Counting flags in triangle-free digraphs

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Abstract

An important instance of the Caccetta-Häggkvist conjecture asserts that an n-vertex digraph with minimum outdegree at least $n/3$ contains a directed triangle. Improving on a previous bound of $0.3532n$ due to Hamburger, Haxell, and Kostochka we prove that a digraph with minimum outdegree at least $0.3465n$ contains a directed triangle. The proof is an application of a recent combinatorial calculus developed by Razborov. This calculus enables one to formalize common techniques in the area (such as induction or the Cauchy-Schwartz inequality). In the talk I shall describe Razborov's method in general, and its application to the setting of the Caccetta-Häggvist Conjecture.