Convolution with theoretical-number methods

Two dimensional convolutions of lengths 2^n

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formulation of the problem
Valentin Vovk, Mobile Lab 2

Presentation , 2011

Outline

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Main Characteristics Of The Studied Algorithms

We study the convolution algorithms are well adapted for the processing of complex images

- pay special attention to ease of implementation and speed performance of these algorithms
- impose the condition of no computational errors in these algorithms

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Applications Of Two-Dimentional Number-Theoretical Convolutions

Integer FFT applied in various areas related to image processing and finding a correlation, such as tomography and processing of images taken by satellite. The motivation to use number-theoretical FFT is

- 32 bit integer algorithms have good specifications for optimizing on existing processors
- number-theoretical Fourier transform works well for convolutions with large kernels

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We were studied classical works using algebraic methods for calculating the convolution. Different techniques, including the arithmetic of finite fields, linear algebra and group theory have been used.

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Powers of two

Implemented a two-dimensional convolution with algebraic methods for the size of $2^n \times 2^m$

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- reducing the number of using modulo field's size
- using the FFT algoritm of length 32 based on symmetry of transform matrix
- transition from 64-bit to 32-bit arithmetic

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- In this work implemented a two-dimensional integer convolution
- Possible sizes are - 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024

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For Further Reading I

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