PREMIER UNIVERSITY

Department of Computer Science & Engineering

Course Code	:	**EEE-202**
Course Title	:	**Signals & Systems Laboratory**
Report No	:	09
Name of Report	:	Image Processing Pipeline for Enhancing and Analyzing Visual Content
Date of Performance	:	31/01/2024
Date of Submission	:	03/02/2024
Course Instructor	:	Mohammed Saifuddin Munna

Submitted By :

Name	**: Mohammad Hafizur Rahman Sakib**
ID	**: 0222210005101118**
Section	**: C**
Semester	**: 4th Semester**
Session	**: Fall 2023**

REMARKS

Name of Experiment: Image Processing Pipeline for Enhancing and Analyzing Visual Content

Objective :

The main goal of this research is to construct an image processing pipeline that systematically employs resizing, contrast enhancement, and segmentation techniques on visual content. The pipeline is designed with the intention of enhancing the overall visual quality of images and facilitating the identification and analysis of distinct objects within the processed images.

Theory :

Image processing plays a pivotal role in computer vision, providing an array of techniques to improve and scrutinize visual content. The envisioned pipeline commences by resizing the original image to a standardized dimension, ensuring uniformity for subsequent analyses. Subsequently, contrast enhancement is implemented on each color channel, enhancing the overall image quality. The conversion to grayscale and the incorporation of edge detection techniques further aid in identifying object boundaries. To refine the segmentation results and achieve a more precise delineation of individual objects, morphological operations are employed in the final stages of the pipeline.

Lab Tasks:

Task 01 :

Orginal Image :

Task 02 :

Code :

```
A = imread('sakib.jpg');
imshow(A);
>> B = imresize(A,[600 600]);
figure;
imshow(B);
>> imwrite(B,'resize.jpg');
>> A=imread('resize.jpg');
imshow(A)
figure;
```

Figure :

Task 03:

Code :

```
>> A=imread('resize.jpg');
imshow(A);
Agray=rgb2gray(A);
imshow(Agray);  % make image gray
level=0.77;
```

```
Athresh=im2bw(Agray,level);
imshowpair(A,Athresh,'montage');
>> A=imread('resize.jpg');
imshow(A);
rmat=A(:,:,1);
gmat=A(:,:,2);
bmat=A(:,:,3);
figure;
subplot(2,2,1),imshow(rmat);
title('Red Plane');
subplot(2,2,2),imshow(gmat);
title('Green Plane');
subplot(2,2,3),imshow(bmat);
title('Blue Plane');
subplot(2,2,4),imshow(A);
title('Original Image');
>> levelr=0.63;
levelg=0.5;
levelb=0.4;
i1=im2bw(rmat,levelr);
i2=im2bw(gmat,levelg);
i3=im2bw(bmat,levelb);
Asum=(i1&i2&i3);

subplot(2,2,1),imshow(i1);
title('Red Plane');
subplot(2,2,2),imshow(i2);
```

title('Green Plane');

subplot(2,2,3),imshow(i3);

title('Blue Plane');

subplot(2,2,4),imshow(Asum);

title('Sum of all the planes');

>> Acomp=imcomplement(Asum);

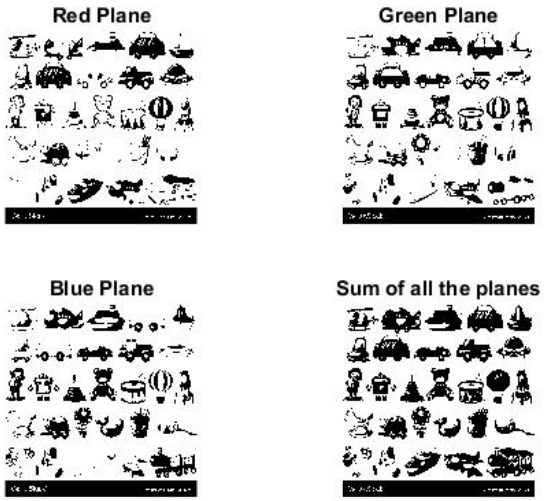
Afilled=imfill(Acomp,'holes');

figure,imshow(Afilled);

>> se=strel('disk',25);

Aopenned=imopen(Afilled,se);

imshow(Aopenned);



Task 04 :

Code :

Aregion=regionprops(Aopenned,'centroid');

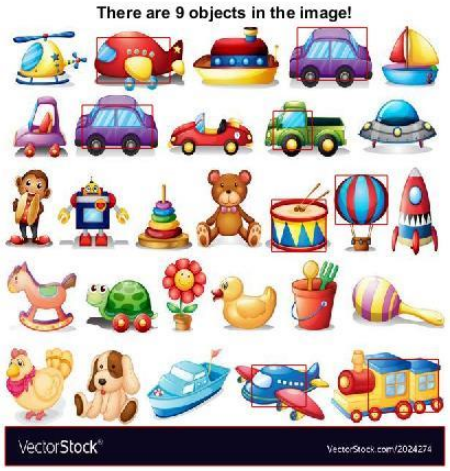
[labeled,numObjects]=bwlabel(Aopenned,4);

stats=regionprops(labeled,'Eccentricity','Area','BoundingBox','centroid');

areas=[stats.Area];

eccentricities=[stats.Eccentricity];

```
idxOfSkittles=find(eccentricities);
statsDefects=stats(idxOfSkittles);
>> figure,imshow(A);
hold on;
for idx=1 : length(idxOfSkittles)
    h=rectangle('Position',statsDefects(idx).BoundingBox);
    set(h,'EdgeColor',[.75 0 0]);
    hold on;
end
if idx > 1
title(['There are ', num2str(numObjects), ' objects in the image!']);
end
hold off;
```



Discussion :

In this MATLAB image processing experiment, we explored three key techniques: image smoothing, edge detection using the Sobel operator and Canny edge detector, and image enhancement through histogram equalization. Increasing the kernel size in Gaussian smoothing resulted in more effective noise reduction, but an excessive size led to a loss of crucial image details. The Sobel operator accurately highlighted vertical and horizontal edges, while the Canny edge detector demonstrated superior performance with fewer false positives.