

Image Processing using MATLAB

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Abstract

MATLAB is widely used by engineers and scientists in both industry and academia for performing numerical computations and for developing and testing mathematical algorithms and image processing with related applications. It makes it very easy to write mathematical programs quickly and display data in a wide range of different ways for various applications, research, and development work. The Image Processing Application is the largest one and therefore offers the greatest number of image modifications.

Keywords: Image quality evaluation, image processing, quality metrics, image enhancement, visual quality.

Introduction

The name MATLAB stands for MATrix LABoratory. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. It is a modern programming language environment with sophisticated data structures, contains built-in editing and

debugging tools, and supports object-oriented programming. This paper describes about MATLAB-based applications useful for image processing and image quality assessment and field where the applications can be useful. The image enhancement is widely used for image processing and as a preprocessing step in speech recognition, texture synthesis and many other image/video processing applications. The main purpose of image enhancement is to bring out details that are hidden in an image or to increase contrast in a low contrast image. Image enhancement is basically improving the interpretability or perception of information in images for human viewers and providing better input for other automated image processing techniques. The principal objective of image enhancement is to modify attributes of an image to make more suitable for given task and a specific observer. During this process, one or more attributes of an image are modified. The choice of attributes and the way they are modified are specific to a given task. Image enhancement is used in the following cases - removal of noise from image, enhancement of dark image and highlight the edges of the objects in an image.

Five Submits of Image Processing

The first subunit is called Intensity Transformations. It enables to simulate intensity distortions on one hand and to increase the contrast and with that also the image quality on the other. The second subunit of IP Application is the Spatial Domain Filtering. It offers two main options – Linear and Non-linear filtering. Linear filtering section contains number of linear filters (complete list can be found in Part I of this paper) based on `fspecial()` and `imfilter()` functions in MATLAB. Non-linear filters are especially useful when applied on the images distorted by “salt&pepper” noise field. The third subunit is the Frequency Domain Filtering. Again two possibilities are available. Either filtering with frequency filters defined in the spatial domain and then transferred to the frequency domain by FFT. The Image Processing Application’s fourth subunit is the Noise Addition. The last division contains basic objective image quality metrics MSE, SNR and PSNR.

Conclusion

This paper completes the description of the MATLAB-based applications for image processing. Various image enhancement techniques such as histogram equalization (like GHE, LHE) and multi-histogram equalization (like DSIHE) are implemented using MATLAB platform and compared based on prior knowledge on the Histogram Equalization. For the enhancement purpose more images can be taken from different application fields so that it becomes clearer that for which application which particular technique is better both for Gray Scale

Images and color Images. Particularly, for color images there are not many performances measurement parameter considered. So, new parameters can be considered for the evaluation of enhancement techniques. New color models can also be chosen for better comparison purpose. Optimization of various enhancement techniques can be done to reduce computational complexity as much as possible.

References

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