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Menoufyia University
Faculty of Science
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جامعة المنوفية
كلية العلوم

THE USE OF MARKOV CHAINS IN IMAGE FILTERING

A Thesis

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SUMMARY

Images play an important role in the organization of our society. Most media (e.g. newspapers, TV, cinema) use pictures (still or moving) as information carriers. The tremendous volume of optical information and the need for its processing and transmission paved the way to image processing by digital computers. The relevant efforts started around 1964 at the Jet Propulsion Laboratory (Pasadena, California) and concerned the digital processing of satellite images coming from the moon. Soon, a new branch of science called digital image processing emerged.

Since then, it has exhibited a tremendous growth and created an important technological impact in several areas, e.g. in telecommunications, TV broadcasting, industry, medical imaging, GIS, remote sensing and scientific research.

But images are often deteriorated by noise due to various sources of interference and other phenomena that affect the measurement processes in imaging and data acquisition systems.

Image filtering techniques are mathematical techniques that are aimed at realizing improvement in the quality of a given image. The result is another image that demonstrates certain features in a manner that is better in some sense as compared to their appearance in the original image. One may also derive or compute multiple processed versions of the original image, each presenting a selected feature in an enhanced appearance.

Simple image filtering techniques are developed and applied in an ad hoc manner. Advanced techniques that are optimized with reference to certain specific requirement and objective criteria are also available. Although most filtering techniques are applied with the aim of generating improved images for use by a human observer, some techniques are used to derive images that are meant for use by a subsequent algorithm for computer processing.

If used inappropriately, filtering techniques themselves may increase noise while improving contrast, they may eliminate small details and edge sharpness while improving noise, and they may produce artifacts in general.

We need to be cautious to avoid these pitfalls in the pursuit of the best possible enhanced image.

In this thesis we propose a suggestion algorithm for filtering noisy images using the definition of Markov chains and apply this algorithm on different equations. Some of them are depending on two pixels of the target pixel's neighbor and the others depending on three pixels. Also we compare between the two pixels techniques and the three pixels techniques by using **MSE (Mean Square Error)**.

We apply all these techniques on different images, some of them in MATLAB and the others are medical images (x-ray images). But the medical images to be available for processing we must convert them to bitmap images by using scanners and then convert all of these images to matrices of data.

The thesis comprises six chapters, in the first chapter we introduce some important definitions for image processing including how the image is formed, sampled and quantized what are the types of images and the measurements for the image quality. Finally we introduce some basic operations.

In chapter two we introduce some former techniques for image filtering beginning with convolution technique pass through low pass, average, high pass techniques and a new technique for low pass depending on four pixels, and finishing this chapter by introducing some nonlinear techniques such as median, weighted median and out-range filters.

In chapter three we introduce five methods of filtering depending on two pixels of the target pixel's neighborhood and mention their required computations and algorithms and finally we implement the algorithm for each method on some noisy images and show the result.

In chapter four we introduce five methods of filtering depending on three pixels of the target pixel's neighborhood and mention their required computations and algorithms and also we implement the algorithm for each method on some other noisy images and show the result.

In chapter five we compare between two and three pixels techniques by using MSE to detect the best one of them. At the end of this chapter we

compare between one of the three pixels technique and some former techniques.

Finally, we summarize our findings in chapter six and introduce headlines for suggestion of the future work.

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