THE BACKBONE DECOMPOSITION FOR SPATIALLY DEPENDENT SUPERCRITICAL SUPERPROCESSES

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Abstract: Consider any supercritical Galton-Watson process which may become extinct with positive probability. It is a well-understood and intuitively obvious phenomenon that, on the survival set, the process may be pathwise decomposed into a stochastically 'thinner' Galton-Watson process, which almost surely survives and which is decorated with immigrants, at every time step, initiating independent copies of the original Galton-Watson process conditioned to become extinct. The thinner process is known as the *backbone* and characterizes the genealogical lines of descent of prolific individuals in the original process. Here, prolific means individuals who have at least one descendant in every subsequent generation to their own.

Starting with Evans and O'Connell [**?**], there exists a cluster of literature, [**?**, **?**, **?**, **?**, **?**], describing the analogue of this decomposition (the so-called *backbone decomposition*) for a variety of different classes of superprocesses and continuous-state branching processes. Note that the latter family of stochastic processes may be seen as the total mass process of superprocesses with non-spatially dependent branching mechanism.

In this article we consolidate the aforementioned collection of results concerning backbone decompositions and describe a result for a general class of supercritical superprocesses with spatially dependent branching mechanisms. Our approach exposes the commonality and robustness of many of the existing arguments in the literature. ...

References

[1] Berestycki, J., Kyprianou, A.E. & Murillo-Salas, A. (2011) The prolific backbone decomposition for supercritical superdiffusions. *Stoch. Proc. Appl.* **121**, 1315–1331.

[2] Chen, Y-T. & Delmas, J-F. (2012) Smaller population size at the MRCA time for stationary branching processes. *Ann. Probab.* **40**, 2034-2068.

[3] Duquesne, T. & Winkel, M. (2007) Growth of Lévy trees. *Probab. Theory Relat. Fields* **139**, 313-371.

[4] Engländer, J. & Pinsky, R.G. (1999) On the construction and support properties of measure-valued diffusions on $D \subseteq R^d$ with spatially dependent branching. *Ann. Probab.*, **27**, 684-730.

[5] Evans, S. N. & O'Connell, N. (1994) Weighted occupation time for branching particle systems and a representation for the supercritical superprocess. *Canad. Math. Bull.* **37**, 187-196.

[6] Kyprianou, A.E. & Ren, Y-X. (2012) Backbone decomposition for continuous-state branching processes with immigration. *Statist. Probab. Lett.* **82**, 139-144.

[7] Salisbury, T. & Verzani, J. (1999) On the conditioned exit measures of super Brownian motion. *Probab. Theory Relat. Fields* **115**, 237–285.