Coupling Discrete Multiphysics with Reinforcement Learning for Simulating of Human Physiology

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Abstract

Discrete Multiphysics is a novel computational technique combining various discrete models like Smoothed Particle Hydrodynamics, Discrete Element Method and the Spring Lattice Model [1]. Simulations that involve phase-change, break-up and 'fuzzy' boundaries, which are considered challenging for traditional −mesh-based− methods, can easily implement in Discrete Multiphysics [2-3].

In this work, Discrete Multiphysics is coupled with Machine Learning and in particular with Reinforcement Learning. This new technique combines the advantage of first principles modelling (i.e. multiphysics) and machine learning (i.e. Reinforcement Learning) and it is particular well-suited to model systems related with human physiology, whose behavior is characterized by the intervention of the autonomic nervous system [4]. The computational-particles used in the Discrete Multiphysics simulation are coupled with computational-neurons and the Reinforcement Learning algorithm trains these particles to behave like the real neurons.

Keywords: Discrete Multiphysics, Reinforcement Learning

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