Graph limits via discrete potential theory

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We present a probabilistic approach to the currently very active area of graph limits; see [3] for background and references. Many of the models considered in this area can be regarded as combinatorial Markov chains $X = (X_n)_{n\in\mathbf{N}}$ that are adapted to the family $\mathcal{G}$ of finite simple graphs in the sense that X_n takes its values in the subset $\mathcal{G}_n$ of graphs with n nodes. For stochastic processes of this kind discrete potential theory, as initiated by Doob in [1], provides a state space compactification with the properties that X_n converges to some X_∞ with values in the boundary $\partial\mathcal{G}$, and that fully captures the persisting randomness of the process in the sense that the limit X_∞ generates the tail σ-field associated with X. We review these concepts and then apply them to several popular graph models.

References

[1] J. Doob, *Discrete potential theory and boundaries*, J. Math. Mech. 8, 1959, 433-458.

[2] R. Grübel, *Persisting randomness in randomly growing discrete structures: graphs and search trees*, submitted, 2014.

[3] L. Lovász, *Large networks and graph limits*, American Mathematical Society Colloquium Publications, vol. 60, American Mathematical Society, Providence, RI 2012.