Design and Implementation of Performance Measurement Model for Human-Robot Interaction (HRI) in Mixed-Initiative Teams (MIT)

by

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Abstract

The integration of autonomous robotic systems across various sectors in our societies demands accurate and objective performance measurement methods to ensure optimal human-robot collaboration. While existing approaches to measuring robot performance often rely on task-specific metrics or subjective human evaluations, there is a critical need for a standardized, quantitative framework that can assess performance across different scenarios. This research proposes an innovative approach using the Average Normalized Estimation Error Squared (ANEES) metric to develop a comprehensive performance measurement model for Mixed-Initiative Teams. The model measures the performance of the overall system by taking into account variables such as robots' time to complete a task, downtime, and frequency of downtime between two of the robots' operating modes — manual and autonomous. As a result, the model can also give numerical insights into the level of trust humans have over the robots. Through controlled simulated experiments, the research will collect performance data from human-robot interactions across various scenarios. The research's significance lies in its potential to establish a standardized, objective and reproducible method for measuring performance in HRI environments.The expected outcomes include a fully functional Performance Measurement Model and an open-source siulation platform that researchers and developers can use.

Keywords **— HRI, Mixed-Initiative Teams, ANEES, Performance Measurement.**