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Why animals swirl and how they group: solved with RL

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We report a possible solution for the long-standing problem of the biological function of swirling motion, when a group of animals orbits a common center of the group. We exploit the hypothesis that learning processes in the nervous system of animals may be modelled by reinforcement learning (RL) and apply it to explain the phenomenon. In contrast to hardly justified models of physical interactions between animals, we propose a small set of rules to be learned by the agents, which results in swirling. The rules are extremely simple and thus applicable to animals with very limited level of information processing. We demonstrate that swirling may be understood in terms of the escort behavior, when an individual animal tries to reside within a certain distance from the swarm center. Moreover, we reveal the biological function of swirling motion: a trained for swirling swarm is by orders of magnitude more resistant to external perturbations, than an untrained one. Using our approach we analyze another class of a coordinated motion of animals – a group locomotion in viscous fluid. On a model example we demonstrate that RL provides an optimal disposition of coherently moving animals with a minimal dissipation of energy.

Biography

Egor Nuzhin Live, work and study in Russia. Experienced with optimization, modeling, machine/deep learning and especially reinforcement learning. PhD student in Skolkovo Institute of Science and Technology. Author of Q1 research paper "Why animals swirl and how they group" published in Scientific Reports (Nature Group) in 2021