NUTAN MAHARASHTRA VIDYA PRASARAK MANDAL'S

Under administrative support of Pimpri Chinchwad Education Trust

Nutan Maharashtra Institute of Engineering and Technology

Talegaon Dabhade, Pune

PROJECT REPORT ON

"VisualBoost: Image Filtering Toolbox"

DEAPARTMENT OF ELECTRONICS &TELECOMMUNICATION ENGINEERING

(2024-25)

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Under administrative support of Pimpri Chinchwad Education Trust

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CERTIFICATE

This is to certify that, this mini project report entitled: VisualBoost: Image Filtering

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BY

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Abstract: -

This project presents an interactive image filtering application developed in MATLAB, enabling users to apply three key image processing techniques: Low Pass Filter (LPF), High Pass Filter (HPF), and High Boost Filter. The tool allows users to upload an image and select the desired filter, transforming the image in real-time. The LPF is used for smoothening and noise reduction, the HPF for enhancing edges and fine details, and the High Boost Filter for sharpening the image. The results are displayed side-by-side for easy comparison. This project highlights fundamental concepts in image processing, convolution, and real-time user interaction within a MATLAB environment.

Introduction: -

This project presents an interactive image filtering application developed in MATLAB. It allows users to apply three essential image filters—Low Pass Filter (LPF), High Pass Filter (HPF), and High Boost Filter—each serving different purposes in image enhancement. The LPF smooths images and reduces noise, the HPF enhances edges and fine details, and the High Boost Filter sharpens the image while preserving important features. Users can upload their own images, choose a filter, and view a side-by-side comparison of the original and filtered images. This project demonstrates key concepts in image processing, providing a practical and visual understanding of digital filtering techniques in real-time.

Scope: -

This project provides a versatile platform for applying basic image filtering techniques using MATLAB. The primary scope of the project includes:

1. **Image Processing:** Implementation of three core filters (Low Pass, High Pass, and High Boost) to manipulate and enhance image quality.
2. **User Interaction:** The application is designed to allow users to easily select and apply filters to images of their choice, with real-time results.
3. **Educational Tool:** The project serves as a learning aid for understanding the impact of different filters in image enhancement and noise reduction.
4. **Future Enhancements:** Future work could include the addition of advanced filters (e.g., Gaussian filters), support for color images, and a GUI for a more interactive experience.

Requirements: -

- Software Requirements:
  - MATLAB (Version R2016b or later)
  - Image Processing Toolbox (for image manipulation and filtering functions)

- Hardware Requirements:
  - A computer or laptop capable of running MATLAB (with sufficient RAM and processing power for image handling)

- User Requirements:
  - Basic knowledge of image processing concepts (optional, as the application is interactive)
  - A computer with a graphical user interface (GUI) to view results in real-time

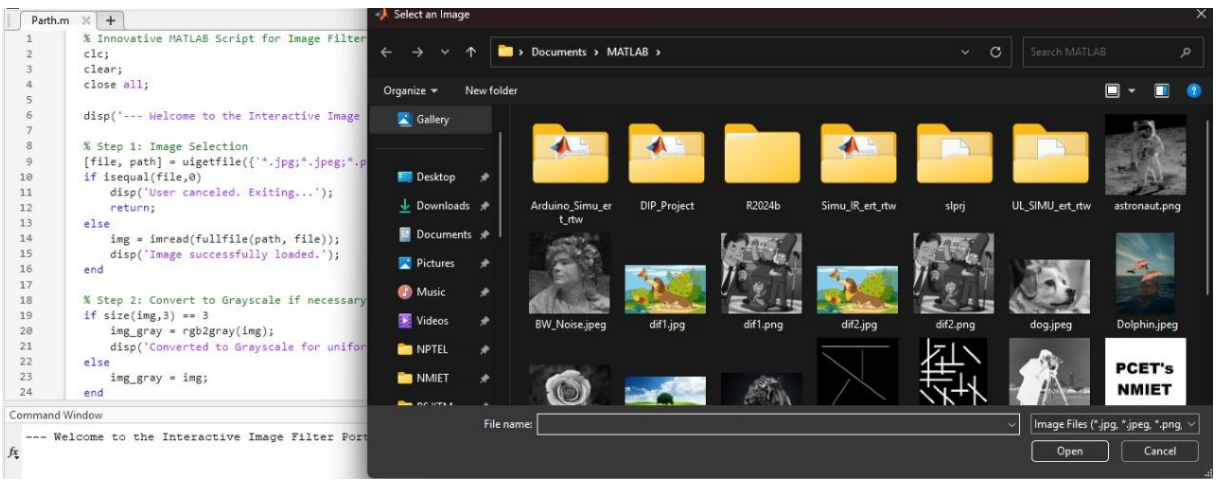
- Other Requirements:
  - Compatible image files (e.g., JPG, PNG, BMP) for testing and processing.
  - An internet connection (optional) for accessing MATLAB's documentation and resources.

Source Code: -

```
% Innovative MATLAB Script for Image Filtering: LPF, HPF, High-Boost
clc;
clear;
close all;

disp('--- Welcome to the Interactive Image Filter Portal ---');

% Step 1: Image Selection
[file, path] = uigetfile({'*.jpg;*.jpeg;*.png;*.bmp','Image Files (*.jpg, *.jpeg, *.png, *.bmp)'}, 'Select an Image');
if isequal(file,0)
   disp('User canceled. Exiting...');
   return;
else
   img = imread(fullfile(path, file));
   disp('Image successfully loaded.');
end

% Step 2: Convert to Grayscale if necessary
if size(img,3) == 3
   img_gray = rgb2gray(img);
   disp('Converted to Grayscale for uniform processing.');
else
   img_gray = img;
end

% Step 3: Filter Selection
disp('Select the type of filter you want to apply:');
disp('1: Low Pass Filter (Smoothening)');
disp('2: High Pass Filter (Edge Enhancement)');
disp('3: High Boost Filter (Sharpening)');
```

```
choice = input('Enter your choice (1/2/3): ');

% Step 4: Filter Kernel Definitions
low_pass_kernel = (1/9) * ones(3,3); % Simple averaging filter
high_pass_kernel = [-1 -1 -1; -1 8 -1; -1 -1 -1]; % High pass for edges
A = 1.5; % High Boost Amplification factor
high_boost_kernel = ((A-1) * (1/9) * ones(3,3)) + high_pass_kernel;

% Step 5: Applying the Chosen Filter
switch choice
    case 1
        filtered_img = imfilter(img_gray, low_pass_kernel, 'replicate');
        filter_type = 'Low Pass Filter Applied';
    case 2
        filtered_img = imfilter(img_gray, high_pass_kernel, 'replicate');
        filter_type = 'High Pass Filter Applied';
    case 3
        % First smooth, then apply high boost
        smoothed = imfilter(img_gray, (1/9)*ones(3,3), 'replicate');
        mask = img_gray - smoothed;
        filtered_img = img_gray + A * mask;
        filtered_img = uint8(filtered_img);
        filter_type = 'High Boost Filter Applied';
    otherwise
        disp('Invalid choice. Exiting...');
        return;
end

% Step 6: Display Results
figure;
subplot(1,2,1);
imshow(img_gray);
title('Original Image');

subplot(1,2,2);
imshow(filtered_img);
title(filter_type);

disp(['--- ' filter_type ' ---']);
disp('Operation successfully completed.');
```

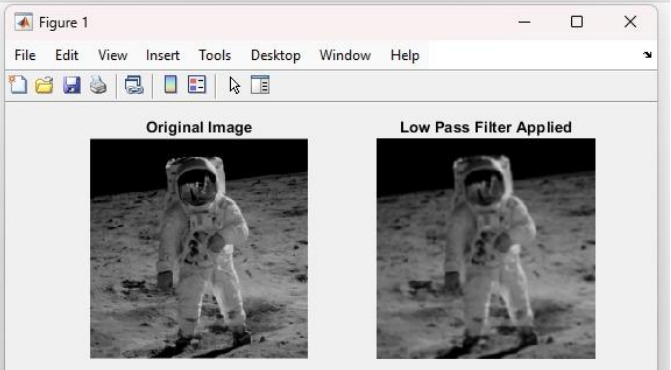
PROCESS:-



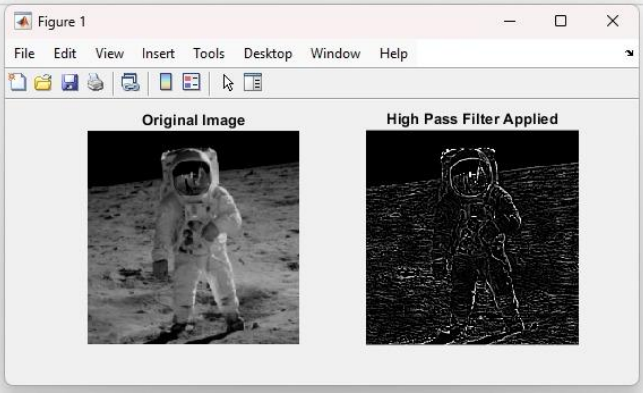
```
Command Window
--- Welcome to the Interactive Image Filter Portal ---
```

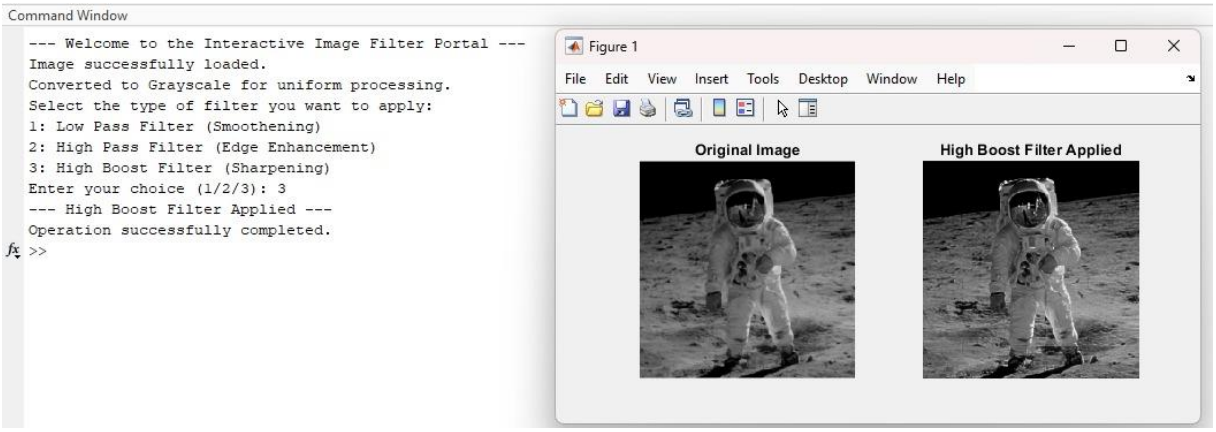
```
Command Window
--- Welcome to the Interactive Image Filter Portal ---
Image successfully loaded.
Converted to Grayscale for uniform processing.
Select the type of filter you want to apply:
1: Low Pass Filter (Smoothening)
2: High Pass Filter (Edge Enhancement)
3: High Boost Filter (Sharpening)
Enter your choice (1/2/3):
```

```
Command Window
--- Welcome to the Interactive Image Filter Portal ---
Image successfully loaded.
Converted to Grayscale for uniform processing.
Select the type of filter you want to apply:
1: Low Pass Filter (Smoothening)
2: High Pass Filter (Edge Enhancement)
3: High Boost Filter (Sharpening)
Enter your choice (1/2/3): 1
--- Low Pass Filter Applied ---
Operation successfully completed.
>>
```




```
Command Window
--- Welcome to the Interactive Image Filter Portal ---
Image successfully loaded.
Converted to Grayscale for uniform processing.
Select the type of filter you want to apply:
1: Low Pass Filter (Smoothening)
2: High Pass Filter (Edge Enhancement)
3: High Boost Filter (Sharpening)
Enter your choice (1/2/3): 2
--- High Pass Filter Applied ---
Operation successfully completed.
>>
```





Advantages:-

- User-Friendly Interface: Allows users to easily select and apply filters without needing advanced MATLAB knowledge.
- Real-Time Visualization: Displays original and filtered images side by side for instant comparison.
- Educational Value: Helps students and beginners understand the effect of different filters on image quality.
- Customizable and Expandable: The code can be easily modified to include more filters or additional features like kernel size selection.
- Efficient Processing: Uses basic convolution operations for fast and accurate image filtering.
- Supports Multiple Image Formats: Accepts common image types such as JPG, PNG, and BMP for flexibility.

Applications:-

- Image Enhancement: Improves image quality by smoothing, sharpening, or highlighting details.
- Edge Detection: Helps in identifying object boundaries using High Pass Filters.
- Preprocessing for Computer Vision: Filters can be applied as a preprocessing step before object detection, recognition, or segmentation tasks.
- Educational Tool: Useful for teaching and learning fundamental image processing concepts in academic settings.
- Medical Imaging: Can assist in enhancing features in X-rays, MRIs, or CT scans for better analysis (basic level).
- Digital Photography: Enhances or corrects images captured by cameras to improve visual appeal

Conclusion: -

This project successfully demonstrates the implementation of basic image filtering techniques using MATLAB. By allowing users to apply Low Pass, High Pass, and High Boost filters interactively, it provides a hands-on understanding of how different filters affect image quality. The tool is simple yet powerful, making it suitable for both educational purposes and basic image enhancement tasks. With its modular design, the project can be easily extended to include more advanced filtering methods, making it a strong foundation for further exploration in the field of digital image processing.