eMOTION: Analysis of Emotion and Movement Variability in the Context of Human-Robot Interaction

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Movement variability is an inherent feature within and between persons. Research on measurement and understanding of movement variability has been well established in the previous three decades in areas such as biomechanics, sport science, psychology, cognitive science, neuroscience and robotics. With that in mind, we hypothesise that the subtle variations of face emotions and simple body movements can be both described and quantified in a similar fashion as with the methodologies of movement variability. Such methodologies are based on nonlinear dynamics, particularly with the use of the state space reconstruction theorem where dynamics of an unknown system can be reconstructed using one dimensional time series. For this work, we explain how the state space reconstruction theorem works and present preliminary results of the use of the state reconstruction to understand the relationship between the variability of arm movements, head pose estimation and the emotion of six participants in the context of human-robot interactions. The results of the state space reconstruction in the context of face emotions lead us to conclude that not only the variability of upper body movement can be analysed and quantified using the state space reconstruction theorem but also the subtle variability of face emotion transitions across time (e.g. from excitement to neutral to boredom, etc) can be understood and measured using nonlinear dynamics.