

Research project proposal – Project title

Application of non-commutative harmonic analysis in determining compact representations of discrete functions

Background(max 500 characters)

Abstract harmonic analysis is a mathematical discipline derived by replacing the group of real numbers R with an arbitrary locally compact Abelian or a compact non-Abelian group. The extension of abstract harmonic analysis to non-Abelian groups is based upon the group representation theory.

The main idea of abstract harmonic analysis is to decompose a complicated function f into pieces that reflect the structure of the group G on which f is defined. The goal is to make some difficult analysis of signals modeled by functions defined on groups manageable.

Project description (max 750karaktera)

When we apply the methods of Fourier analysis to a natural or man-made signals, the measurements or the data generated is represented as functions from a set to another. In principle, we could embed these sets in any mathematical structures, groups, rings, etc., for which the tools of Fourier analysis have been developed. However, to get full benefit from this powerful theory, the underlying structures should reflect at least some of the "true" properties of the signals, just as the cyclic group fits naturally to periodicity.

The main task is to consider different domain groups and check their suitability for selected classes of discrete functions including binary and multiple-valued logic functions as particular examples.

References (max 5)

Terras, A., *Fourier Analysis on Finite Groups and Applications*, Cambridge University Press, Cambridge, UK, 1999.

Stanković, R.S., Moraga, C., Astola, J.T., *Fourier Analysis on Finite Non-Abelian Groups with Applications in Signal Processing and System Design*, Wiley/IEEE Press, 2005.

Karpovsky, M.G., Stanković, R.S. Astola, J.T., *Spectral Logic and Its Applications for Design of Digital Devices*, Wiley, 2008.

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