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Department of Computer Science and Information Technology



A Project Report

On

**“Design and Development of Basic Image Processing Tool Using Open Source
Technology”**

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Department of Computer Science and Information Technology



CERTIFICATE

This is to certify that **Mr. Sachin D. Rathod** has successfully completed Major Project on
“**Design and Development of Basic Image Processing Tool Using Open Source Technology**”
for the partial fulfillment of M.Sc. Information Technology semester-IV during 2018-2019.

Hence certified .

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Thanking You

By,

Mr. Sachin D. Rathod

Abstract

Main aim of **Image processing project** is to extract important data from images. image processing is called as altering and analyzing pictorial information of images. Design and development of basic image processing tool using open source technology is windows software which can be useful for various types of students, Laboratory, Hospital, Industry, etc. Using this tool we can enrol, visualize, process and analyse the Selected data. It can do any types of operations like Morphological operations, We can do Filtering, Enhancement. This dictionary does not need internet connectivity.

Contents

1	Introduction	1
	Introduction.....	2
	Objective.....	3
2	Literature Review	4
	Technique.....	5
	Color Code Model.....	5
	RGB Color Model.....	5
	HSV Color Model.....	5
	CMY Color Model.....	5
3	Methodology.....	6
	Data Flow Diagram.....	7
	Requirement.....	9
4.1	Python dependencies.....	10
	Feasibility Study	10
	Software Requirements Specification	10
	Data Analysis	11
	Features of Python Programming Language.....	12
	Advantages of Python	13
4	Implementation.....	14
	Data Enrollment and Visualization	16
	View Windows	16
	Basic tool	19
	Opening.....	20
	Closing.....	21
	Rotation.....	23

	Dilation	23
	Erosion	25
	Edge Detection.....	25
	Histogram.....	26
	Histogram Equalization.....	28
	 Filter menu	 29
	2 D Filter	30
	Gaussian Filter	31
	Median Filter	32
	Bilateral	33
	Low Pass Filter.....	34
	5.4 6 High Pass Filter	35
	5.4 7 Laplacian Filter	36
5	Help Menu	36
6	Conclusion and future scope.....	38
7	References.....	40

Introduction

Introduction

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. Digital image processing deals with manipulation of digital images through a digital computer.

It is a subfield of signals and systems but focus particularly on images.

Image processing focuses on developing a computer system that is able to perform processing on an image.

ImageJ software used in digital image processing. We can make infrastructure like ImageJ using Open source Technology.

MATLAB is also a good software for image processing. In this software we can take input image and visualize it then we can do color code conversion, morphological operation, and enhancement it.

This software can display, edit, process, save and print 8-bit, 16-bit and 32-bit images. It can read many image formats including TIFF, GIF, JPEG, BMP, etc. We can use Tkinter, easyGui, pillow library for this software.

This software will very useful for laboratory.

Objectives

- To design data enrolment and visualization mechanism
- To do color code conversions.
- To do morphological operations.
- To do enhancement of an image.

Literature review

Technique

- Edge detection: edge detection technique is use full to find the edges of the input image.
- Opening an image: Opening an image technique is use to find and remove the small dots from input image.
- Closing an image: Closing an image technique is use to find and remove the small holes from input image.

Color code model :

1) RGB color model :

The RGB color model is a color model used largely in display technologies that use light. In this model, the colors red (R), green (G) and blue (B) are added together at different intensities to produce millions of different colors on modern video display screens.

2) HSV color model :

All color models treated so far are hardware oriented. The Hue-Saturation-Value model is oriented towards the user/artist. The allowed coordinates fill a six sided pyramid the 3 top faces of the color cube as base. Note that at the same height colors of different perceived brightness are positioned. Value is given by the height, saturation is coded in the distance from the axes and hue by the position on the boundary.

3) CMY color model :

CRTs produce color by emission and uses the RGB model. Printers produce color by reflective light so it is a subtractive process and uses a model based on the colors: Cyan, Magenta, Yellow.

Methodology

Methodology

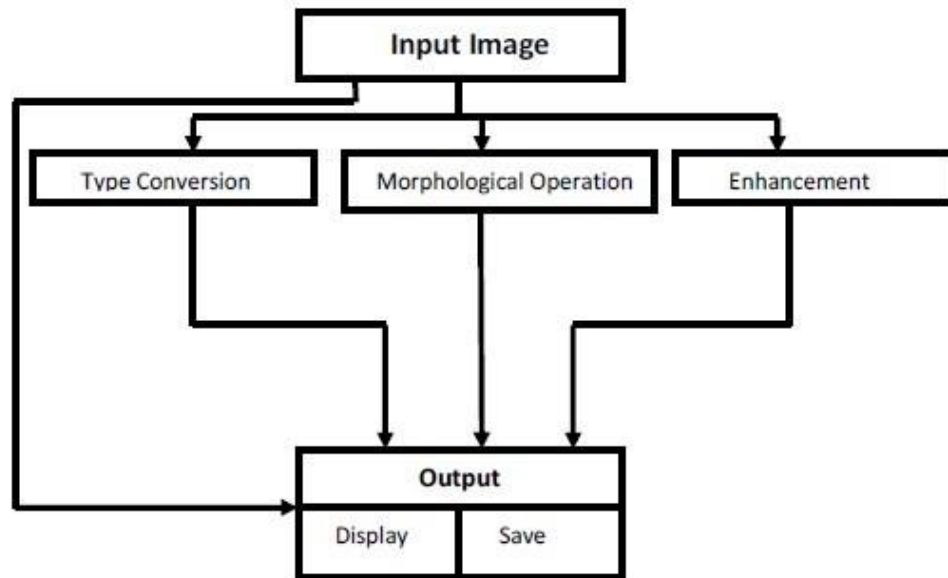


Figure 1 : Methodology

Display

In this step Binary, Gray and RGB image will be visualize.

.

Type conversions

In type conversions we can do type conversions for example: (RGB to HSV, RGB to CMY, CMY to HSV)

Enhancement

Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further image analysis. For example, you can remove noise, sharpen, or brighten an image, making it easier to identify key features.

Requirements

Python dependency required

Python 3.7 with library.

No	Dependency	Description
1.	Python 3.7 32 Bit	The core programming language
2.	Numpy: 1.7.1	The basic library consisting of large multidimensional array objects and a collection of routines for processing those arrays.
3.	Scipy: 1.0.0	The basic library for statistical analysis.
4.	Matplotlib:	The basic library for graph plotting.
5.	Tkinter	The basic library for creating the GUI.
6.	OpenCv	OpenCV -OpenCV is a cross-platform library using which we can develop real-time computer vision applications.
7.	Matplotlib	The basic library for hyperspectral data visualization.
8.	Scikit-Learn	The basic machine learning library
9.	Scikit-Image	The basic Image Processing Library
10.	PIL	The basic library for Image Processing.
11	Request	

Feasibility Study

Before recommending the new system, it necessary to investigate whether it is possible as well as feasible to develop the new system. The important outcome of this preliminary investigation is the determination of whether the proposed system is possible an feasible for the organization or not there are basically three aspects of feasibility study which can be listed as shown below.

Software Requirements Specification

It is an agreement between the system developer and the user. Here we have developed a system as specified by teacher and friend. periodically they specified us with some additional feature that must be including in the system. We selected those strategic that fulfil the goal of the system and met the specification.

Data Analysis

Computerized working system for various organizations has been designed. We have surveyed the current working system. There whole word is carried put manually.

They require an automated system. For furnishing their capabilities. With this software, the manual work in terms of record report is reduced, which put forth the necessity and the way to automated the manual work is fulfil by our software. Our software provides security for accidental loss of data. It's also provides easy information with user. It also provides systematic database. As we have provided automatic calculation facility, it minimizes work load of user & save efforts. So this software easily use at anywhere. With greater efficiency.

Features of Python Programming Language

Today, there are so many, and all with their own specialties. But what make a language unique is its features. And ultimately, it is its features that get it chosen or passed for a project. So before beginning with deeper concepts of Python, let's take a look at the major features of python programming language that give you reasons why you should learn Python as compared to R or other tool. So let's start with the Features of Python Programming Language.

- **Easy to code**

As we have seen in earlier lessons, Python is very easy to code. Compared to other popular languages like Java and C++, it is easier to code in Python. Anyone can learn python syntax in just a few hours. Though sure, mastering Python requires learning about all its advanced concepts and packages and modules. That takes time. Thus, it is programmer-friendly.

- **Easy to read**

Being a high-level language, Python code is quite like English. Looking at it, you can tell what the code is supposed to do. Also, since it is dynamically-typed, it mandates indentation. This aids readability.

- **Expressive**

First, let's learn about expressiveness. Suppose we have two languages A and B, and all programs that can be made in A can be made in B using local transformations. However, there are some programs that can be made in B, but not in A, using local transformations. Then, B is said to be more expressive than A. Python provides us with a myriad of constructs that help us focus on the solution rather than on the syntax. This is one of the outstanding python features that tells you why you should learn Python.

- **High- Level**

As we discussed in point 2b, it is a high-level language. This means that as programmers, we don't need to remember the system architecture. Nor do we need to manage the memory.

- **Large Standard Library**

Python downloads with a large library that you can use so you don't have to write your own code for every single thing. There are libraries for regular expressions, documentation-generation, unit-testing, web browsers, threading, databases, CGI, email, image manipulation, and a lot of other functionality.

- **GUI Programming**

You can use Tk to create basic GUIs.

- **Dynamically Typed**

Python is dynamically-typed. This means that the type for a value is decided at runtime, not in advance.

- **Object-Oriented**

A programming language that can model the real world is said to be object-oriented. It focuses on objects, and combines data and functions. Contrarily, a procedure-oriented language revolves around functions, which are code that can be reused.

Python supports both procedure-oriented and object-oriented programming which is one of the key python features. It also supports multiple inheritance, unlike Java. A class is a blueprint for such an object. It is an abstract data type, and holds no values.

Advantages of Python

The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry. Some of its advantages are

- **Extensive Support Libraries**

It provides large standard libraries that include the areas like string operations, Internet, web service tools, operating system interfaces and protocols. Most of the highly used programming tasks are already scripted into it that limits the length of the codes to be written in Python.

- **Integration Feature**

Python integrates the Enterprise Application Integration that makes it easy to develop Web services by invoking COM or COBRA components. It has powerful control capabilities as it calls directly through C, C++ or Java via Jython. Python also processes XML and other markup languages as it can run on all modern operating systems through same byte code.

- **Improved Programmer's Productivity**

The language has extensive support libraries and clean object-oriented designs that increase two to tenfold of programmer's productivity while using the languages like Java, VB, Perl, C, C++ and C#.

- **Productivity**

With its strong process integration features, unit testing framework and enhanced control capabilities contribute towards the increased speed for most applications and productivity of applications. It is a great option for building scalable multi-protocol network applications.

Implementation

Design and develop image processing software using open source technology is developed to enroll, visualize, process and analyze the image data.



Figure 2 Home Window

Figure 3 indicates the general menu schema provided into the Data.

File	View	Tools	Filter	Help
Open	RGB Channel	Opening	2D filter	About
Exit	RGBtoHSV	Closing	Gaussian	Documentation
	CMYtoRGB	Rotation	Median	
		Dilation	Bilateral	
		Erosion	Low pass	
			High pass	
			Laplacian	

1) Show image user

The data enrolment and visualization module is designed to enrol and visualize the data and. The module supports multiple file formats (i.e. . TIFF, GIF, JPEG,BMP,etc.). The File menu provides drop-down list with 'Open', and 'Exit' menus. The 'Open' menu opens the Selected images for visualization purpose. The 'Exit' terminates the entire session.

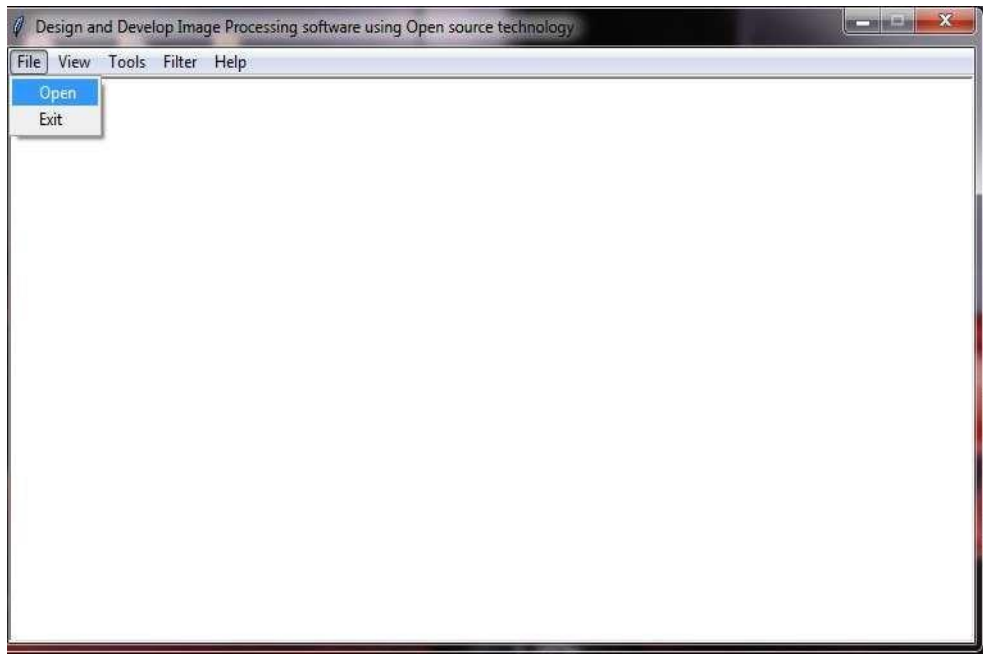


Figure 3 File menu

Once data get read successfully, the selected image will display on the window.

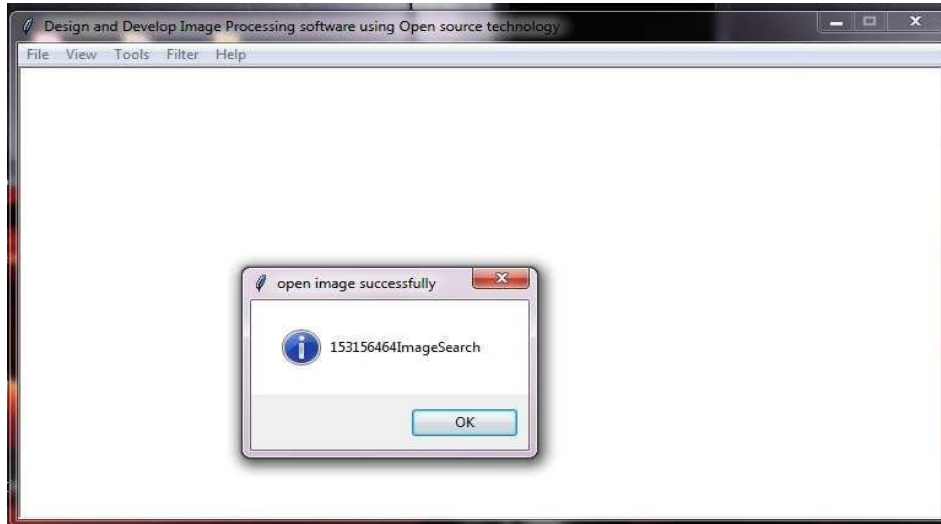


Figure 4 Image search window

Once we can read image successfully after that exit menu also we can use.

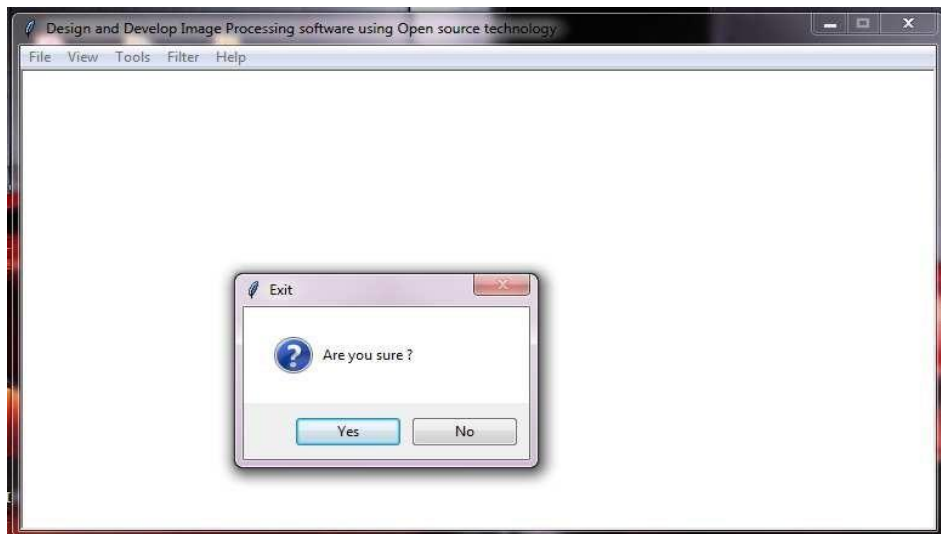


Figure5 Exit window

2) View window

In view window we can see the color code conversions.

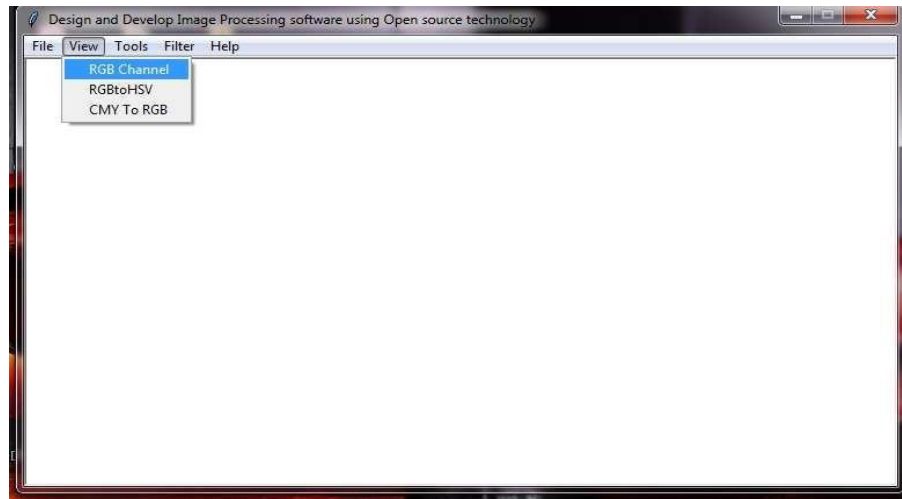


Figure 6 View window

RGB channel

Here we can see the given image is converted into RGB format.

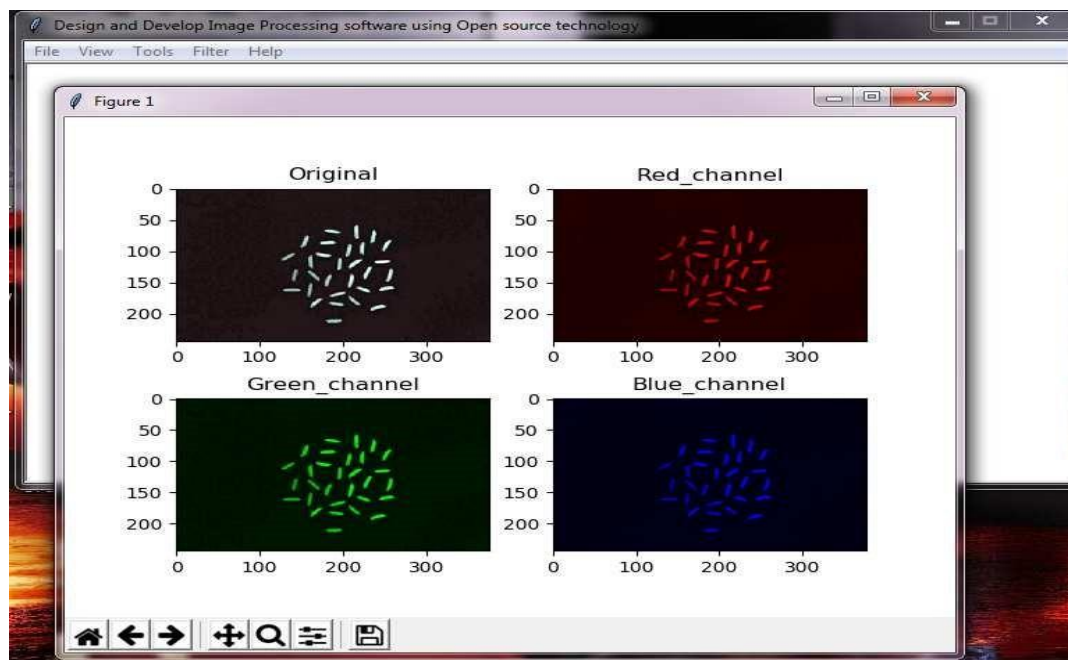


Figure 7 RGB window

RGB to HSV

Here we can convert RGB image into the HSV image.

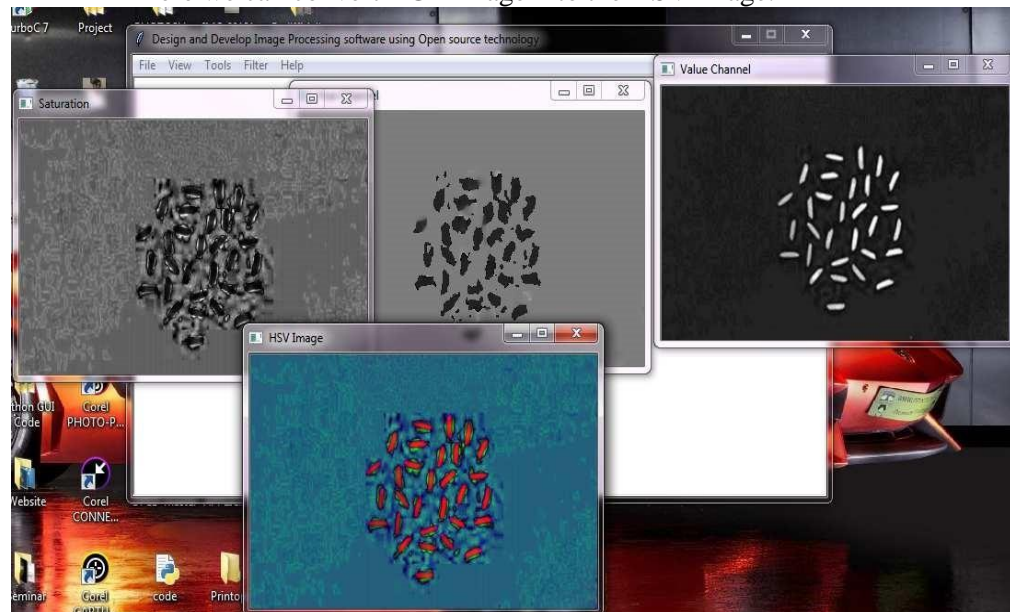


Figure 8 RGB to HSV window

3 Basic Tools

The basic tools provides the drop-down menus.

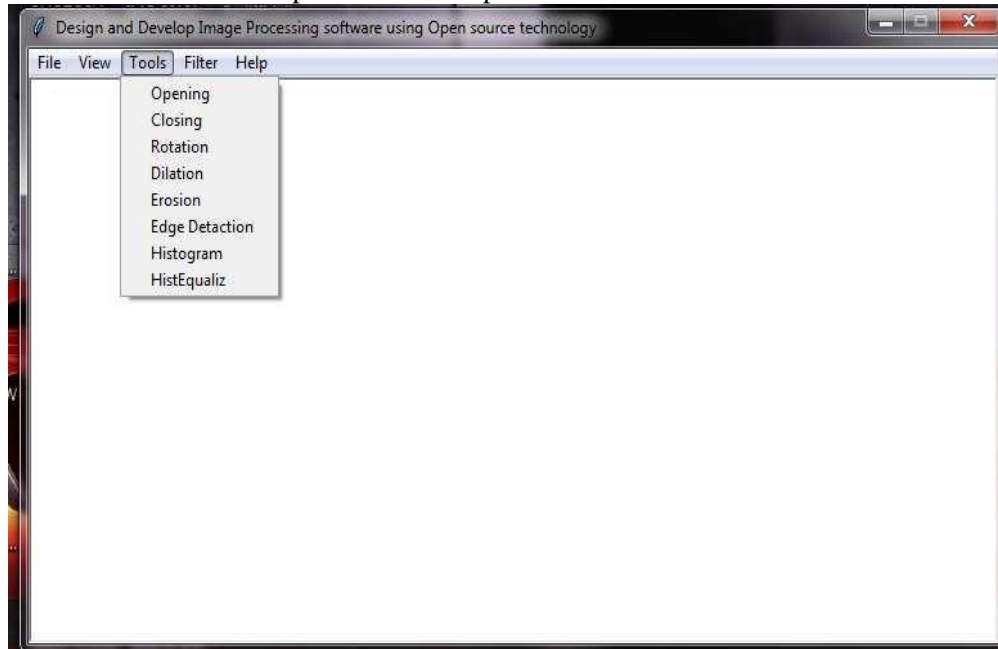


Figure 9 Tool menu

3.1) Opening

An opening is defined as an erosion followed by a dilation using the same structuring element for both operations.

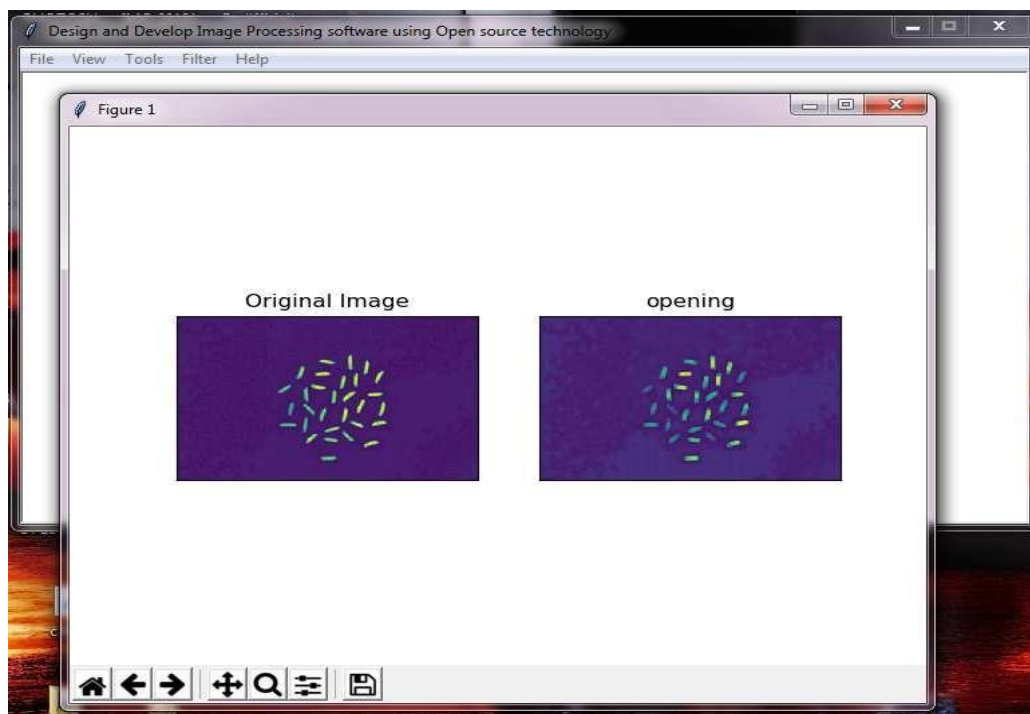


Figure 10 Opening window

3.2) Closing

Closing is opening performed in reverse. It is defined simply as a dilation followed by an erosion *using the same structuring element for both operations*.

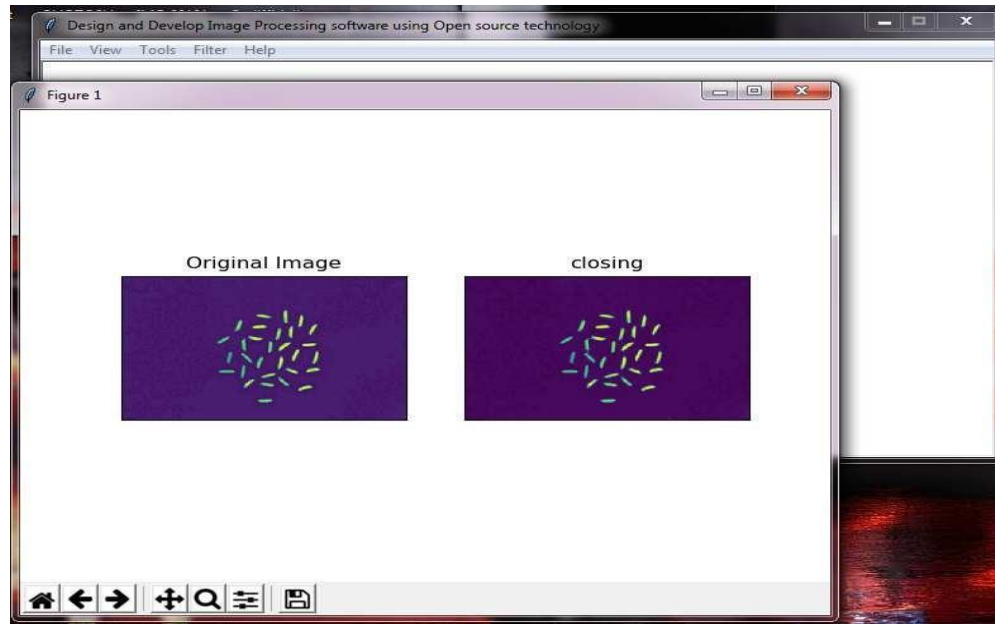


Figure 11 Closing window

3.3) Rotation

The rotation operator performs a geometric transform which maps the position (x_1, y_1) of a picture element in an input image onto a position (x_2, y_2) in an output image by rotating it through a user-specified angle θ about an origin O . In most implementations, output locations (x_2, y_2) which are outside the boundary of the image are ignored. Rotation is most commonly used to improve the visual appearance of an image, although it can be useful as a preprocessor in applications where directional operators are involved. Rotation is a special case of affine transformation.

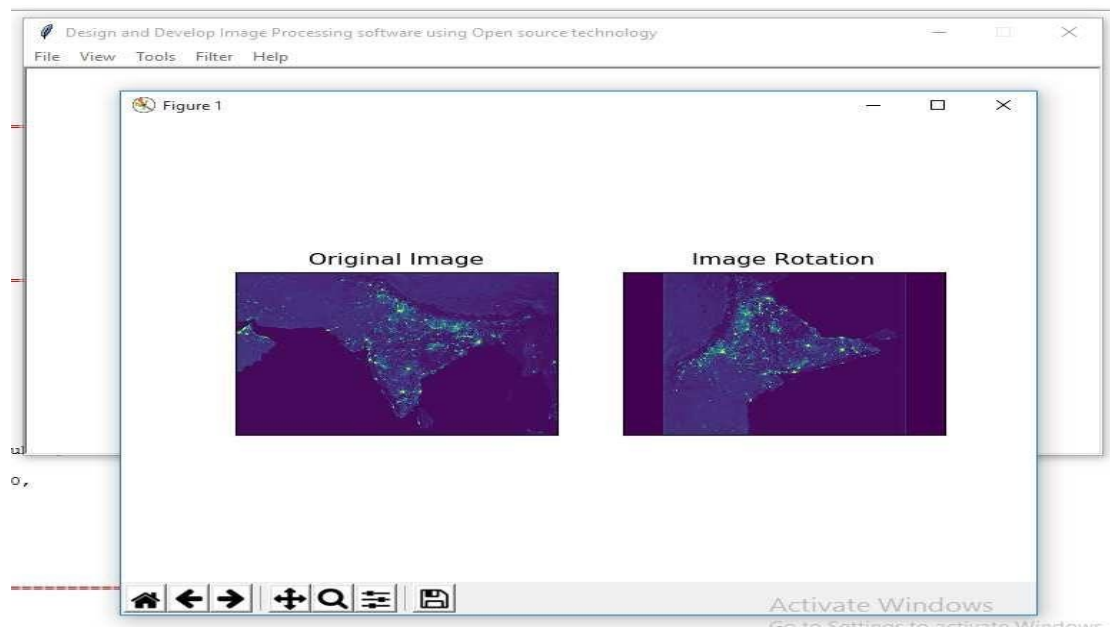


Figure 12 Rotation window

3.4) Dilation

The value of the output pixel is the *maximum* value of all pixels in the neighborhood. In a binary image, a pixel is set to 1 if any of the neighboring pixels have the value 1.

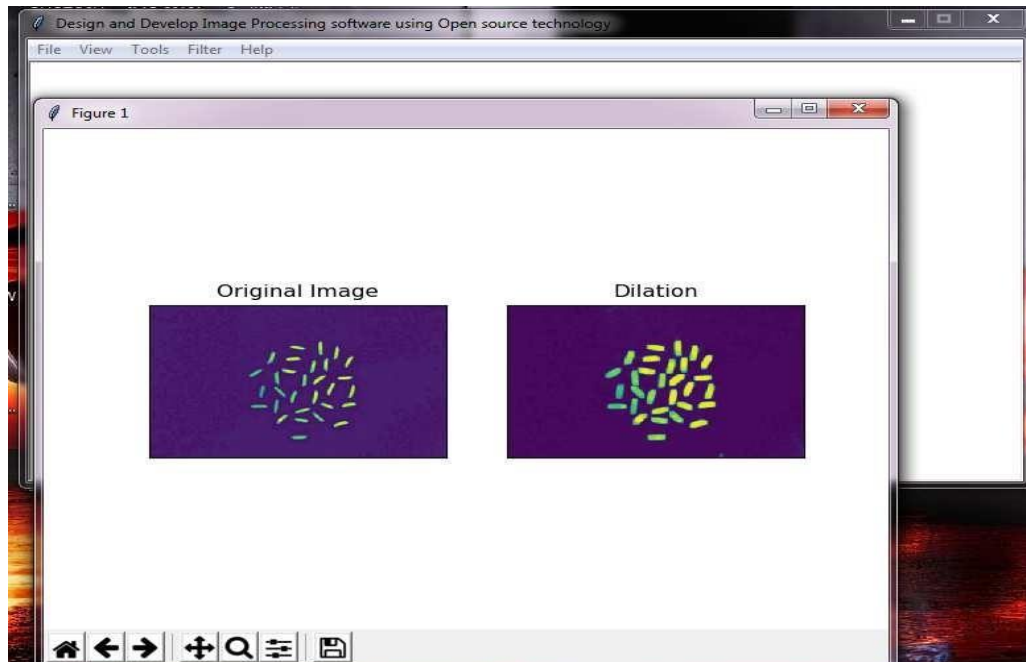


Figure 13 Dilation window

Erosion

The value of the output pixel is the *minimum* value of all pixels in the neighborhood. In a binary image, a pixel is set to 0 if any of the neighboring pixels have the value 0.

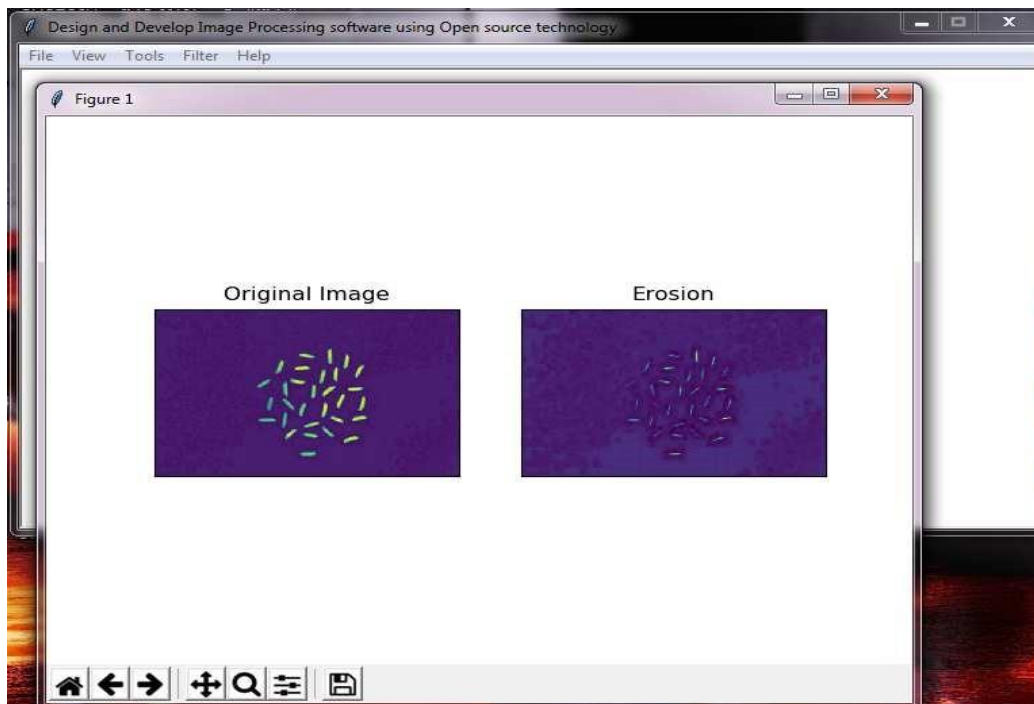


Figure 14 Erosion window

Edge Detection

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision.

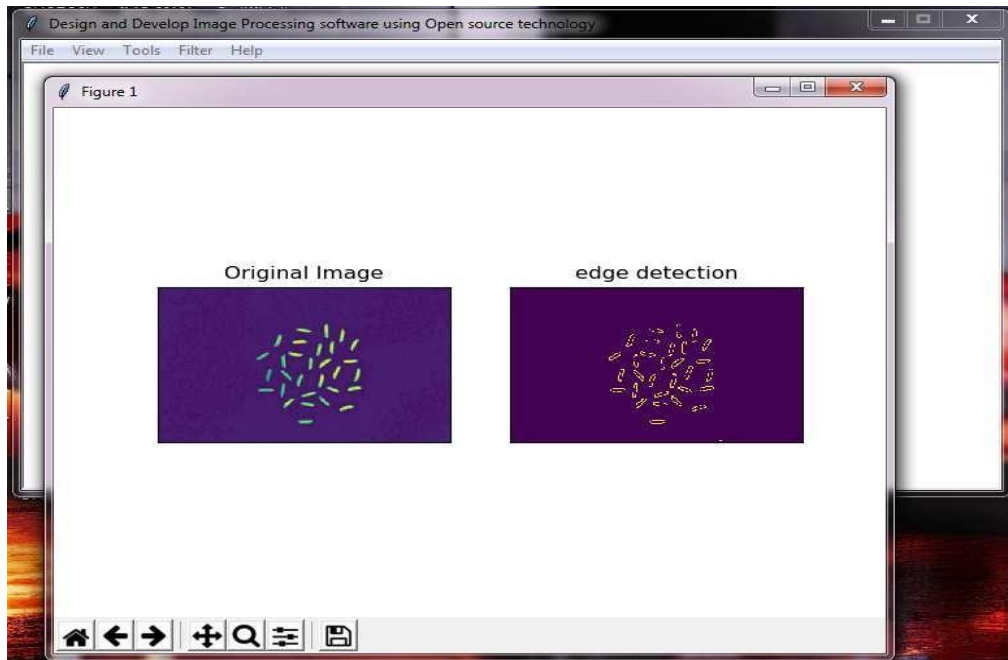


Figure 15 Edge detection window

Histogram

In an image processing context, the histogram of an image normally refers to a histogram of the pixel intensity values. This histogram is a graph showing the number of pixels in an image at each different intensity value found in that image

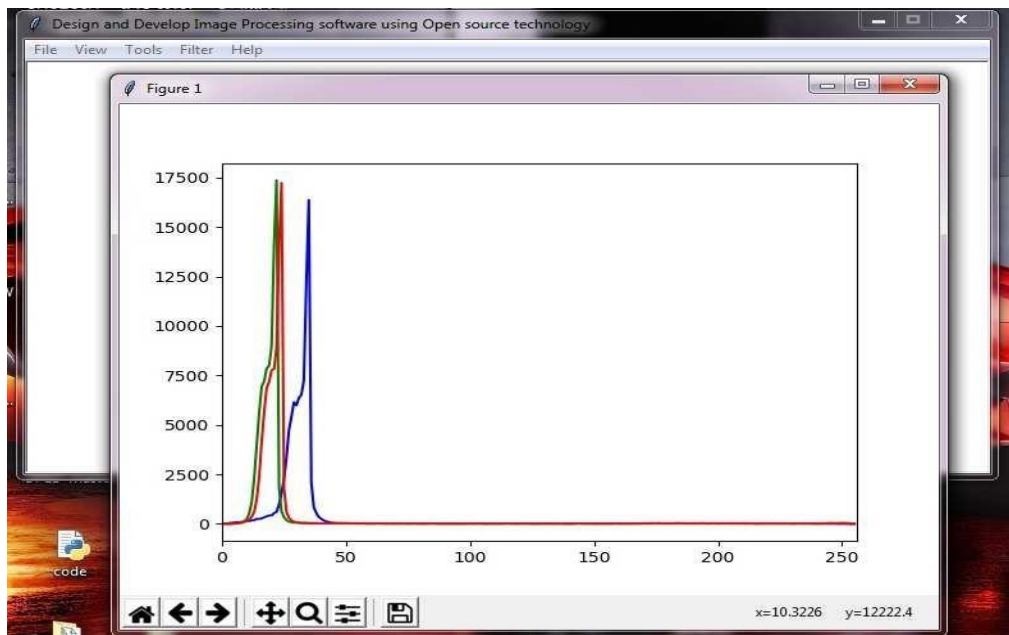


Figure 16 histogram window

Histogram Equalization

Histogram equalization is used to enhance contrast. It is not necessary that contrast will always be increase in this. There may be some cases were histogram equalization can be worse. In that cases the contrast is decreased

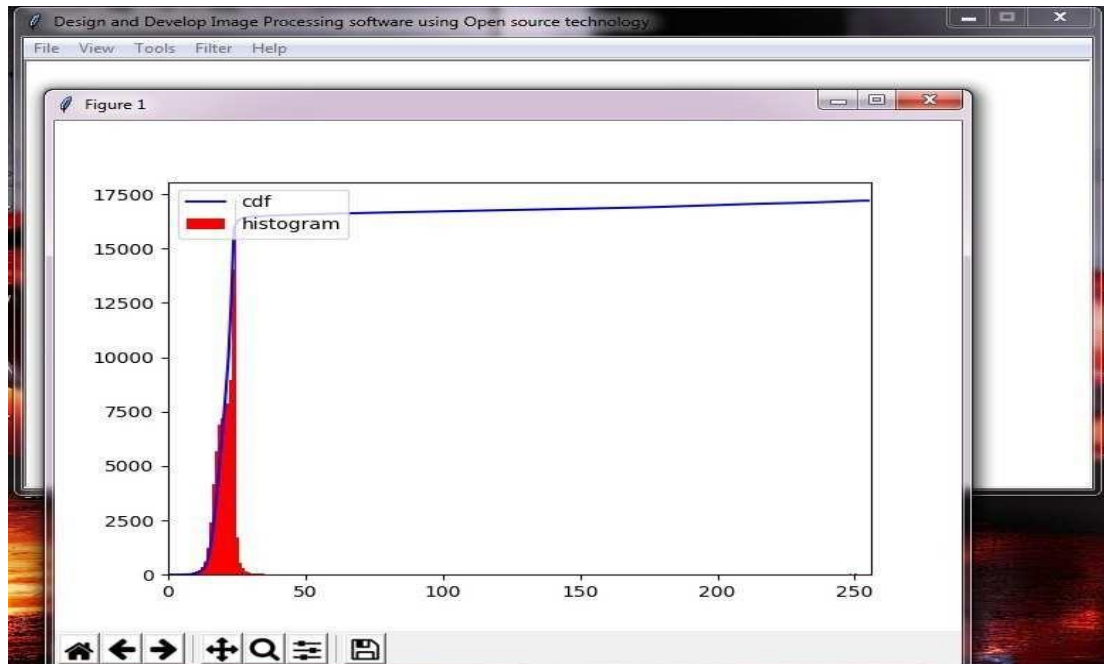


Figure 17 histogram Equalization

4) Filter Menu

The Filter menu provides the drop-down menus.

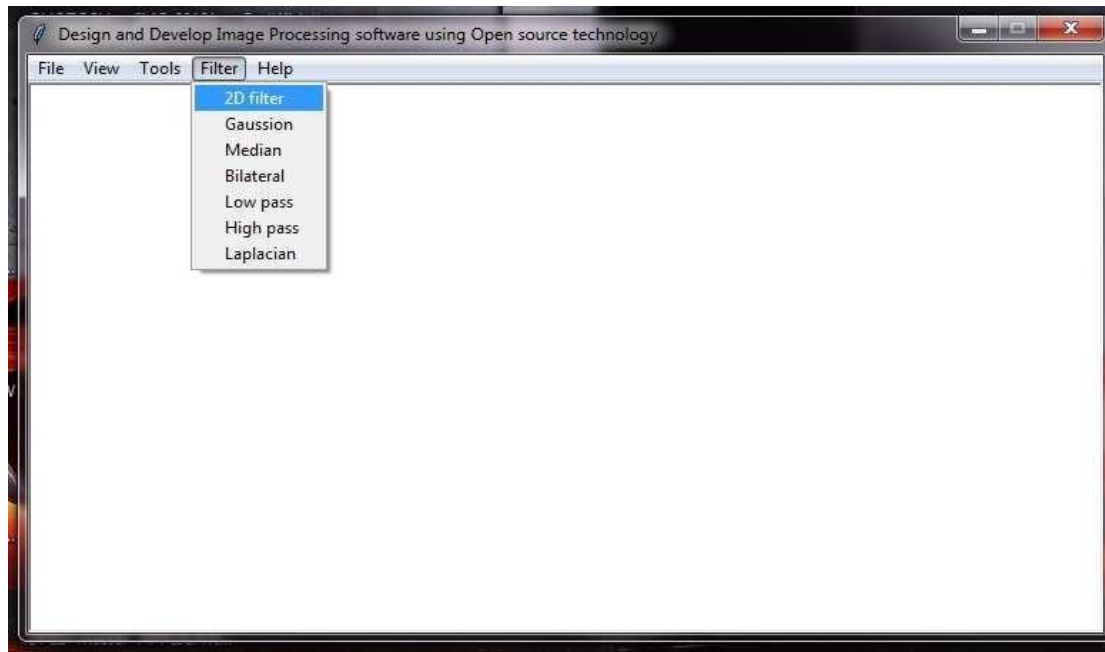


Figure 17 Filter menu

2D filter

In image processing filters are mainly used to suppress either the high frequencies in the image, i.e. smoothing the image, or the low frequencies, i.e. enhancing or detecting edges in the image. An image can be filtered either in the frequency or in the spatial domain

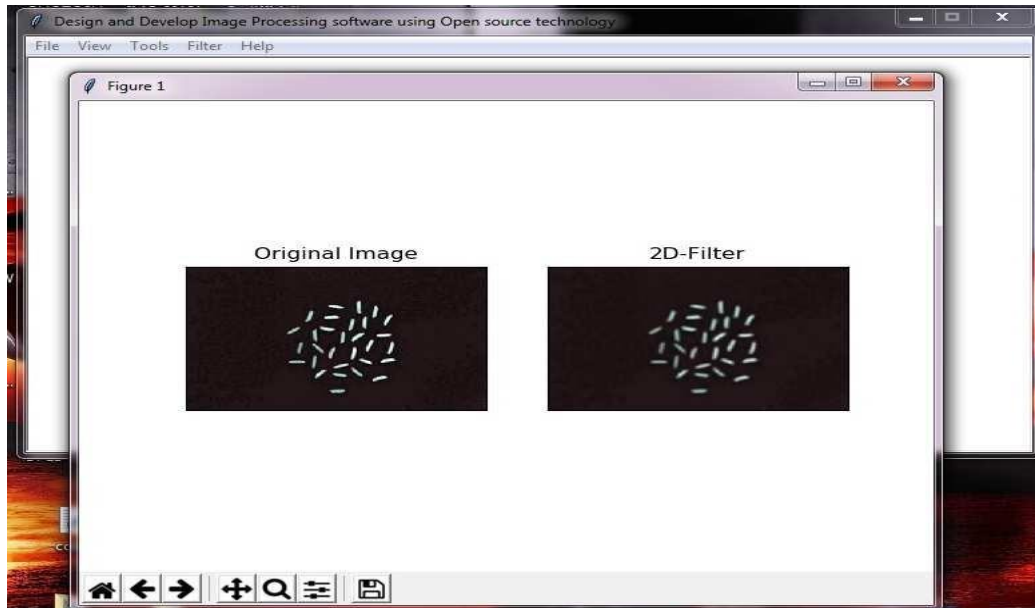


Figure 18 2D Filter wingdow

Gaussian filter

In image processing, a Gaussian blur (also known as Gaussian smoothing) is the result of blurring an image by a Gaussian function (named after mathematician and scientist Carl Friedrich Gauss). It is a widely used effect in graphics software, typically to reduce image noise and reduce detail. The visual effect of this blurring technique is a smooth blur resembling that of viewing the image through a translucent screen, distinctly different from the bokeh effect produced by an out-of-focus lens or the shadow of an object under usual illumination. Gaussian smoothing is also used as a pre-processing stage in computer vision algorithms in order to enhance image structures at different scales—see scale space representation and scale space implementation

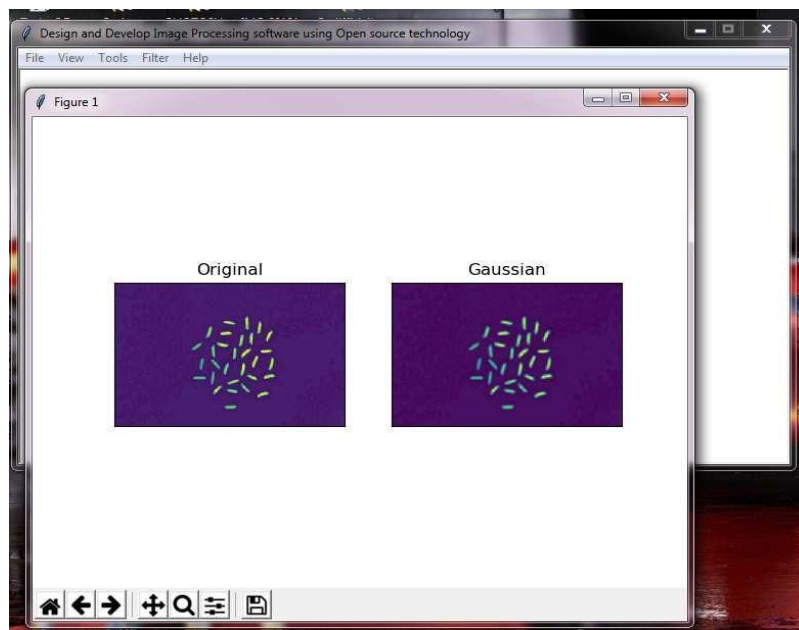


Figure 19 Gaussian Filter window

Median filter

The Median Filter is a non-linear digital filtering technique, often used to remove noise from an image or signal. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise (but see discussion below), also having applications in signal processing.

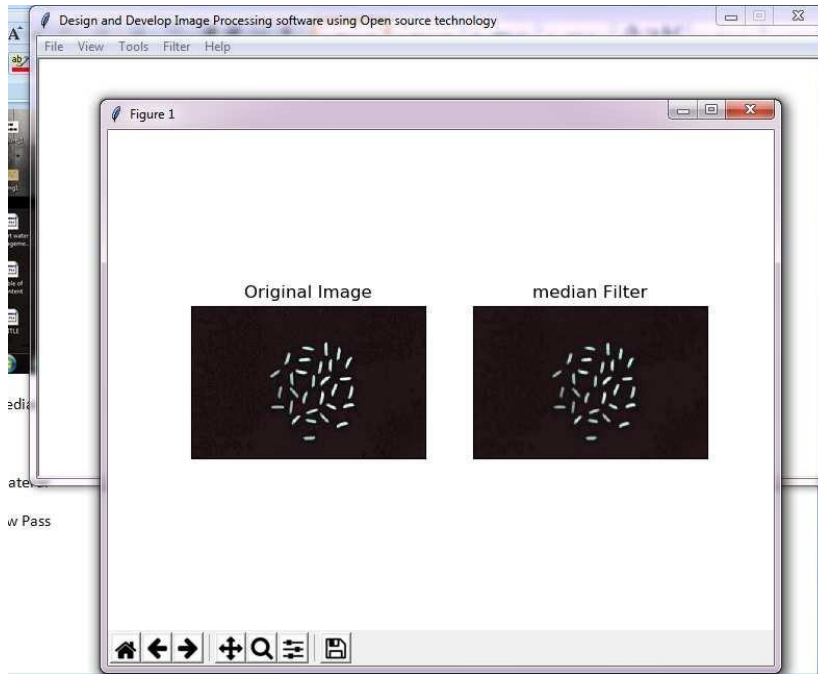


Figure 20 Median Filter wingdow

Bilateral

A bilateral filter is a non-linear, edge-preserving, and noise-reducing smoothing filter for images. It replaces the intensity of each pixel with a weighted average of intensity values from nearby pixels. This weight can be based on a Gaussian distribution. Crucially, the weights depend not only on Euclidean distance of pixels, but also on the radiometric differences (e.g., range differences, such as color intensity, depth distance, etc).

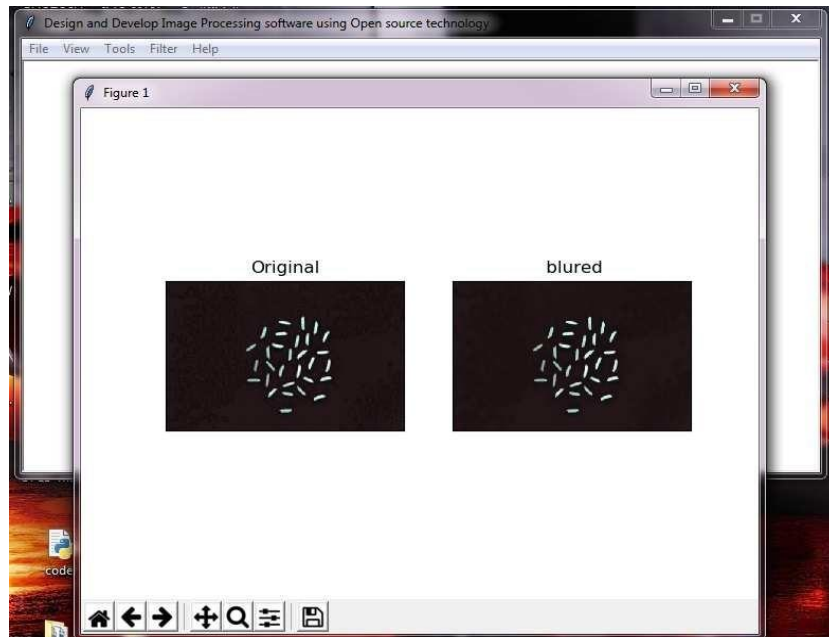


Figure 21 Bilateral Filter wingdow

Low Pass filter

The most basic of filtering operations is called "low-pass". A low-pass filter, also called a "blurring" or "smoothing" filter, averages out rapid changes in intensity. The simplest low-pass filter just calculates the average of a pixel and all of its eight immediate neighbors. The result replaces the original value of the pixel. The process is repeated for every pixel in the image

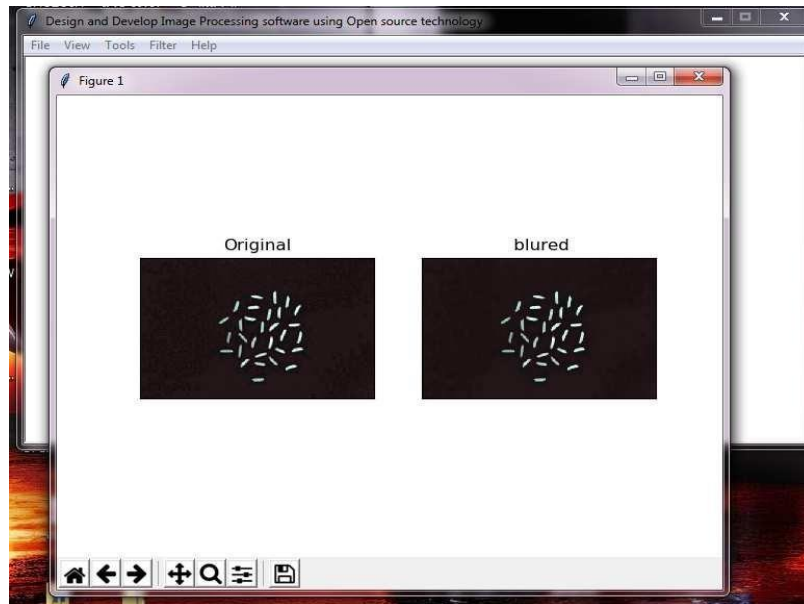


Figure 22 Low pass Filter wingdow

High Pass filter

A high-pass filter can be used to make an image appear sharper. These filters emphasize fine details in the image – exactly the opposite of the low-pass filter. High-pass filtering works in exactly the same way as low-pass filtering; it just uses a different convolution kernel. In the example below, notice the minus signs for the adjacent pixels. If there is no change in intensity, nothing happens. But if one pixel is brighter than its immediate neighbors, it gets boosted.

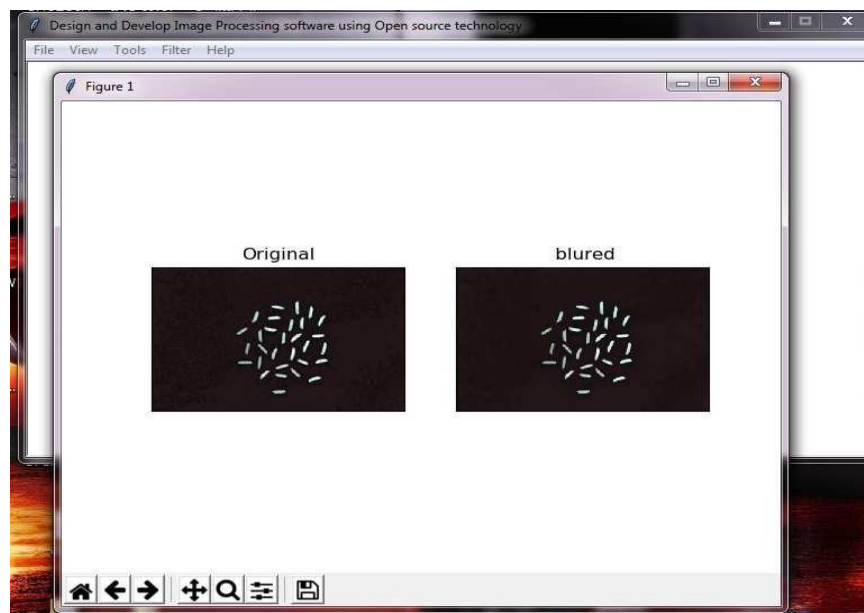


Figure 23 High pass Filter wingdow

Laplacian filter

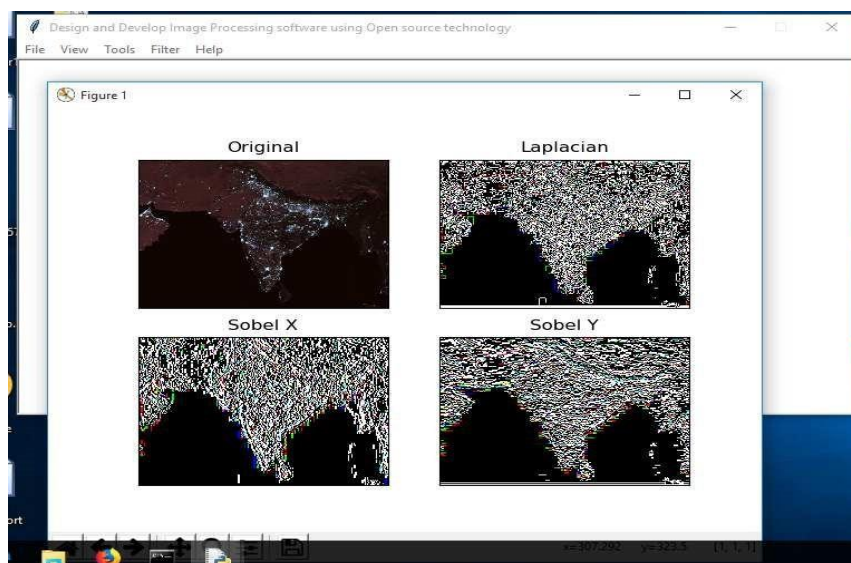


Figure 24 Laplacian Filter wingdow

The Laplacian is a 2-D isotropic measure of the 2nd spatial derivative of an image. The Laplacian of an image highlights regions of rapid intensity change and is therefore often used for edge detection (see zero crossing edge detectors). The Laplacian is often applied to an image that has first been smoothed with something approximating a Gaussian smoothing filter in order to reduce its sensitivity to noise, and hence the two variants will be described together here. The operator normally takes a single graylevel image as input and produces another graylevel image as output

5 Help menu

The Help menu contains help document regarding the software

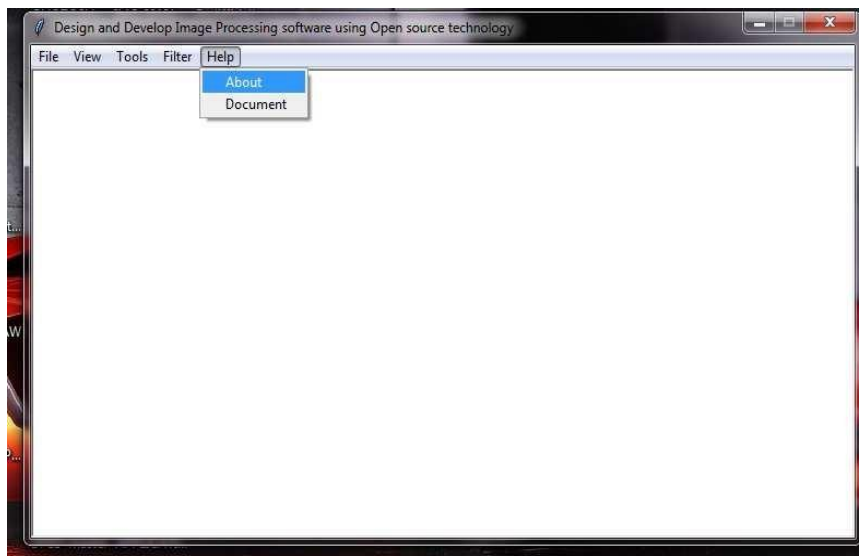


Figure 25 Help menu

Conclusion and Future scope

Conclusion

In this work, several methodologies are used. Like morphological operations in morphological operations erosion. Erosion is used for thinning the image as it shrinks the image and helps to reduce noise or unwanted small objects. and dilation are used. Dilation is being used after erosion As well as Filters are also used in Filters several filters are used like Low pass filter, High pass filter, Gaussian filter , Median filters are used. This tool is very useful for Laboratory.

Future Scope

This tool is very useful for everyone. This is also useful for students, in hospitals in Laboratory. Using this tool we can easily perform any kinds of operations.

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Author : Rafael C. Gonzalez(2009-05-03) Digital Image Processing Using MATLAB, 2nd ed.Prentice Hall Upper Saddle River, New Jersey 07458.
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- “digital image processing”[Internet Cited] 2019 march 17 ,3:00 am ,Available from, <https://www.quora.com/What-are-the-advantages-of-digital-image-processing>
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