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Abstract

Action Convergence of Operators and Applications to Graphs and Matrices

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This master's thesis takes a deep dive into the evolving landscape of graph limit theories, with a focus on the emergence and application of action convergence, as introduced by Backhausz and Szegedy in 2022. Originating from the need to bridge the conceptual gap between limit theories of dense and sparse graph sequences, action convergence arises as a unifying concept capable of capturing the convergence of graph sequences with intermediate density.

The thesis begins with a foundational exploration of action convergence of operators, detailing the construction and exploring the properties of the resulting action limit. Convergence results of operators corresponding to the star graph are presented as illustration. Through rigorous analysis, the optimality of conditions for the existence of the limit objects is also investigated, shedding light on the theoretical underpinnings of the convergence notion. In the context of the star graph, there are also presented results (following the work of Hrušková) where the norm constraints originally given on action convergence are not met.

Subsequently, the relationship between action convergence and previously established notions of dense and sparse graph limits is elucidated, revealing action convergence as a natural generalization encompassing both extremes.

Finally, the theory of action convergence is extended to the realm of random matrices, demonstrating the versatility and applicability of this limit theory beyond the domain of graphs.