

Faculty Candidate, Electrical Engineering Open Search

Taming the swarm: towards robust and flexible bio-inspired autonomy

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Abstract

Soon we will share our airspace, roads, homes, offices, warehouse floors, and construction sites with teams of autonomous robots, self-driving vehicles, and delivery drones. To coexist in crowded environments, autonomous agents must simultaneously achieve individual goals and behave cohesively as a group. Groups in nature seamlessly balance these objectives and are thus a compelling source of inspiration for the design of cooperative autonomous behavior. In this talk I will illustrate how reimagining the building blocks of autonomy using mathematical principles grounded in biological collective behavior can enable groups of engineered agents to self-organize through local interactions. In particular, we will focus on collective decision-making. First we will discuss a new, biologically inspired nonlinear framework for modeling and design of multi-agent decisions. This framework mimics properties of natural swarms that are able to break deadlock even when there is no 'best' decision available, and to simultaneously adapt the collective decision in response to meaningful signals encountered locally during operation. We will then connect this modeling framework to a range of technological and interdisciplinary applications.

Bio

Anastasia Bizyaeva is a postdoctoral scholar with the AI Institute in Dynamic Systems at the University of Washington, Seattle. In her research, Anastasia studies mathematical models of collective behavior and biologically inspired computation with the dual goal of gaining new scientific insights, and of developing innovative biologically inspired, flexible, and collaborative approaches to autonomy. To do this she draws on a combination of tools from nonlinear dynamical systems, control theory, network science, and data-driven modeling. Anastasia received her Ph.D. in Mechanical and Aerospace Engineering in September of 2022 from Princeton University. Prior to her graduate studies, Anastasia earned a B.A. in Physics with a minor in Mechanical Engineering from the University of California, Berkeley.

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