Licensing Opportunity

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Low-complexity Walsh-Hadamard Transform (WHT) for sparse data

Key words:
Signal processing, computing algorithm, signal subsampling, Walsh-Hadamard.

Patent:
US 2015/0098313 A1
Granted US

Scientific publications:
"A Fast Hadamard Transform for Signals with Sub-linear Sparsity in the Transform domain"
Scheibler *et al.* 2015. IEEE Trans. Inf. Theory, vol. 61, num. 4, p. 2115 - 2132, 2015.

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Main contact:
Dr. Robin Scheibler
Tel: +41 21 693 1278
robin.scheibler@epfl.ch

Dr. Mauro Lattuada
Tel: +41 21 693 3563
mauro.lattuada@epfl.ch

Technology transfer office

EPFL-TTO
EPFL Innovation Park J
CH-1015 Lausanne
Switzerland
Phone: +41 (0) 21 693 70 23

Problem Addressed

The discrete Walsh-Hadamard transform is a known signal processing tool with multiple and diverse applications. However, some of its useful properties, especially those related to signal subsampling have remained underdeveloped

Technology

A low-complexity algorithm to compute the length N Hadamard transform of data K-sparse in the Hadamard domain.

Key features and benefits

- Improved algorithm complexity ~ $K \log^2 N$
- Reduced number of samples ~ $K \log N$

Applications

- Tailored signal-decoding in shared channels of spread spectrum communications
- Reduced Hadamard measurements in sparse spectrum spectroscopy
- Data encryption

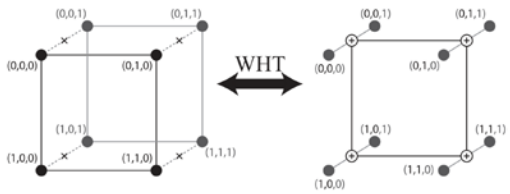
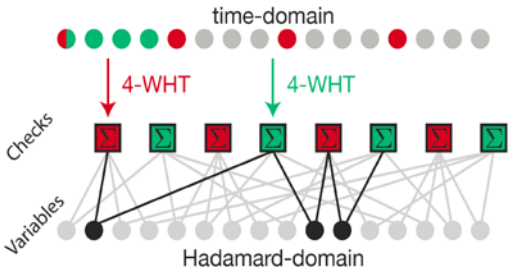
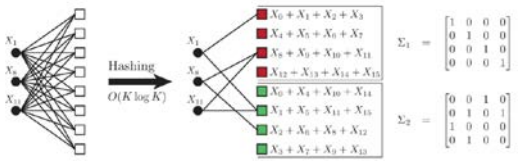


Illustration of the downsampling property on a hypercube





On the left, bipartite graph representation of the WHT for N = 8 and K = 3. On the right, the underlying bipartite graph after applying C = 2 different hashing produced by plugging $\sum_1$, $\sum_2$ in (6) with B = 4