Syndrome decoding of Reed-Muller codes and tensor decomposition over finite fields

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Abstract

In this talk, we will look at decoding Reed-Muller codes beyond their minimum distance when the errors are random (i.e., in the binary symmetric channel). A recent beautiful result of Saptharishi, Shpilka and Volk showed that for binary Reed-Muller codes of length n and degree n - O(1), one can correct polylog(n) random errors in poly(n) time (which is well beyond the worst-case error tolerance of O(1)). We will see two efficient algorithms as well as a different proof of the same result, where the decoding is done given the polylog(n)-bit long syndrome vector of the corrupted codeword: 1) The first is via. a connection to the well-studied 'tensor decomposition problem'. 2) The second via. a reduction to finding all common roots of a space of low degree polynomials, which is also of independent interest.

Joint work with Swastik Kopparty

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