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Characterizing Human-Machine Teams with Process Algebras

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Abstract: We conceptualize human-machine (computer, robot) teams as concurrent processes. Such a conceptualization means: (1) the human and machine agents have a common goal or mission; (2) each agent may have different subtasks within the goal space; (3) they do not have a shared memory, but (4) they do have a means of communicating with each other. Process algebras, such as communicating sequential processes (Hoare, 1977), are formal languages for describing the ways in which two concurrent processes interact through message passing across information channels. In this research, we enumerate the ways in which human-machine interactions can be structured, such as strictly serial, parallel, and cascade-like architectures. We use process algebras to characterize the interactions in candidate architectures. We discuss design implications for active and interactive machine learning systems.