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Peer-Assisted Individual Assessment in a Multi-Agent System

Abstract - Consider a community of agents, all collaborating to perform a predefined task (sensing, detection, classification...), but with different levels of ability (LoA). Initially, each agent does not know how well it performs in comparison with its peers and it is thus willing to assess its ability. This general scenario is relevant, e.g., in Wireless Sensor Networks (WSNs), or in the context of crowd sensing, where devices with embedded sensing capabilities collaboratively collect data to characterize the surrounding environment: the global performance is very sensitive to the quality of the gathered measurements and agents providing outliers or bad-quality measurements should themselves avoid transmitting data.

This paper presents a distributed algorithm allowing each agent to assess its ability at doing some task. This assessment involves pairwise interactions with peers and a local comparison test, able to determine which, among two agents performs better. The dynamics of the proportions of agents with similar beliefs in their LoA are described using continuous-time state equations. The existence of an equilibrium is shown. Closed-form expressions for the various proportions of agents with similar beliefs in their LoA is provided at equilibrium. Simulation results match well theoretical results in the context of agents equipped with sensors and aiming at determining the performance of their equipment.

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