

**DEVELOPMENT OF ITERATIVE MINIMUM-MAXIMUM
FILTER FOR REDUCING IMPULSE NOISE
FROM HIGHLY CORRUPTED IMAGES**

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FILTER FOR REDUCING IMPULSE NOISE
FROM HIGHLY CORRUPTED IMAGES**

By

AMJAD NAJIM JABIR

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirement for the Degree of Master of Science**

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia
in fulfilment of the requirement for the degree of Master of Science

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Chairman: Mohammad Hamiruce bin Marhaban, PhD

Faculty: Engineering

Digital images are often corrupted by impulse noise during acquisition or transmission through communication channels. Noisy pixels are characterized by having values that are substantially different from their surroundings. In an environment of fierce noise contamination, infected pixels tend to connect into noise blotches that could give the filtering algorithm an illusion of being part of the original image data. Therefore, many impulses would be difficult to detect, with the consequence of a less chance for proper detection and thus, filtering.

Different methods have been introduced in literature to filter images with high noise levels, including non-linear, fuzzy and combined filters. Performance of some typical filters of each category is studied in detail and compared to that of the suggested filter.

This study introduces an iterative minimum maximum filter for images highly corrupted with impulse noise, typically in the range 30-80%. Noise detection and filtering are done separately and iteratively, where the impulse detector with a threshold value and the scanning window size, are made proportional to a measure of noise level.

Extensive testing, using different types of standard test images, has proved the effectiveness of the proposed filter to give lower Mean Square Error (*MSE*) of the filtered images. Higher Bit Correct Ratio (*BCR*) values with better visual quality images have also been recovered compared to other studied filters such as non-fuzzy, fuzzy, and combined filters.

This study has verified that a reasonable tradeoff has been achieved between the two aspects of impulse noise suppression and image edges preservation, which are considered as two inherently conflicting requirements.

To facilitate use of the proposed filter, the algorithm has been implemented as a stand-alone application, in the form of an attractive graphical user interface.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**PEMBANGUNAN PENURAS ITERATIF MINIMA DAN
MAKSIMA UNTUK MENGURANGKAN HINGAR
DEDENYUT DARI IMEJ YANG TERUK DIROSAKKAN**

Oleh

AMJAD NAJIM JABIR

Mei 2006

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Imej digital selalu diganggu oleh hingar dedenyut ketika pengambilan atau penghantaran melalui saluran komunikasi. Pikel hingar dicirikan sebagai mempunyai nilai yang berbeza daripada persekitaran. Dalam persekitaran yang mempunyai pencemaran hingar yang lampau, piksel yang dijangkiti akan terdorong untuk disalur ke dalam tompok hingar yang boleh menyebabkan ilusi kepada algoritma turasan bahawa piksel tersebut ialah sebahagian daripada data imej asal. Dengan demikian, kebanyakan dedenyut sukar dikesan dan seterusnya mengurangkan peluang untuk mengesan dan seterusnya dituras.

Pelbagai cara telah diperkenalkan dalam kajian untuk menuras imej yang mempunyai tahap hingar yang tinggi, cara-cara ini termasuk tidak linear, samar dan penuras bergabunan. Keberkesanan beberapa penuras biasa dalam setiap kategori dikaji dan dibandingkan dengan penuras yang dicadangkan.

Kajian ini memperkenalkan penuras iteratif minima dan maksima untuk imej yang teruk dirosakan oleh hingar dedenyut, biasanya dalam lingkungan 30% hingga 80%. Pengesanan dan penurasan hingar dilakukan berasingan dan iterative di mana pengesanan dedenyut dengan nilai ambang dan tettingkap imbasan telah dibina supaya berkadar terus kepada tahap ukuran hingar.

Ujian yang menyeluruh dengan menggunakan imej ujian piawai telah menunjukkan keberkesanan penuras yang diperkenalkan untuk memberi nilai ralat punca kuasa dua purata yang lebih rendah. Nilai nisbah bit sebenar yang tinggi dan kualiti visual yang lebih baik untuk imej yang dituras telah diperolehi berbanding dengan cara penurasan yang lain seperti, tak-samar, samar dan penapis bergabung.

Kajian telah membuktikan tolak ansur yang berpatutan di antara dua aspek iaitu pengurangan hingar dedenyut dan pemeliharaan kandungan imej yang dianggap aspek kewujudan yang bercanggahan, telah diperolehi.

Untuk memudahkan penggunaan penuras yang diperkenalkan, algoritma tersebut telah diimplementasikan sebagai satu aplikasi tunggal, dalam bentuk antara-muka grafik yang menarik.

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I certify that an Examination Committee has met on 4th May, 2006 to conduct the final examination of Amjad Najim Jabir on his Master of Science thesis entitled “Development of Iterative Minimum-Maximum Filter for Reducing Impulse Noise from Highly Corrupted Images” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

AMJAD NAJIM JABIR

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