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香港中文大學
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Institute of Theoretical Computer Science and Communications

CSE - ITCSC Joint Seminar

Mansour's Conjecture for Random DNF formulas

By

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2:30pm – 4:30pm

Room 121, 1/F., Ho Sin Hang Engineering Building, CUHK

Abstract: The problem of efficiently learning DNF formulas dates back to Valiant's introduction of the PAC learning model [Valiant, 1984] and has remained open despite intensive study. Linial et al. were the first to reduce the problem of learning DNF formulas to certain properties of their representations as polynomials over the reals [Linial, Mansour, Nisan 1993]. In 1994, Mansour showed that every t-term DNF formula on n variables could be approximated by a sparse polynomial, i.e. a polynomial p : {+1,−1}^n --> {+1,−1} that satisfies E[(p − f)^2] ≤ eps and has at most t^O(log log t log(1/eps)) non-zero coefficients. This result implied a n^O(log log n) time query algorithm for learning polynomial-size DNF formulas, and he conjectured that the sparsity could be improved to t^O(log 1/eps), which would give a polynomial time query algorithm.

We make the first progress on this conjecture and show it is true for several natural subclasses of DNF formulas, including randomly chosen DNF formulas and read-k DNF formulas for constant k. Though an efficient query algorithm was finally given by Jackson in 1997 (without confirming Mansour's conjecture), our results can be applied in conjunction with recent work to obtain new results in learning theory and unconditional pseudorandomness. In particular, applying recent work by Gopalan et al., [Gopalan, Kalai, Klivans 2008], we achieve the first polynomial-time, noisy query algorithm for learning the ablove subclasses of DNF formulas. By recent work on sandwiching polynomials, our results also imply that t−O(log 1/ε)-biased distributions fool the above subclasses of DNF formulas. This gives pseudorandom generators for these subclasses with shorter seed length than all previous work.

This is a joint work with Adam Klivans and Homin K. Lee

Biography: Andrew Wan is currently an Assistant Professor at ITCS at IIIS, Tsinghua University. He received his PhD in 2010 from Columbia University under the supervision of Tal Malkin and Rocco Servedio. His research interests include complexity theory, computational learning theory, and cryptography.

******* ALL ARE WELCOME *******

Hosted By: Prof. Andrej Bogdanov
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