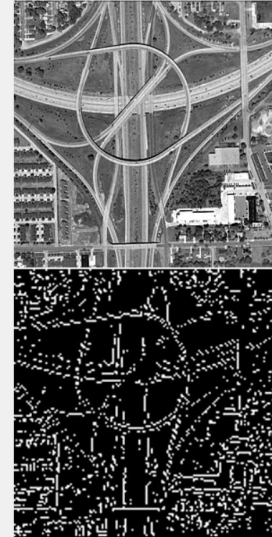
### Parameters for Edge Enhancement

Threshold Value

Gaussian Blur Kernel Size

Run

### Edge Enhanced Image



Save Result





## Guide to GUI

- Press Choose Image and navigate to the image whose edges you want to enhance.
- Enter the threshold value that you desire to apply after the non-maximal suppression step.
- Enter the size of the gaussian blurring filter that you want to use.
- Press run. Voila! The edge map as well as the edge enhanced image will be displayed on the right. You have the option to save these images to your computer.



## References

1. D. D. N. De Silva, Subha Fernando, I. Thilini S. Piyatilake, & A. V. S. Karunaratne (2018). Wavelet based edge feature enhancement for convolutional neural networks. *CoRR*, *abs/1809.00982*.



**Thank You**