[Graph Matching Transformers](https://github.com/jp-guo/gm-transformer): Proposed QueryTrans, a backbone specially designed for graph matching (GM) tasks which introduced key-point patches and cross-attention mechanism to better capture the local information of key-point in the graph. Applied the attention-mechanism to the backend module in response to the combinatorial nature of GM to better capture the underlying structure. The backbone improved all the existing frameworks performance on widely used benchmarks of GM.

[Guided Diffusion Models For Combinatorial Optimization Problem](https://github.com/Thinklab-SJTU/T2TCO): Propose a framework based on diffusion models which introduces the gradient of the loss as the guidance to generate solutions for the TSP and MIS problems, with rewriting strategy to alleviate the local minima. Achieved SOTA performance compared with learning-based models, outperformed some heuristic solvers, reduced the solving time by one order of magnitude compared with advanced heuristic solvers (e.g. from 1.5h to 4min).

[Learning Reliable Interpretations with SATNet](https://github.com/jp-guo/satnet-rules): Proposed SATNet\*, built on a differentiable MaxSAT solver named SATNet, to learn interpretable and reliable rules of logical puzzles such as Sudoku and Rubik's Cube by representing the CNF formula as a parametric matrix and applied Gurobi as the backend solver to solve weighted Max2SAT. Proposed two theories to verify the equivalence of different expressions of SAT and Max2SATVerified our learned rules on extensive experiments including Sudoku, Parity Function, Stream Transformation, etc.

[Benchmarking and Advancing SAT Solving with Graph Neural Networks](https://github.com/jp-guo/G4SATBench): Built the first comprehensive and systematic ML-scaled SAT benchmarks encompassing seven different SAT instance generation strategies to evaluate the SAT solving abilities of ML models, especially for GNNs. Proposed a novel interpretation of the GNNs’ SAT solving strategy analogue to the local-search heuristic solvers and verified our proposition with empirical results on our benchmarks.

BioMap: Focused on end-to-end protein recognition: Conducted extensive experiments to evaluate various transformers on protein sequence detection. Analyzed different performances associated with different model structures and attention mechanism designs. Proposed a pre-training method for transformers to capture the underlying structure of proteins.