# Graph Neural Network Guided Local Search for the Traveling Salesperson Problem

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## Summary


- Our hybrid approach for solving the TSP combines ML and OR
  - We define **global regret** for edges
  - We use a GNN-based model to predict the regret of edges in an unseen problem
- Our computational experiments focus on the **tradeoff between solution quality and computation time**
- Our approach finds better solutions, faster than three recent learning-based approaches


## Global Regret

$$r_i = \frac{g(s_i^*)}{g(s^*)} - 1$$

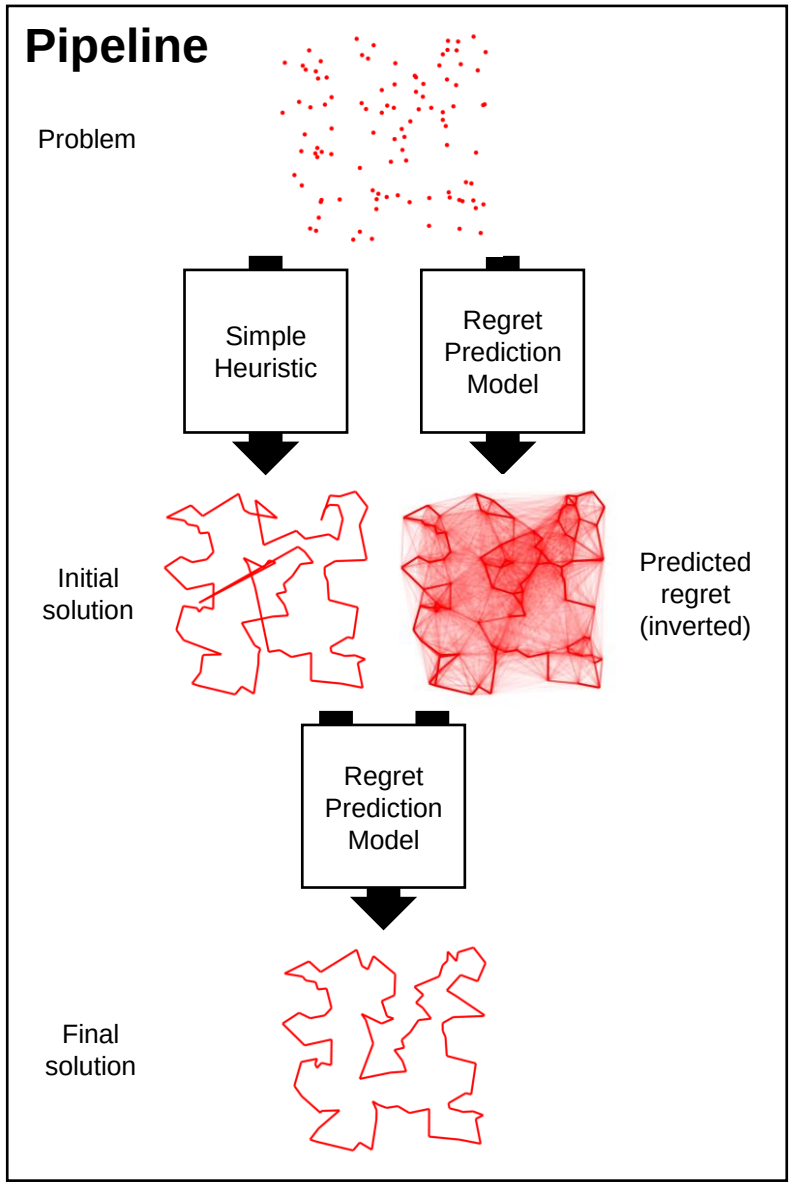
$g(s_i^*)$: Optimal solution value with edge *i* fixed

$g(s^*)$: Optimal solution value with no edges fixed

## Discussion

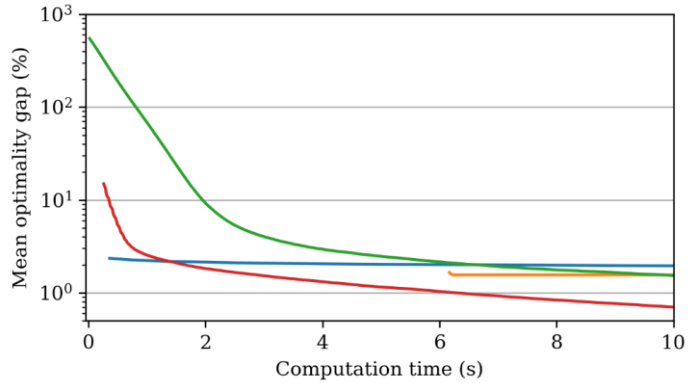
- Our approach uses edge weight as the only input feature, and can be applied to non-Euclidean TSPs

## Pipeline

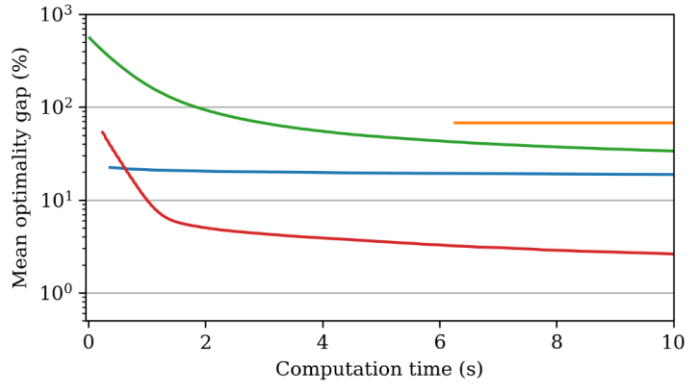



## Results (100 node problem set)

Trained on 100 node problems (x2 better)




Trained on 20 node problems (x7 better)





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