Research project proposal – Project title

Spectral methods over finite fields for compact representations of logic functions

Background(max 500 characters)

The group-theoretic approach to spectral techniques and, in particular, Fourier analysis, has many advantages, for instance, the possibility for a unified treatment of various seemingly unrelated classes of signals. This approach allows toextend the powerful methods of classical Fourier analysis to signals that are defined on very different algebraic structures that reflect the properties of the modelled phenomenon. In the case of logic functions, underlying algebraic structures are often selected as linear vector spaces over finite fields admitting existence of Fourier transforms.

Project description (max 750karaktera)

Functional expressions for logic functions can be viewed as either polynomial-like representations or spectral series representations. In both cases, a logic function is expressed as a linear combination of certain predefined basis functions. Coefficients in these representations are interpreted in different ways, in terms of difference operators, or as spectral (Fourier-like) coefficients, which allows different approaches to their computing.

The main task is to explore different classes of spectral transforms over finite fields to determine compact representations of logic binary and multiple-valued functions. Compactness is considered in terms of space to store a function and time required for computing with it. The computing of functional expression is performed through fast algorithms similar to the Fast Fourier transform. Various hardware platforms should be considered for the implementation of these algorithms, including multi-core Central Processing Unit (CPU) with Message Passing Interface (MPI), and Graphics Processing Unit (GPU) systems.

References (max 5)

Stanković, R.S., Astola, J.T., Moraga, C.,*Representation of Multiple-Valued Logic Functions*, Claypool and Morgan Publishers, 2010.

Miller, D.M., Thorton, M.A., *Multiple Valued Logic - Concepts and Representations*, Morgan &Calypool, 2008.DOI: 10.2200/S00065ED1V01Y200709DCS012

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