DEFINITION AND COMPOSITION OF MOTOR PRIMITIVES USING LATENT FORCE MODELS AND HIDDEN MARKOV MODELS.

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RESUMEN:

The movement representation problem is at the core of areas such as robot imitation learning and motion synthesis. In these fields, approaches oriented to the definition of motor primitives as basic building blocks of more complex movements have been extensively used because they cope with the high dimensionality and complexity by using a limited set of adjustable primitives.

Traditional methods for representing motor primitives have been purely data-driven or strongly mechanistic. In the former approach new movements are generated using existing movements and these methods are usually very flexible but their extrapolation capacity is limited by the available training data. On the other hand, strongly mechanistic models have a better generalization ability by relying on a physical description of the modeled system, however, it may be hard to fully describe a real system and the resulting differential equations are usually expensive to solve numerically. Therefore, in this work a different motor primitive parameterization is proposed using a hybrid model which jointly incorporates the flexibility of the data-driven paradigm and the extrapolation capacity of strongly mechanistic models, namely the Latent Force Model (LFM) framework.

Aside of the proposed motor primitive representation, the sequential composition of different motor primitives is also addressed using Hidden Markov Models (HMM) which allows to process movement realizations efficiently. The resulting joint model is a Hidden Markov Model with Latent Force Models as emission processes.

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