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On the Space Complexity of Counting Triangles Using Oracles

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Abstract

In this paper we study data stream algorithms for approximating the number of triangles under the assumption that the algorithm has unlimited access to an oracle that answers certain queries about the input graph. We present both upper bounds (algorithms) and space lower bounds for this problem. More specifically, our bounds apply to algorithms that use a degree oracle (given a vertex, the oracle provides the degree of the queried vertex) and an edge-triangle oracle. Given the query edge $\{u, v\}$, an edge-triangle oracle answers whether the edge $\{u, v\}$ participates in a triangle or not. In addition, we implement two single-pass algorithms (and the associated oracles) in both the edge-arrival and the vertex-arrival models to evaluate their performance on real-world datasets. Despite the inaccuracies of the oracles used in our experiments, our study shows that they can improve the performance of state-of-the-art triangle counting algorithms on some real-world graphs.

Keywords: Triangle Counting, Learning Augmented Algorithms, Data Stream Algorithms

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