Rover Teleoperation through Machine Coaching

Names and affiliations of the authors: Loizos Michael
                                          Open University of Cyprus & Research Center on
                                          Interactive Media, Smart Systems, and Emerging
                                          Technologies designated
Designated speaker: Loizos Michael

Delayed and intermittent communication with rovers in long-distance missions remains a key challenge for teleoperation, as it affects critically either the liveness or the safety of the rover. This position paper proposes the use of the newly-introduced human-machine interaction paradigm of Machine Coaching, as a middle-ground approach between a fully remotely-controlled and a fully autonomously-operated rover. According to this paradigm, the rover makes decisions and takes actions based on a policy, under the in-situ (even if delayed) supervision of a human coach. Whenever the human coach observes an unexpected decision made by the rover, the former enquires about the reasoning of the latter in making that decision, and then provides feedback on why a possibly different decision (including that of waiting to receive further directions by a remote operator) would have been preferable. This particular protocol, through the bilateral exchange of explanations between the rover and the human coach, allows the rover to provably and efficiently converge towards a policy that is acceptable to the human coach, while also endowing the rover with conditional autonomy in those situations where its current policy offers, in the human coach's expert opinion, an appropriate balance between liveness and safety. The rover's initial policy can be designed either in a simulated environment during the rover's development or it can be based on early information on the remote environment transmitted by the rover upon deployment.