# Image Processing Techniques Used In Machine Learning

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**Abstract -** There are usually two reasons why Human beings process or conduct computations on pictures:-
1) In-order to highlight or bring out certain features in an image or 2) To process the image in a manner where a machine is able to read and pick up patterns for learning. An image is an electronic representation to a real world object. It can typically either be a bitmap image which is an image constructed by a small unit called as bit, a single dot carrying certain intensity. Club several such dots of varying intensities together and you have a picture ready. In contrast, vector images are constructed from lines and curves which can be used to construct scalable geometric images. Besides these two types, images can be further classified into different types based on their characteristics such as greyscale images, 2D or 3D images, bit depths classified based on no. of pixels such as 8 bits, 16 bits, 32 bits etc. Reiterating intentions of processing images, each of these image formats would have different applications depending on their characteristics. This paper will discuss the different pre-processing techniques that an image is subject to before it can be used further.

*Key Words***: Image processing, image pre-processing algorithms, image segmentation, image contrast, transformations, edge detection**

## 1.INTRODUCTION

Following are steps we follow for image Processing:-

**1. Image Acquisition**- It is done through many mediums such as cameras, live videos, phone cameras or other sources such as the internet: blogs, social media, websites, image libraries etc. In this stage, image obtained is raw or in case of the internet there may some processing already done.

**2. Image Pre-processing-** The stage we will focus on the most in this paper. Purpose of pre-processing could be many. It could be to reduce noise, or normalize the data, changing the depth ratio. Mainly it is to do some process, which will make the subsequent processes simpler.

**3. Data Reduction**- Ideally means compression techniques. Post performing computations on an image, its image size usually increases. An image is compressed so that it occupies limited bandwidth or memory space.

**4.Image Segmentation**- It partitions an image in fundamentals such as edges, contours, shapes etc.

**5.Object Recognition**- A label is assigned to an object based on the descriptions gathered about the image. Eg- Car, Dog etc. Description could be boundary or regional representations. Boundary refers to external or corner shape and styled characteristics and regional refers to internal characteristics.

**Fig -1:** Steps in Image Processing
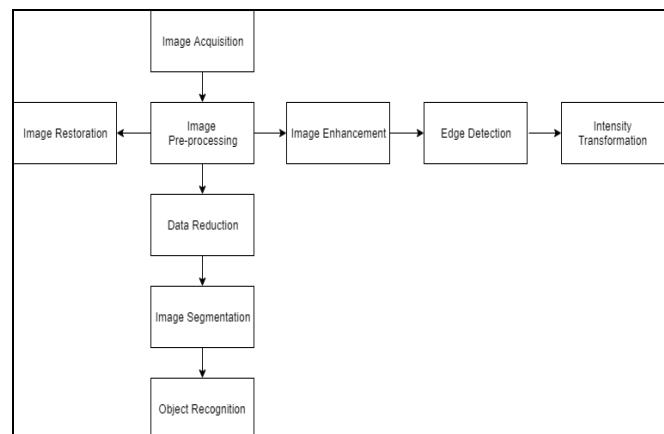


## 2. PRESENTING THE IDEA

Though any technique can be used in pre-processing stage depending on how you want to edit the image, certain operations typically done in this step include intensity transformation, improvement of image data by enhancing or distorting certain features in the image, geometric transformations such as rotation, scaling, translation etc. Hence, we will discuss some of them here, though some may seem left out.

**1.Image Restoration**- Image restoration is done to improve the quality of the image from problems such as blurring, noise, unfocused image etc. It can be called a type of image enhancement but where Image Enhancement is more subjective, Restoration techniques are usually more objective. We can use certain filters which can help to restore an image using signal to noise ratios.

**2.1.Weiner Filter**- Is an inverse filter. Uses liner technique and does restoration for deconvolution, where an image is blurred by a lowpass filter. This filter is sensitive to additive noise. It tries to balance both blurring as well as noise.
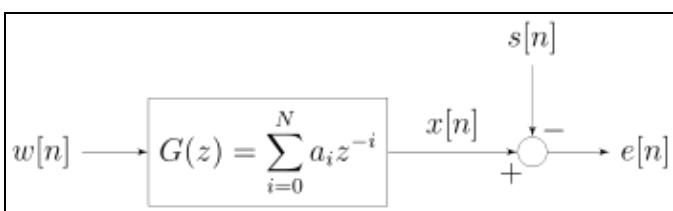
**Fig 2**- Weiner Filter

**1.2 Direct Inverse Filter**
If the blurring function of the image can be constructed, then is passed as a lowpass filter to the original image which leads to the original image. However, it is not a good choice to use it if there is too much noise in the image or if the blurring function formed is too small a value.

**1.3 Constrained Least-Square Filter**
It is an extension of Weiner filter, where the deconvolution process does not require noise.

**2.Image Enhancement** – Ideally encompass techniques where the quality of images are improved subjectively as per a person. Usual factors considered in image enhancement are edge detection, sharpening or unsharpening an image, contrast variations etc. Some techniques are:-

**2.1 Morphological Factors**-They are non-linear actions performed related to shape or morphology features of an image. They rely on relative ordering of pixels and not on numerical values. Suited to binary images.
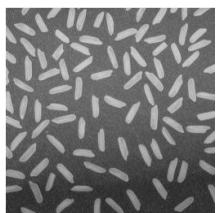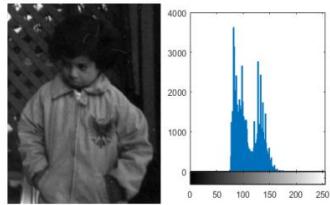


Fig –3(a):Original Image      Fig -3(b):Increased Contrast

**2.2 Histogram Equalization**- Histogram is a graphical representation of the different colour intensities of an image. It is a method to adjust the contrast of an image by modifying the intensity distribution of the histogram.



**Fig 4-** Histogram Representation

**2.3 Unsharp Mask Filtering**- Apply filter to sharpen a specific area or region of an image.

**3.Edge Detection-** It is a technique for finding boundaries of objects in images. Works by detecting differences in contrast of objects in the image. Ideally used for data extraction and image segmentation. Some edge detection algorithms in place are Canny , Sobel, Prewitt, Roberts and Fuzzy Logic methods.

**3.1Canny Method**- The most powerful edge-detection method that edge provides is the Canny method. The Canny method differs from the other edge-detection methods in that it uses two different thresholds (to detect strong and weak edges), and includes the weak edges in the output only if they are connected to strong edges. This method is therefore less likely than the others to be affected by noise, and more likely to detect true weak edges.

**3.2Fuzzy Logic Method-** The fuzzy logic approach for image processing allows you to use membership functions to define the degree to which a pixel belongs to an edge or a uniform region.

**3.3Sobel Method**- Consists of an isotropic 3 x 3 image gradient operator. It uses discrete differentiation. It computes a gradient of the image intensity function.

**4. Intensity Transformation**- Intensity transformation means ideally playing with intensity values of the different pixels in the image. In other words it deals highly with contrast. They are ideally used in Greyscale images. Some techniques are:-

4.1 **Photographic Negative**- You inverse the pixel values. '0' becomes '1' and '1' becomes '0' in the image map. That is, black becomes white and white becomes black in the image. The result is a very sharp contrast.
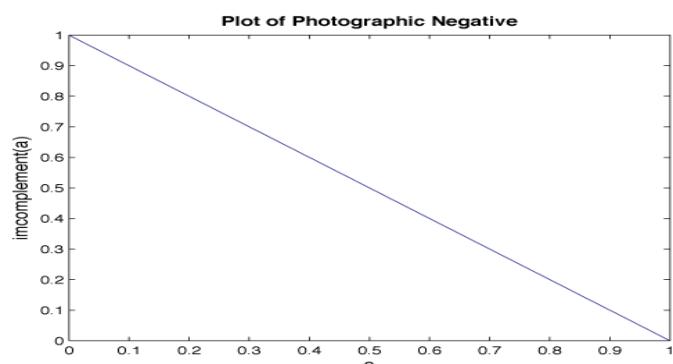


**Fig 5 (a)**-Photographic Negative

**Gamma Transformation**- Uses a factor called Gamma. Depending on the value of the gamma co-efficient, the contrast can be brighter or darker. A gamma value above '1' will create a very dark image and a gamma value below '1' will create a brighter image.
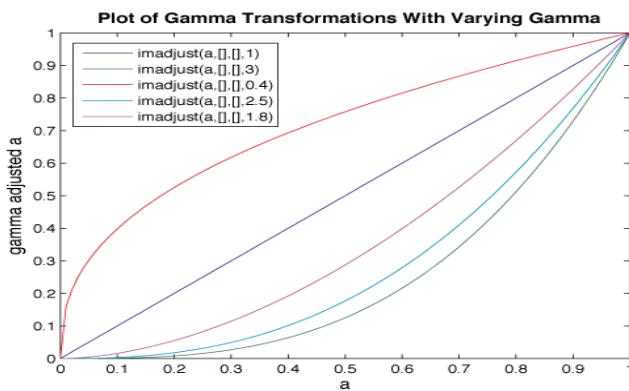
**Fig 5(b)**- Gamma Transformation

**Logarithmic Transformations**- Works similar to Gamma Transformations, however they work better in increasing the brightness of lower intensity value pixels. Work well with Fourier Transformations. In case of loss of detail in certain regions, clamping is used to display those regions with intensity value of '1'.
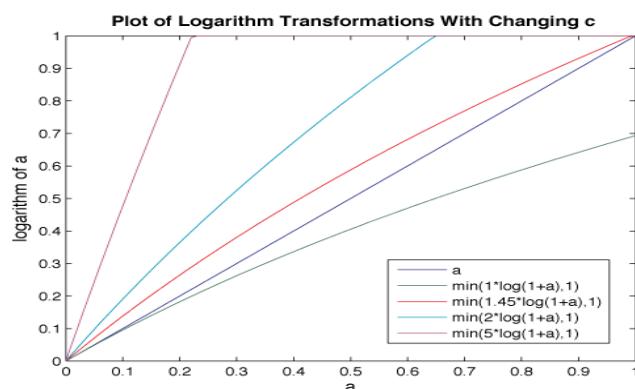


**Fig 5(c)-** Logarithmic Transformations

**Contrast-Stretching Transformations**- In case, we need contrast stretching between extreme values of dark and white this is the technique to be used. It will make the dark darker and the white more whiter. There are only few grey levels around areas of focus.
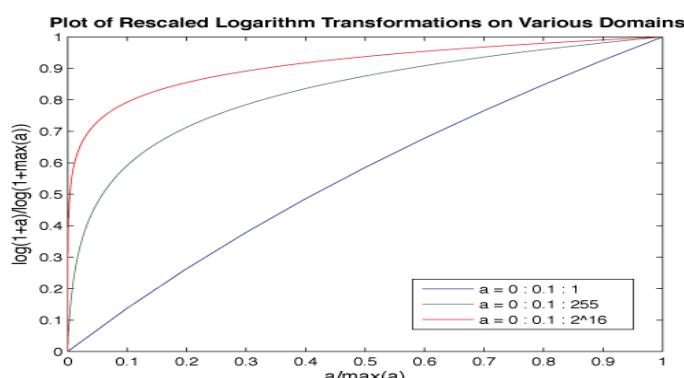


**Fig 5(d)-** Contrast Stretching Transformations

## 3. CONCLUSIONS

The paper has highlighted some basic techniques that get used to for performing pre-processing in Images. However, there are several variations to these techniques, and more often they are used in combination with each other to produce the desired effects in images.

## ACKNOWLEDGEMENT

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