SPiELE

Stochastic Processes in EvoLution and Ecology

Bath - Berlin - Frankfurt - Mainz - Warwick

Terence Tsui, University of Oxford

„Looking forwards and backwards: dynamics and genealogies of locally regulated populations"

We introduce a broad class of spatial models to describe how spatially heterogeneous populations live, die, and reproduce. Individuals are represented by points of a point measure, whose birth and death rates can depend both on spatial position and local population density, defined via the convolution of the point measure with a nonnegative kernel. We pass to three different scaling limits: an interacting superprocess, a nonlocal partial differential equation (PDE), and a classical PDE.

A novelty of our model is that we explicitly model a juvenile phase: offspring are thrown off in a Gaussian distribution around the location of the parent, and reach (instant) maturity with a probability that can depend on the population density at the location at which they land. Although we only record mature individuals, a trace of this two-step description remains in our population models, resulting in novel limits governed by a nonlinear diffusion.

Using a lookdown representation, we retain information about genealogies and, in the case of deterministic limiting models, use this to deduce the backwards in time motion of the ancestral lineage of a sampled individual. We observe that knowing the history of the population density is not enough to determine the motion of ancestral lineages in our model.

We also investigate the behaviour of lineages for three different deterministic models of a population expanding its range as a travelling wave: the Fisher-KPP equation, the Allen-Cahn equation, and a porous medium equation with logistic growth.

Time: Monday, 13.11.2023 – 4 P.M. CET

The lecture will be held online. Interested? Link available from Jochen Blath
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