

## ABSTRACT

Digital Image Processing evolves in variety of science and engineering applications. The modern application of Image Processing invites novel techniques for further evolution. In image based applications, Image pre-processing techniques are mandatory. Image enhancement is commonly used as one of the preprocessing steps in many image processing applications. All image enhancement techniques are generally interactive and application dependent. With this intention, the analysis and relative studies of Image Contrast Enhancement was focused and pursued in this research.

Image contrast enhancement techniques simply expand the range of brightness values in an image so that the image can be efficiently displayed. Linear approaches for image enhancement are not suitable and have undesired effects on the resultant image background. For Non linear approaches, Mathematical Morphology was initiated in image pre-and post-processing techniques for developments. The pixel values of darker image lies in the lower contrast region. For enhancing this type of images, single valued threshold is not enough. By varying threshold with different regions, resultant image pixels are distributed over a wider range. It springs the enhancement practice towards improved results. This thesis analyzes a series of non liner image enhancement techniques together with their qualitative and quantitative analysis. In addition to this image contrast enhancement research, a modified morphology based fuzzy domain procedure is proposed.

Weber's law concept in Image Processing was the first to set the trends and needs. In this regard, it is relatively studied and extremely discussed with image processing principles and a definition of object contrast in an image is derived. The image contrast is relatively proportionate to the logarithmic function. This function is approximated with its background features and scaling constant. In this, the image function is measured as a sum of small function and

each function is a sub image of a given image. Sub image is enhanced by approximated transformation procedure which is named Simple Mathematical Transformation. In this block by block enhancement practice, a threshold value is intended as the average value of maximum and minimum intensity of the related sub image. Then, the Simple Mathematical analysis is extended based on the modified threshold value. For threshold modification, minimum and maximum intensity values are derived by grayscale erosion and dilation. Erosion and Dilation are basic morphological operations. This image enhancement procedure is called Morphological Transformation.

To increase the performance and preserve the information, sub image enhancement practices is avoided. To deal with image background vagueness, a modified framework is developed with the help of fuzzy knowledge base system. In the proposed Fuzzy based Morphological Transformation, after fuzzifications of the image data, modified contrast intensification functions are used as membership functions. In this proposal, morphology based maximum and minimum values are determined in the intensified fuzzy plane. Then intensified fuzzy values are enhanced by modified logarithmic function and the resultant values are defuzzified to get the enhanced image.

The proposed algorithm is tested with different constrained images, and the results are compared with the existing histogram equalization and other discussed methods. It produces superior quality in resultant image and preserves more image information. Further, the proposed method enhances contrast and offers a good appearance to the poor background images. Due to these desirable features, the proposed technique is appropriate for electronic equipment. The proposed algorithm can be used for medical images, remote sensing images, microscopic images and real life photographic pictures which suffer from poor contrast problems during their acquisition.