Lower bounds for homogeneous depth-4 and depth-5 arithmetic circuits

Mrinal Kumar
Rutgers University

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Abstract

Starting with a very influential result of Gupta, Kamath, Kayal and Saptharishi (2012), the last few years have seen some exciting progress on the question of proving lower bounds for homogeneous depth-4 arithmetic circuits. This question is particularly interesting since it is intimately connected to the question of proving super-polynomial lower bounds for general arithmetic circuits.

In this talk, I will briefly talk about these developments. I will then present a recent result showing an exponential lower bound for homogeneous depth-4 arithmetic circuits. It is known that any asymptotic improvement in the exponent in this lower bound would imply super-polynomial lower bounds for general arithmetic circuits.

I will then talk about a follow up work, where we build upon these ideas to show an exponential lower bound for homogeneous depth-5 circuits over small finite fields. These are the first super-polynomial lower bounds for this model over any field other than \( \mathbb{F}_2 \).

The talk is based on joint work with Shubhangi Saraf and with Ramprasad Saptharishi.

Examination Committee: Shubhangi Saraf and Swastik Kopparty (advisers), Eric Allender and Ulrich Kremer