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A message-passing approach to obtain tr(f(A)) with applications to network analysis

In recent decades, graphs have become widely used for studying technological, biological, and social systems. For this reason, several methods have been proposed to measure the structural and dynamical properties of graphs, aiming to gain insights into the represented system. Among these methods, measures based on matrix functions have been introduced for assessing vertex centrality and communicability. While numerous iterative techniques for computing matrix function traces have been suggested, these methods often necessitate a global perspective or collective coordination, such as a global sum. To address these limitations, we present a message-passing approach designed to operate efficiently within parallel, heterogeneous, distributed, and asynchronous computing systems. Through simulations and analyses on both simulated and real-world networks, we demonstrate the performance of our method and compare it with the current state-of-the-art approach.

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