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Modelling collective movement: theoretical and applicative aspects

Abstract

In this talk, I will present recent contributions to the field of collective movement. The first part will focus on non-local PDE models for the collective movement of heterogeneous groups. Specifically, I will discuss two types of group heterogeneity: follower-leader systems and chase-and-run (i.e., pursue-and-escape) systems. A combination of analysis and numerical simulations is used to investigate, respectively, the conditions under which (i) different degrees of leadership enable cohesive collective movement toward a destination and (ii) variations in non-local interaction ranges lead to emergent chase-and-run behaviour.

The second part will introduce an ongoing, experimentally driven project that models the collective movement of a bacterial population within confined spatial domains. This study involves the calibration of PDE models to infer biological insights and supports the development of a novel microbiological diagnostic method, in collaboration with Eltek S.p.A. (Casale Monferrato, Italy).