Project Report On

Fuzzy Filtering of Image

Submitted By

Bhagyasree (181IT111)

C Sneha (181IT112)

Chinmayi C Ramakrishna (181IT113)

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Under the guidance of

Mr. G. Ram Mohana Reddy

Dept of IT, NITK Surathkal

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PROBLEM STATEMENT

Noise reduction by fuzzy image filtering

Reduces noises in the images using fuzzy filtering

1. Input the noisy image
2. Smooth the image using fuzzy filtering
3. Get noise reduced image

AIM OF THE PROJECT

Images are ubiquitous in the modern digital world. Image filtering has a wide field of applications such as image processing, computer vision, telecommunications, medicine, satellite imaging and robots, where the main objective of the de noising procedure is to detect, filter, or remove undesired noise from a color image and videos.

Here, we develop a fuzzy logic based technique to remove additive noise from a color image. We use local statistics to train the membership function of a fuzzy filter for image processing to remove both Gaussian noise and impulsive noise while preserving edges.

We show that such a fuzzy filter gives superior results when compared to averaging filters, median filters, and other fuzzy filters.

PROBLM FINDINGS

Addition of noise in an image not only affects its performance in a specific task but also reduce the quality of an image. Noise can be generated during image capture, transmission, storage, as well as during image copying, scanning and display.

The two common types of noise in images are impulse (or salt and pepper) noise, and random (or Gaussian) noise. Common noise reduction techniques like mean or median lead to loss of edge information in the image.

Linear filtering techniques tend to blur edges and degrade other fine image details. Noise smoothing and edge enhancement are inherently conflicting processes.

The advantage of fuzzy filtering techniques is in the efficient preservation of image features, such as edges, chromaticity characteristics, texture, and fine details, while corrupted pixels are being filtered.

PROBLEM METHODOLOGY

In our approach, we start with the edges. The first step for removing noise effectively is to detect which directions have edges near the pixel being processed. All edges in an image share a common property. They show a sharp change in the color intensity across them. This property is exploited to indicate potential edges in an image. The technique of fuzzy analysis defines a parameter called degree of edgeness for each pixel.

We consider the entire image matrix as a fuzzy set, and define the membership grade for each pixel in the image.

Membership grade is calculated for the image and used to find how influential the difference of value in a direction must be in calculation of final corrected value. The greater the membership grade, the greater fraction of difference is added. Hence, if no edge is present in a direction, then the difference of pixel value in its perpendicular direction should be added to final correction.

Optimization (finding sd)

The value of sd determines the spread of the MF small and ultimately the threshold for edge detection. Instead of sampling the whole image for standard deviation, we take K x K blocks of the image and find their Standard Deviation. Then we take the minimum Standard Deviation across all blocks. This gives us a measure of the minimum amount of variation in luma values present in an almost smooth K x K block in the image. Currently, we choose K=8 for reasonable efficiency. This minimum deviation sd will always be less than the deviation in case of an edge. Finally, we multiply Standard Deviation by a amplification parameter a to increase noise reduction.

Averaging In all Directions

After obtaining CDp and CDn for all directions, we can average their value to obtain final correction.

$\Delta C(x,y) = (CDp - CDn)/8$

Where directions={N,S,E,W,NE,NW,SW,SE}

Hence, we obtain the correction term with contribution from only those directions which do not have an edge going through its perpendicular direction

PERFORMANCE METRICS

Module 1

edge correction in images

number of labs -1

Module 2

Fuzzy smoothing

Number of labs-1

Module 3

Optimization

Number of labs -1

Module 4

Averaging in all directions

Number of labs -1

Module 5

Output of the processed image

Number of labs -1

REFERENCES

https://in.mathworks.com/help/matlab/

https://graduateway.com/noise-reduction-by-fuzzy-image-filtering/