

Limit theories: graphons, permutons, latinons

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(This overview is based on various collaborations with many co-authors.)

The rise of extremely large networks presents a significant challenge: understanding the global structure of a network that is too vast to be fully analysed. This leads to the following key question: What can be inferred about the overall network structure if we have statistical data on the small structures observed when zooming into tiny areas of the network?

In recent years, a promising research field has emerged that seeks to establish a theoretical framework for addressing these challenges by introducing the concept of limits for discrete structures. The goal is to identify a suitable limit object that accurately captures both the information from local sampling and the overall global behaviour. This approach results in a fascinating interplay between analysis and combinatorics.

In this talk, we discuss the fundamental properties of such theories in the dense setting. We highlight parallels between the limit notions for dense graphs and permutations and present some applications, e.g. to the feasible region of pattern densities and inhomogeneous random graphs. Finally, we outline how to generalise this framework to a limit theory for Latin squares.