

Analysing random structures using the Warning Propagation algorithm

Oliver Cooley

The Warning Propagation algorithm was introduced in physics literature as an elegant heuristic tool, and has since been employed as a powerful method for analysing random discrete structures. Its flexibility means that it can be applied to a wide variety of different settings, including cores of graphs and hypergraphs, constraint satisfaction problems, matrices and many more. A typical approach to the analysis of such a random structure proceeds as follows.

1. Run an appropriate recursive algorithm for a large, bounded number of steps;
2. Show that subsequently few further changes will be made before the algorithm terminates.

By phrasing recursive algorithms in the language of Warning Propagation, we are able to show that this approach works in a very general setting. Not only does this result unify past proofs in a common framework, it can be used a black box to significantly simplify similar proofs in future.

We will discuss this result and its applications, as well as potential future generalisations. This is based on joint work with Joon Lee and Jean Bernoulli Ravelomanana.