

Scientific report on a RGLIS short visit grant: Reinforced random processes

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Purpose of the visit. Scientific collaboration with P. Diaconis and S. Bacallado (Stanford)

Description of the work carried out during the visit. We worked with Sergio Bacallado on the calculation of limit densities for some generalisations of edge-reinforced random walk (ERRW), which naturally define conjugate priors for variable-order Markov chains (Bacallado, 2011), extending the prior introduced for reversible Markov chains by Diaconis and Rolles (2010). We studied with Persi Diaconis reinforced random walks which keep track of their velocity. I also took advantage of the current MSRI Random Spatial Processes program to work with Christophe Sabot during the first week.

Description of the main results obtained. We introduced with Sergio Bacallado a generalisation of Vertex-Reinforced Jump Process (VRJP) for variable-order Markov chains, which takes values in the de Bruijn graph of words of the vertices: it jumps to a neighbour at a rate proportional to the local time spent on the neighbour taken in reverse order. The result of Sabot and Tarrès (2011) that ERRW can be interpreted in terms of VRJP with random conductances can be extended to that case. We could then compute the limit density in some particular cases. We studied with Persi Diaconis a reinforced random walk keeping track of its velocity, and showed on trees and cycles that the occupation measure eventually converged to the uniform measure. The difficulty in extending that result to more general graph lies in the lack of underlying reversibility of the walk. We showed with Christophe Sabot that VRJP with large reinforcement is transient; this is essentially a consequence of our earlier result in 2011, and of the proof of a delocalization result of Disertori, Spencer and Zirnbauer (2010), but was not immediately apparent from their results. Then we discussed transience of ERRW, which is hard to obtain, given the already technical proof of delocalization in the case of one-parameter VRJP.

Future collaboration with host institution. A follow-up visit of Sergio Bacallado to Oxford was scheduled for August 2012. I plan to visit again Stanford during the academic year 2012/13.

Projected publications/articles to result from the grant We expect that the research efforts developed during these two weeks will lead to three joint publications, on the topics mentioned above.