Bayesian Nonparametric Construction of Fleming-Viot Models in Population Genetics

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Keywords: Fleming-Viot process; Measure-valued diffusion; Generalised Pòlya-urn schemes; Stationary distribution; Two-parameter Poisson-Dirichlet process

AMS: Primary: 60G57; 60J35. Secondary: 60J60; 92D25.

Abstract

The Fleming-Viot process is a probability-measure-valued diffusion which arises as the large population limit of a wide class of population genetics models. In a few of its formulations its stationary distribution is known to be the Dirichlet process or a mixture of Dirichlet processes, but its connections with Bayesian statistics are still to be explored.

This work provides several explicit constructions of Fleming-Viot processes in the Bayesian nonparametric framework, and yields a previously unknown stationary distribution. In particular, by means of known and newly defined generalised Pòlya-urn schemes, several types of pure jump particle processes are introduced, describing the evolution in time of an exchangeable population. In each case, the process of empirical measures of the individuals converges in distribution in the Skorohod space to a specific Fleming-Viot diffusion, and the stationary distribution is shown to be the de Finetti measure of the infinite sequence of individuals. In presence of viability selection the stationary distribution turns out to be the two-parameter Poisson-Dirichlet process.

Acknowledgements: Matteo Ruggiero is supported by CRT Foundation, Turin, and by MIUR, grant 2006/133449.