Prof. R. Wattenhofer

SAT Solving with Graph Neural Networks

The Boolean Satisfiability Problem (SAT) is a cornerstone of theoretical computer science with numerous real-world applications, from hardware verification to automated reasoning in AI. While SAT is NP-hard in general, many practical instances exhibit patterns that make them solvable more efficiently using heuristics. However, developing these heuristics is both time-consuming and highly domain-specific.

In this project, we apply deep learning, specifically Graph Neural Networks (GNNs), to solve SAT problems. SAT instances can be naturally framed as graphs, where literals and clauses are represented as nodes, and their relationships as edges. Instead of relying on handcrafted heuristics, the solver learns to infer patterns from the data to solve the instances efficiently. GNNs are well-suited to learning patterns and structures in such graph representations, offering a promising direction for both theory and practice.

Requirements: Strong motivation, ability to work independently, and an interest in conducting innovative theoretical and/or empirical research. Solid algorithmic background, some machine learning knowledge, and Python programming skills are essential. Prior experience with PyTorch, GNNs or SAT solvers is a plus. Depending on your interests and background, we can tailor the project to be more theoretical or implementation-focused.
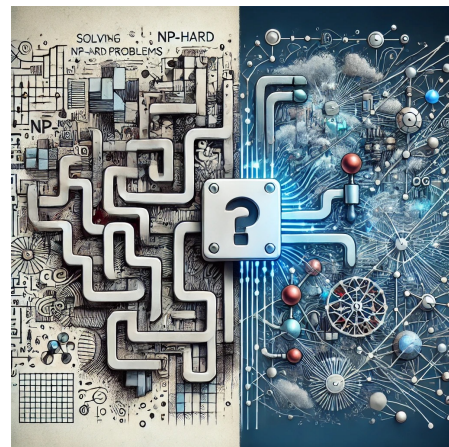
Contact

Interested? Please reach out with a brief description of your motivation in the project, along with any relevant courses or prior projects (personal or academic) that demonstrate your background in the area.

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