



# Vidyavardhini's College of Engineering & Technology

Department of Computer Engineering

---

Processing image with OpenCV 3
Date of Performance: 24/07/2023
Date of Submission: 31/07/2023



# Vidyavardhini's College of Engineering & Technology

## Department of Computer Engineering

---

**Aim:** Processing image with OpenCV 3

**Objective:** To perform conversion between different colour spaces, the fourier transform, high/low pass filters .

**Theory:** OpenCV is a popular open-source library for computer vision and image processing tasks. It provides a wide range of tools and functions to manipulate images, perform object detection, track motion, and more includes advanced features for computer vision tasks and improvements over earlier versions, enhancing its capabilities for image and video analysis, machine learning integration, and real-time applications.

### **Conversion between colour space:**

There are literally hundreds of methods in OpenCV that pertain to the conversion of colour spaces. In general, three colour spaces are prevalent in modern day computer vision: grey BGR, and Hue, Saturation, Value (HSV). Gray is a colour space that effectively eliminates colour information translating to shades of grey: this colour space is extremely useful for intermediate processing, such as face detection. BGR is the blue-green-red colour space, in which each pixel is a three-element array, each value representing the blue, green, and red colours: web developers would be familiar with a similar definition of colours, except the order of colours is RGB. In HSV, hue is the colour tone, saturation is the intensity of a colour, and value represents its darkness (or brightness at the opposite end of the spectrum).

### **The Fourier Transform :-**

Much of the processing you apply to images and videos in OpenCV involves the concept of Fourier Transform in some capacity. Joseph Fourier was an 18th century French mathematician who discovered and popularised many mathematical concepts, and concentrated his work on studying the laws governing heat, and in mathematics, all things waveform. In particular, he observed that all waveforms are just the sum of simple sinusoids of different frequencies. In Other words, the waveforms you observe all around you are the sum of other waveforms. This Concept is incredibly useful when manipulating images, because it allows us to identify regions in images where a signal (such as image pixels) changes a lot, and regions where the change is less dramatic. We can then arbitrarily mark these regions as noise or regions of interests, background or foreground, and so on. These are the frequencies that make up the original image, and we have the power to separate them to make sense of the image and extrapolate interesting data



# Vidyavardhini's College of Engineering & Technology

## Department of Computer Engineering

---

### High pass filter:-

A high pass filter (HPF) is a filter that examines a region of an image and boosts the intensity of certain pixels based on the difference in the intensity with the surrounding pixels. Take, for example, the following kernel:

$$\begin{bmatrix} 0 & -0.25 & 0 \\ -0.25 & 1 & -0.25 \\ 0 & -0.25 & 0 \end{bmatrix}$$

compared to all the immediate neighbours, the intensity of the central pixel will be boosted (or not) if a high level of changes are found. In other words, if a pixel stands out from the surrounding pixels, it will get boosted. This is particularly effective in edge detection, where a common form of HPF called high boost filter is used. Both high pass and low pass filters use a property called radius, which extends the area of the neighbours involved in the filter calculation.

### Low pass filter:-

If an HPF boosts the intensity of a pixel, given its difference with its neighbours, a lowpass filter (LPF) will smoothen the pixel if the difference with the surrounding pixels is lower than a certain threshold. This is used in denoising and blurring. For example, one of the most popular blurring/smoothening filters, the Gaussian blur, is a low pass filter that attenuates the intensity high frequency signals.

### Conclusion :

OpenCV 3 offers a robust platform for image processing that empowers both beginners and experts in the field. Its versatile toolkit enables a wide range of operations, from basic manipulations like reading, writing, and resizing images, to more advanced tasks such as edge detection, object recognition, and even complex computer vision algorithms. With OpenCV3, the possibilities for enhancing, analysing, and understanding visual data are vast. Its user-friendly interface coupled with its extensive library of functions makes it a pivotal tool for various industries, including robotics, healthcare, entertainment, and more. Whether in researcher application, OpenCV 3 stands as a foundation for transforming raw visual information into valuable insights and innovations.