Image Processing For Healthcar

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Department of Electrical Engineering
MNIT Jaipur

Present
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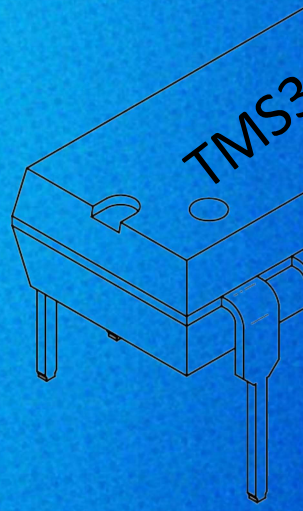
Image Enhancement to detect Medical Condition.

A brief presentation on application of DSP



Contents :

- What is Image Enhancement?
- How is it useful in other contexts
- Brief analysis of implemented pr
- Conclusion

What is Image Enhancement?

Introduced in newspapers during World War-II.

Involves Edge Detection, Dehazing, Colour detection, Noise Reduction, Segmentation.

Different than Image Classification.

Used by military & bio-medical engineers.

Police Dept uses this technique. The famous D.B.Cooper fligh incident.

Picturing the Black Hole in the centre of Milky Way.

Original

Blur function used on original image.

Clear function used on blurred image.

Image enhancement in other contexts:

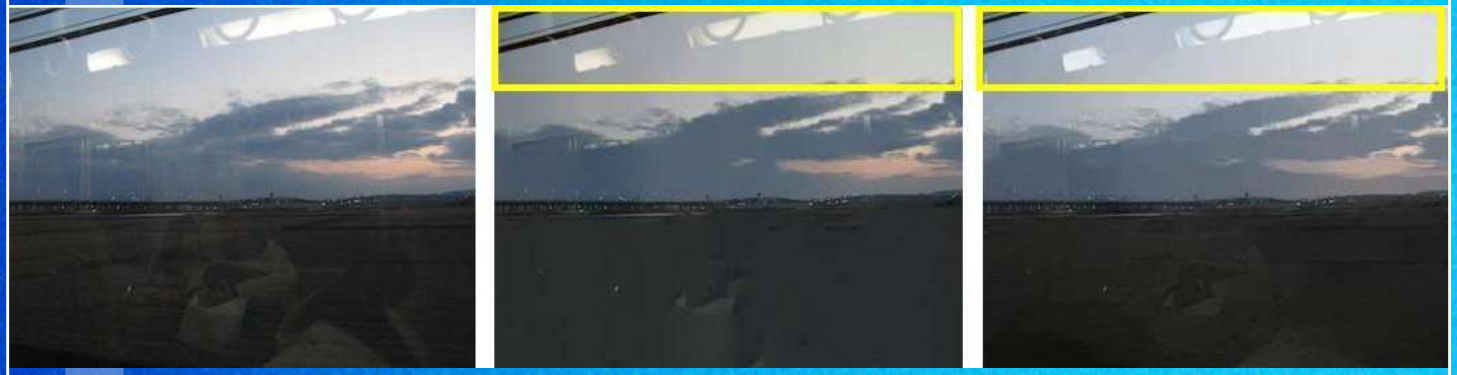
A blurry image can be de-blurred simply by using BW-masking a loop.

Smart-detection of edge in Image with faded crease. (Impleme Photoshop 2019 onwards.)

Adding pixels to bump up resolution without adding noise or losi details.

Removing reflection from a reflective surface by separating diff gradients.

Radiation detection from an image using AI and ML.

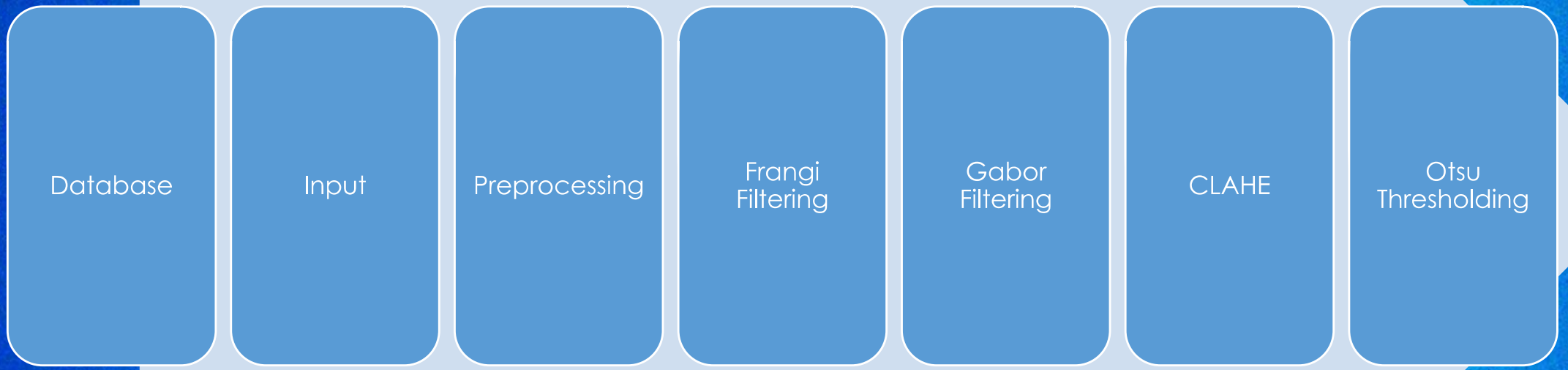


Reflection Removal

Unwanted reflection is
removed by separatin
two different gradient
layers overlapped on
of each other.

Flowchart for implementation of Retinal Vessel Segmentation

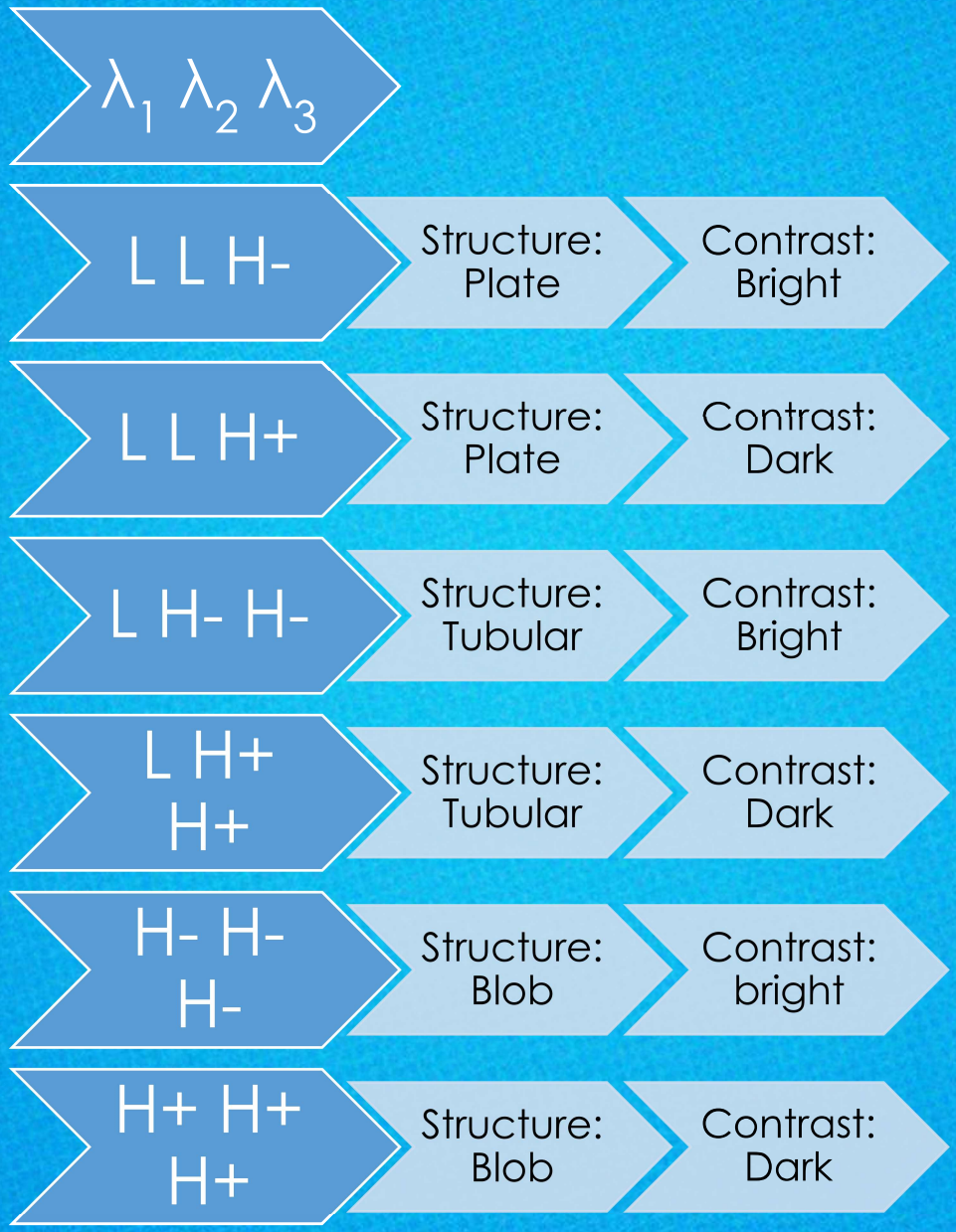
1. Collecting Data from Medical database.	Some reference image of Retina, c with fundus camera.
2. Providing the reference image as input.	Filter green channel.
	Reduce the noise (if necessary)
3. Using algorithms such as Frangi filtering technique and Gabor segmentation technique.	Finds edges of a picture.
	Vascular based enhancement.
4. CLAHE	Image processing tool within Matla
	Enhances contrast of Grayscale pic
5. Otsu Thresholding and Morphological Opening	Finds threshold value of enhanced picture.
	Removes unwanted parts from ima


Database
Input
Preprocessing
Frangi Filtering
Gabor Filtering
CLAHE
Otsu Thresholding

Frangi Filtering Technique

Employs Hessian Eigen values based approach.

Input:	High boost filtered image.
Output:	Vessels are enhanced.
	Non-vascular structures are suppressed.
	Every pixel value has the maximum possible valu contrast.
Algorithm:	Form Hessian 2D matrix out of image. (for Sigma
	Image scale correction.
	Find out Eigen vectors. Calculate eigen values.
	Compute the direction from each eigen vectors
	Compute similarity measures in that direction.
	Store the filtered image in 3D-matrix. Repeat ste


λ_1 λ_2 λ_3
L L H-
Structure: Plate
Contrast: Bright
L L H+
Structure: Plate
Contrast: Dark
L H- H-
Structure: Tubular
Contrast: Bright
L H+ H+
Structure: Tubular
Contrast: Dark
H- H- H-
Structure: Blob
Contrast: bright
H+ H+ H+
Structure: Blob
Contrast: Dark

Otsu's Thresholding:

Developed by Nobuyuki Otsu.

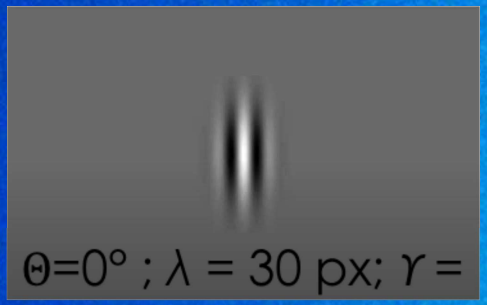
Algorithm:

- Input is preprocessed image.
- Obtain image histogram. (i.e. distribution of
- Compute threshold value, T. And saturation
- Replace image pixels into white if (S>T) & bl

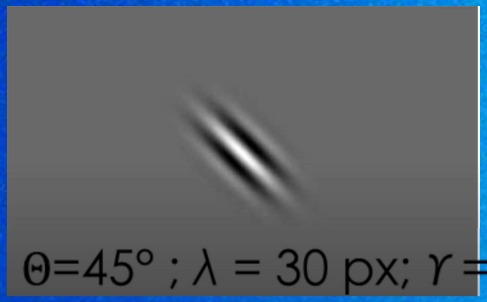
Computing Threshold Value:

- Obtain image histogram.
- The entire image is divided in 2 classes.
- $\sigma_w^2(t)$ = variance of these classes. w(t) = pro these classes. 't' is threshold.
- Minimize $\sigma_w^2(t)$ or maximize $\sigma_b^2(t)$ to find va

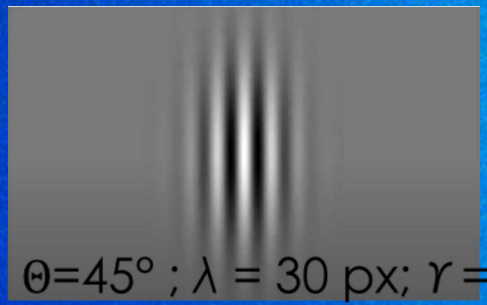
Gabor Wavelet:



Θ=0° ; λ = 30 px; γ = 0.5, BandWidth = 1



Θ=45° ; λ = 30 px; γ = 0.5, BandWidth = 1



Θ=45° ; λ = 30 px; γ = 0.5, BandWidth >> 1

Input:

High contrast image obtained fr
Filter.

Output:

Detects edges corners of that im
highlight those pixels.

Algorithm:

Better approach compared to H
wavelet and derivative of a Gau
function.

Edge Detection

Feature Extraction

$$g(x,y;\lambda,\theta,\psi,\sigma,\gamma) = e^{-\frac{x'^2+\gamma^2 y'^2}{2\sigma^2}} \times e^{i(\frac{2\pi x'}{\lambda}+\psi)}$$

$$x' = x\cos(\theta) + y$$

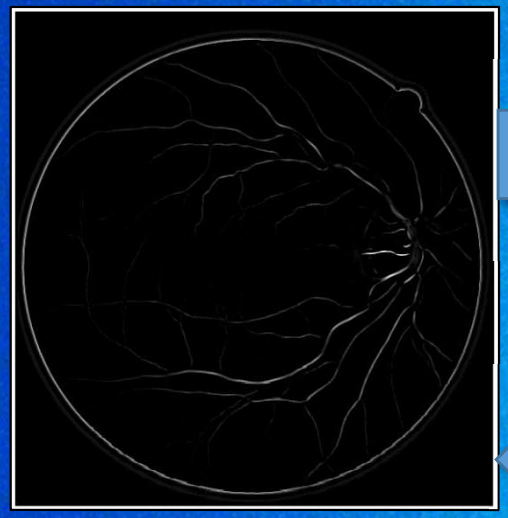
$$y' = y\cos(\theta) - x$$

2022PPD5228 ; 2022PPD5236

Liu Bolin

CLAHE:

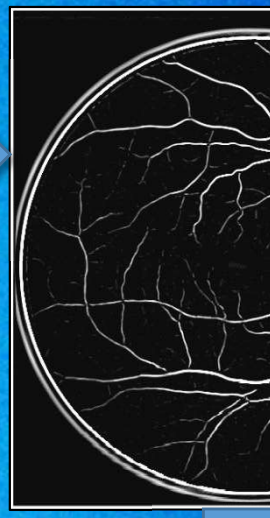
Variant of Adaptive Histogram Equalization. [Contrast Limiting Adaptive Histogram Equalization]	Takes care of over-amplificat contrast.
	Operates on tiles of image.
	Neighbouring tiles are combi bilinear interpolation.
	Effects only the alpha chann
Parameters of CLAHE:	clipLimit: Sets threshold for co limiting.
	tileGridSize: Sets the tile dime

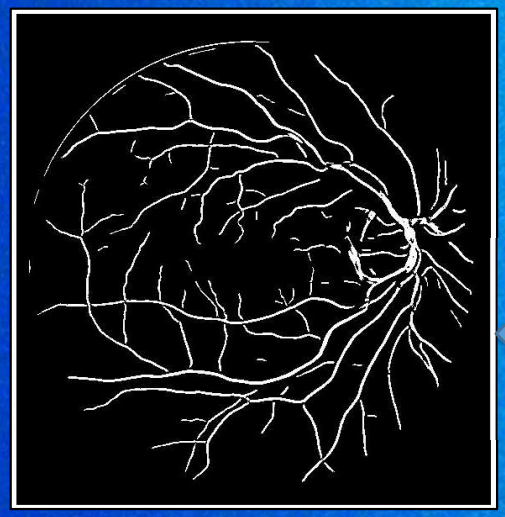


GABOR-OUTPUT

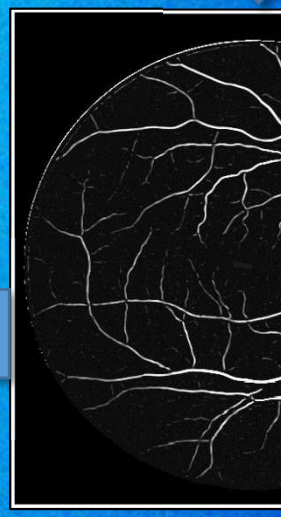
GRAYSCALE

FRANGI-OUTPUT

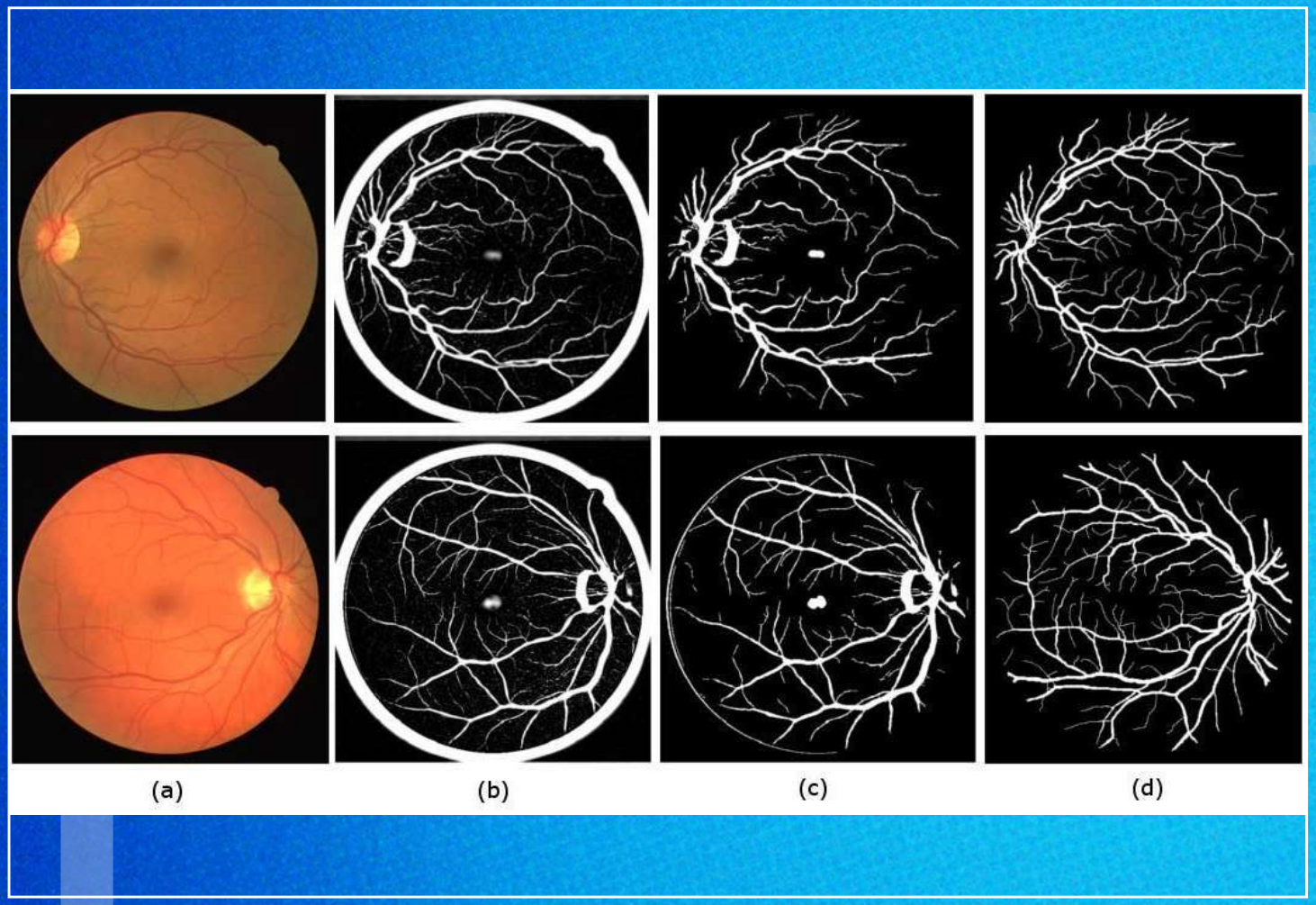




Otsu-OUTPUT



CLAHE-OUTPUT



Retinal vessel segmentation.

- To detect risk of diabet
- Eradicates the need of manual segmentation.
- Rightmost image can b used by physician alon with OCT to determine thickness of retinal vess

Report Analysis

Conclusion:

Image Enhancement is an application more specific to that
Image Processing.

Retinal Segmentation is ubiquitously used in other medical co
diagnosis as well.

Tools used for this purpose are mostly slow and manually ope
Which is currently the situation of most OPD clinics.

The future aspect of Biased segmentation is limitless.

Reference:

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