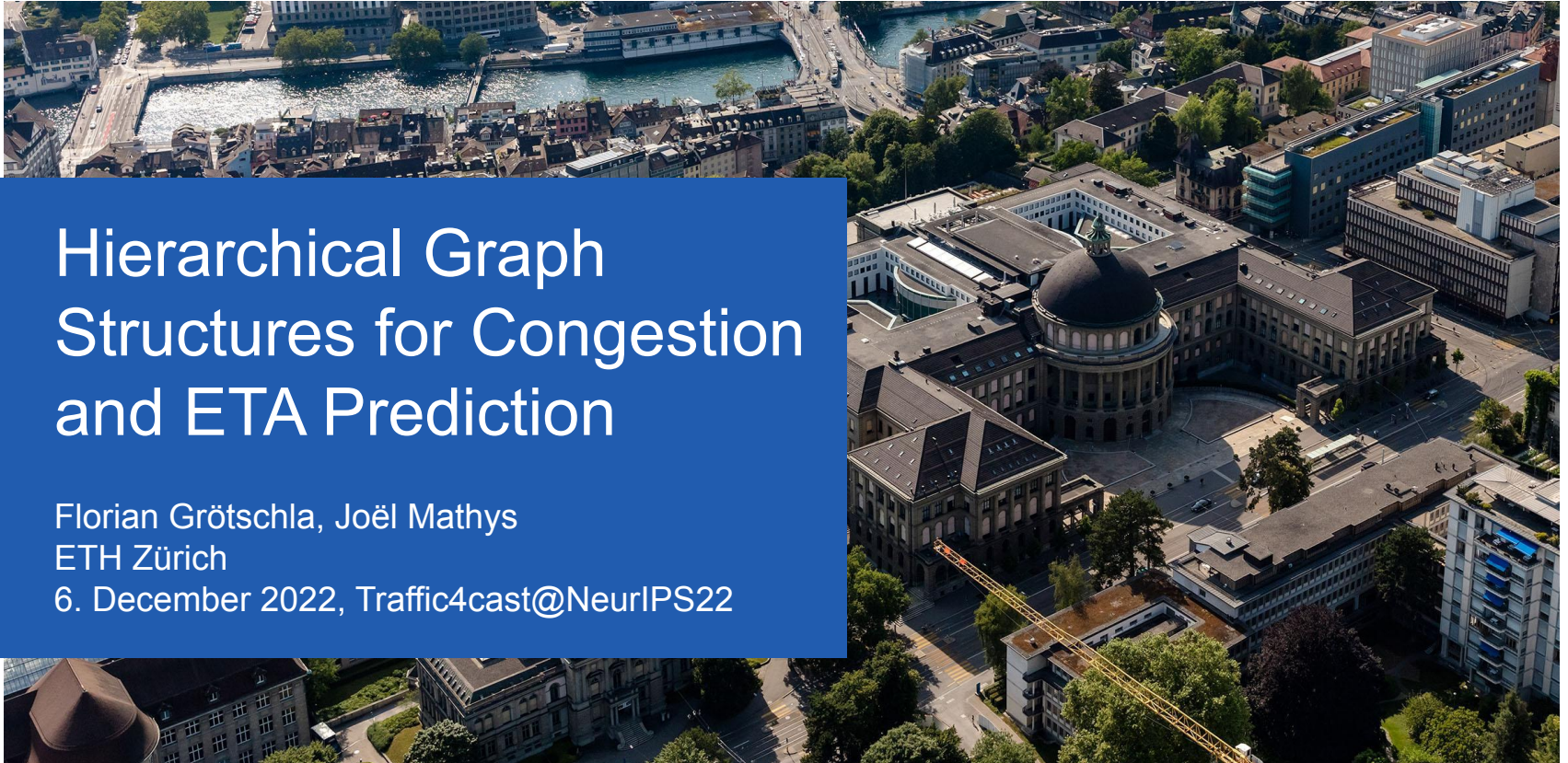
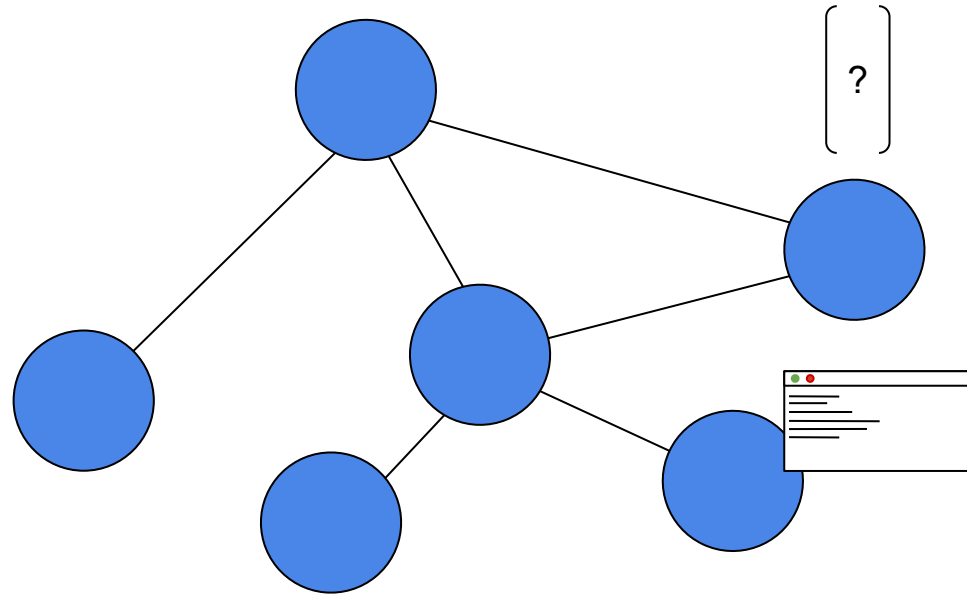


Hierarchical Graph Structures for Congestion and ETA Prediction

Florian Grötschla, Joël Mathys
ETH Zürich
6. December 2022, Traffic4cast@NeurIPS22



Key Challenges

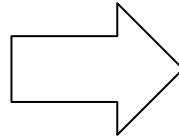


Graph

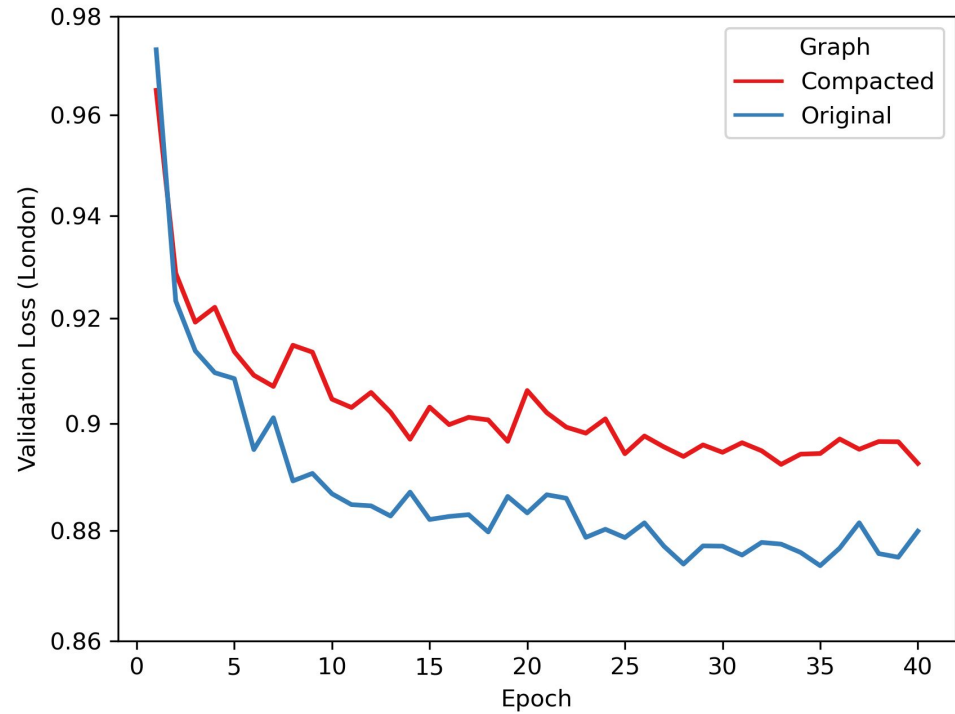
Data

GNN

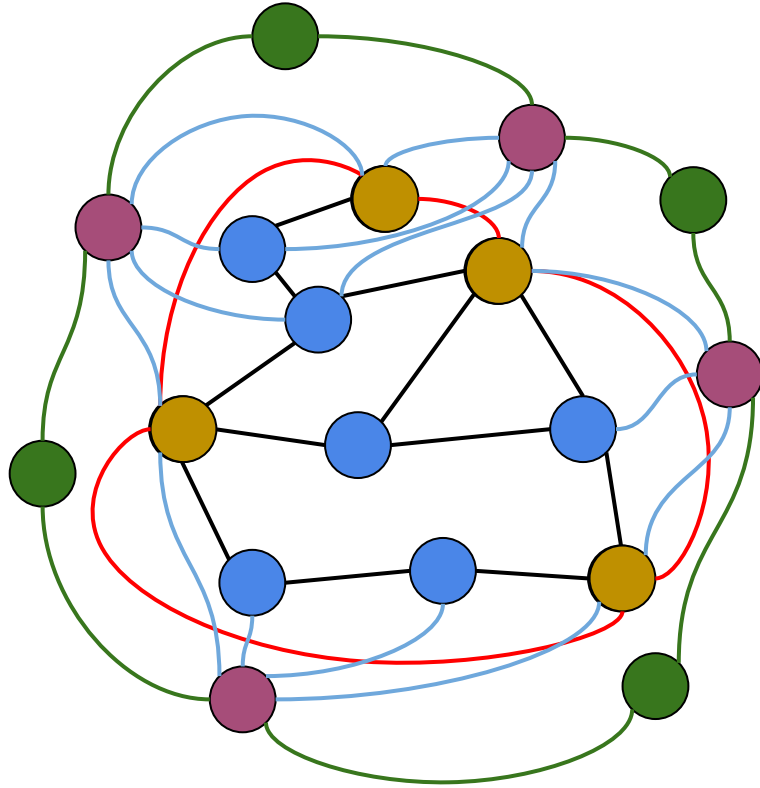
Graph Representation - Compaction



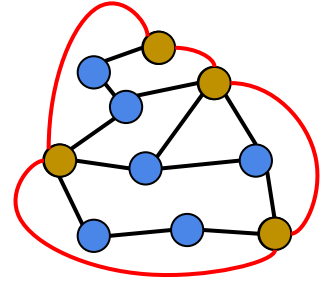
Insights 1 - Compaction



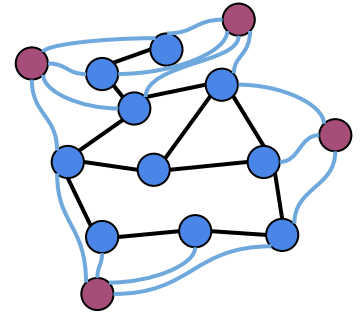
Graph Representation - Hierarchical



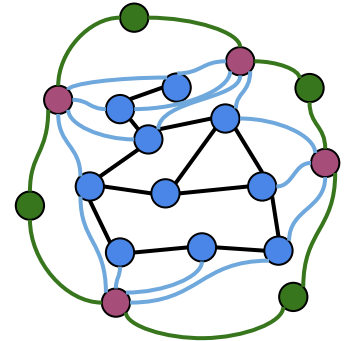
Approach 1



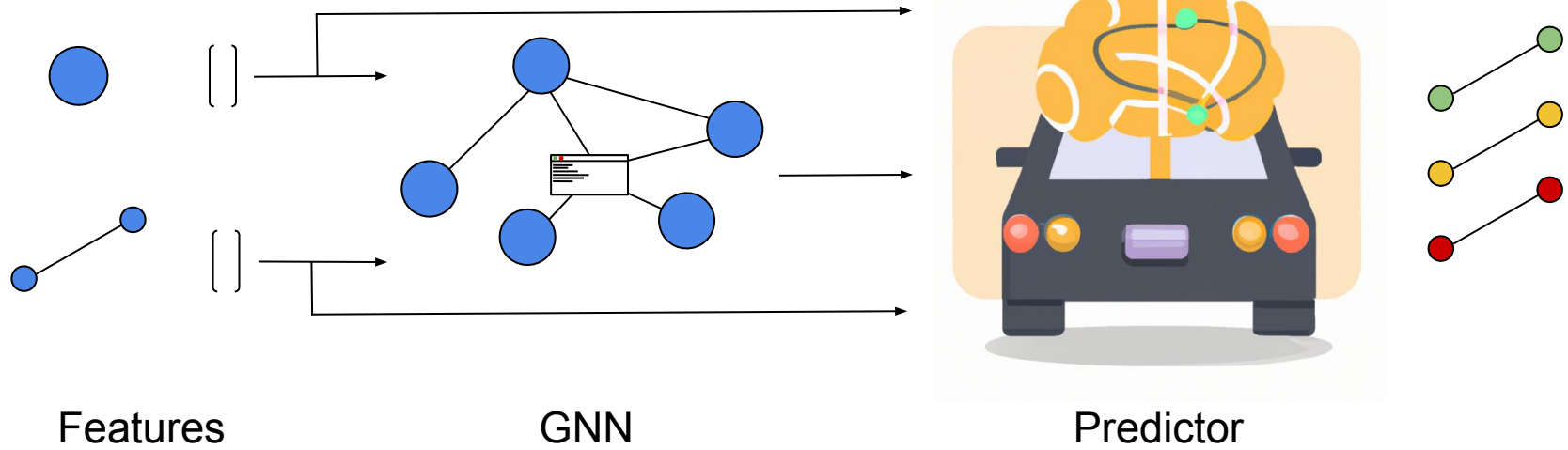
Approach 2



Approach 3



Model Overview: Big Picture



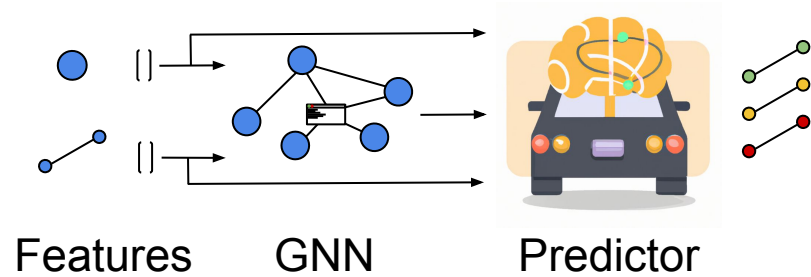
Model Overview

Features

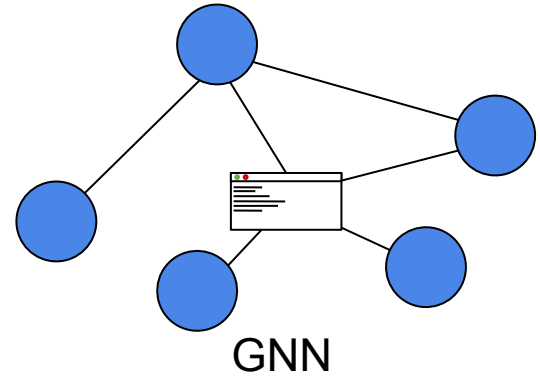
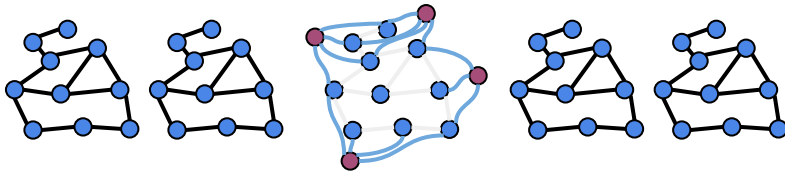
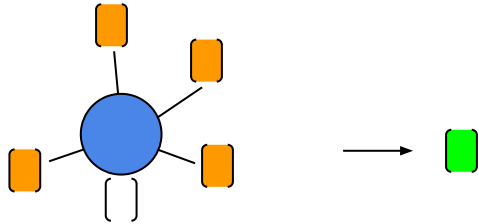
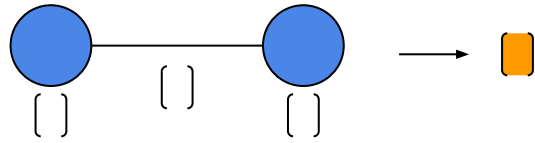
- Nodes: counts/position/global statistics
- Edges: length/speed/importance

Model Size

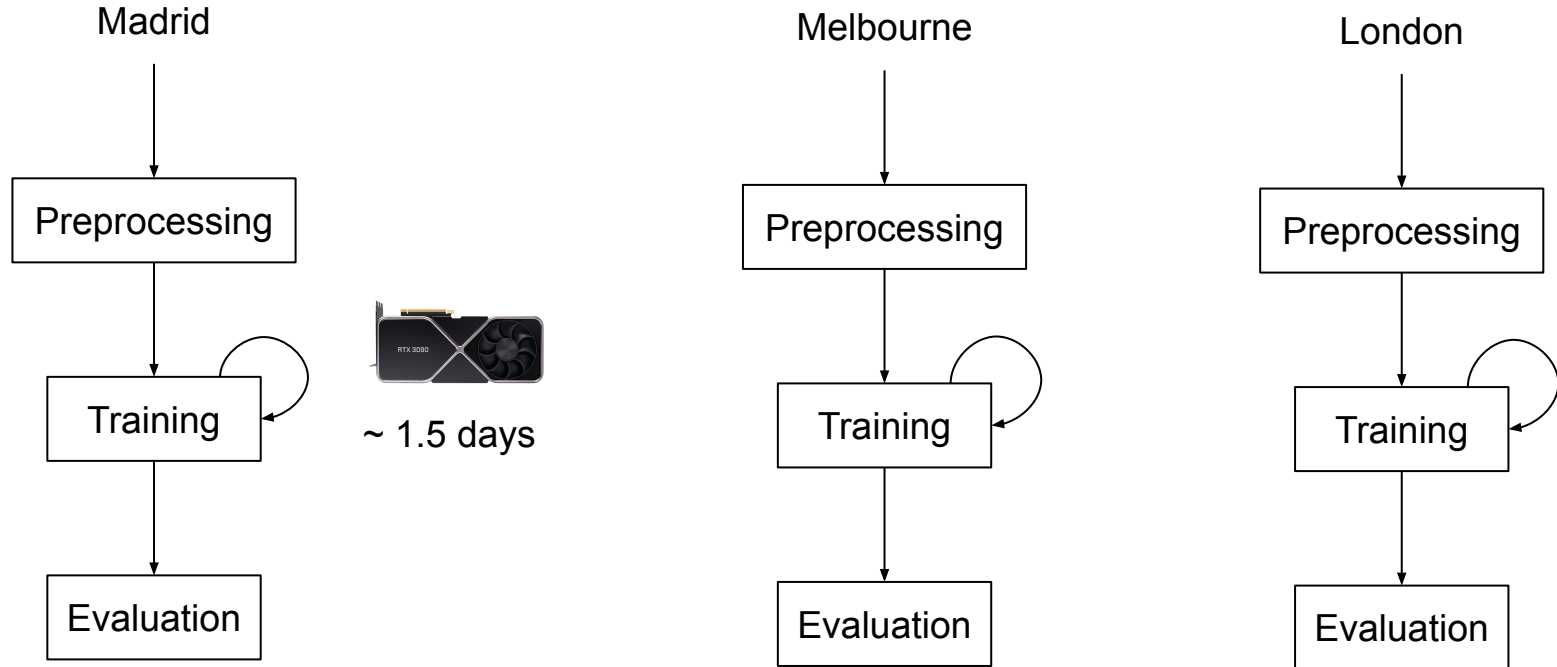
- ca. 5M parameter



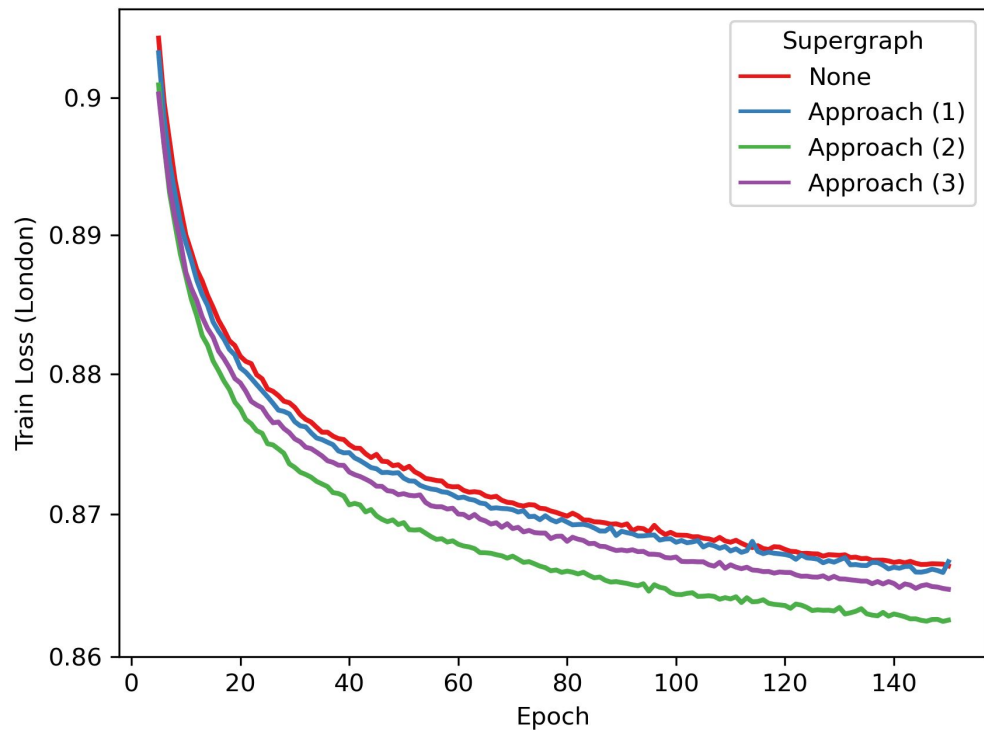
Model Overview: GNN Architecture



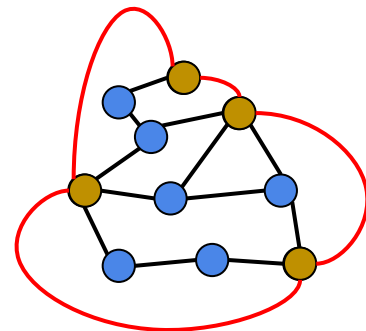
Training



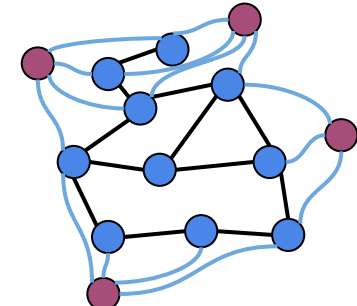
Insights 2 - Hierarchical ablation



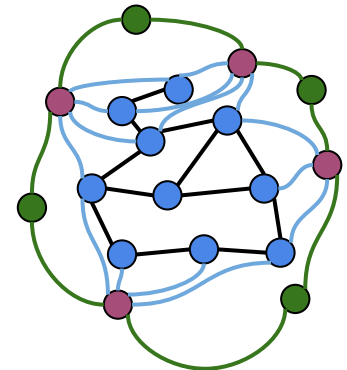
Approach 1



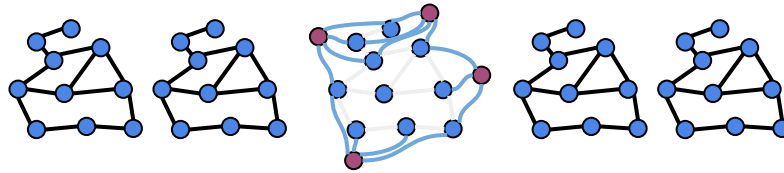
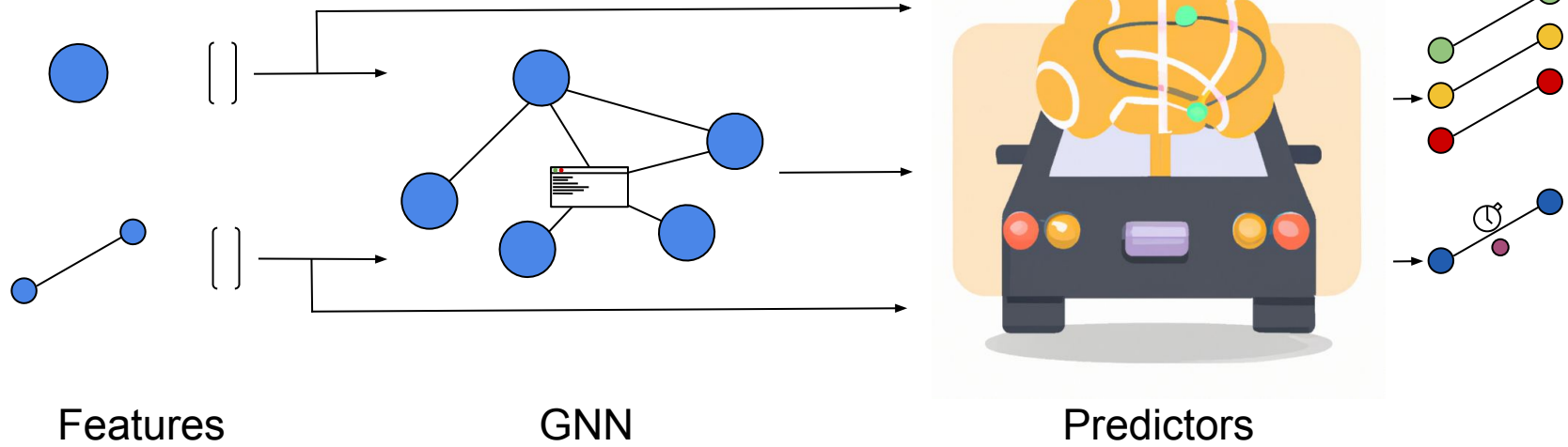
Approach 2



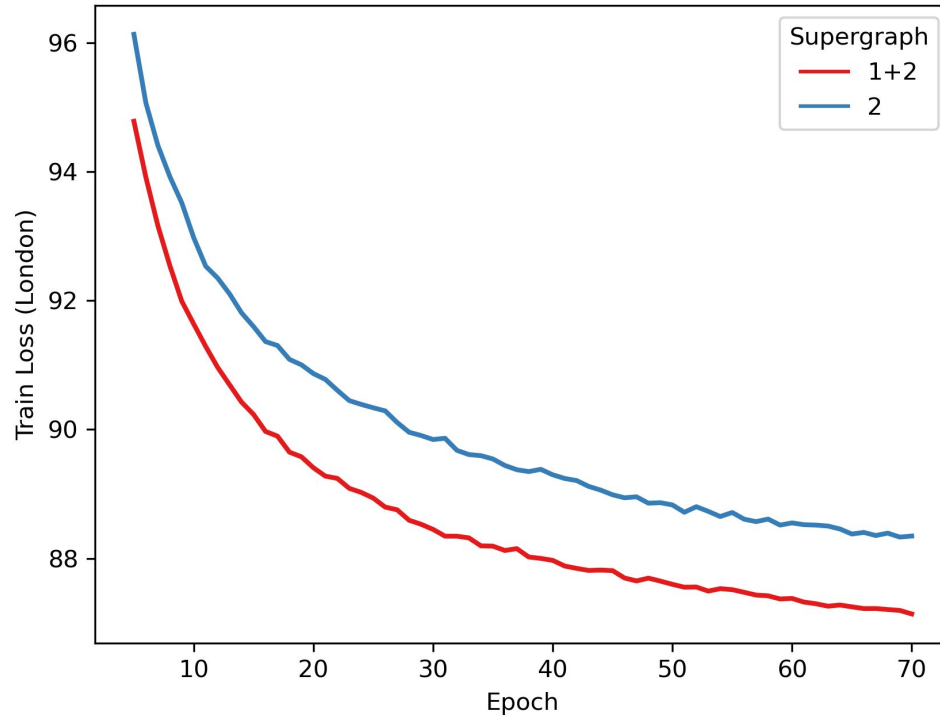
Approach 3



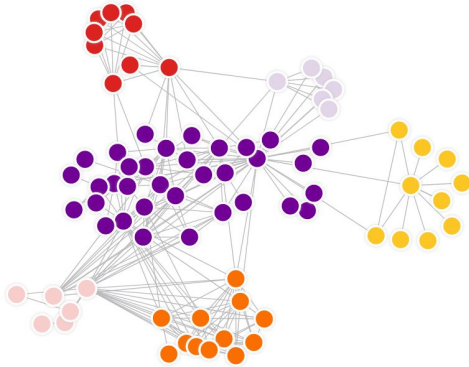
Model Overview: ETA



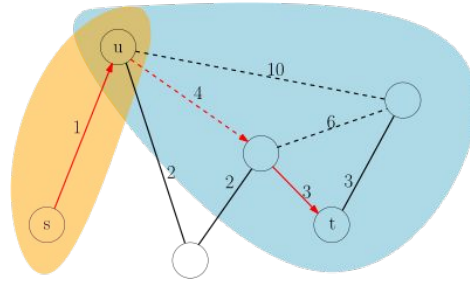
ETA results



Future directions



More hierarchical (maybe using clustering?)



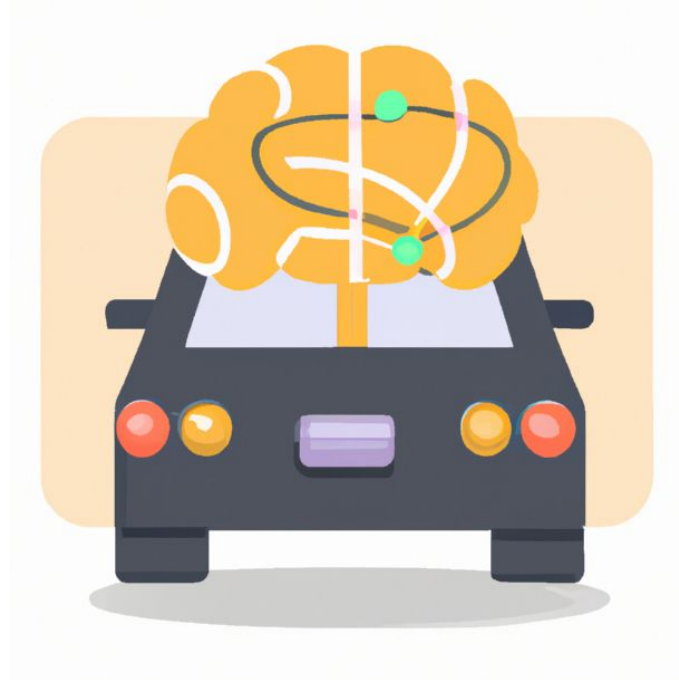
Routing inspired methods



Other compaction methods

Thanks for your attention!

Questions?



Backup

Dataset statistics

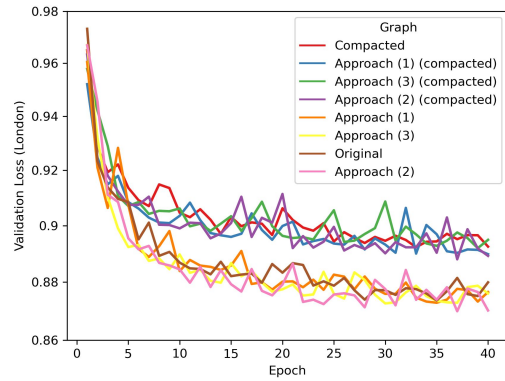
Graph	City	Nodes	Edges
Original Graph	London	59110	132414
	Madrid	63397	121902
	Melbourne	49510	94871
Compact graph	London	39762	93718
	Madrid	60366	115840
	Melbourne	39035	73921

(a) The graph compaction can reduce the graph size up to thirty percent by removing degree two nodes.

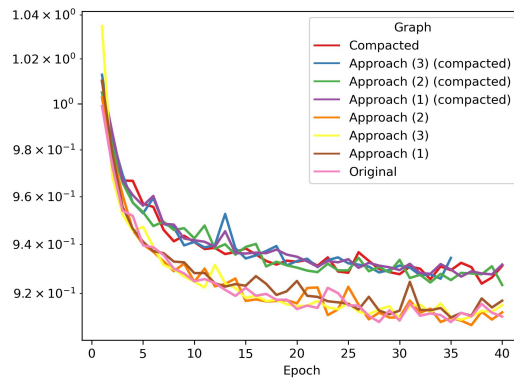
Graph	City	Nodes	Edges
Approach (1)	London	-	8024
	Madrid	-	7938
	Melbourne	-	6492
Approach (2)	London	4012	118999
	Madrid	3969	102456
	Melbourne	3246	82620
Approach (3)	London	4512	135047
	Madrid	4431	118332
	Melbourne	3692	95604

(b) Three different approaches to model the supersegments. The table denotes the number of additional nodes and edges added to the original graph.

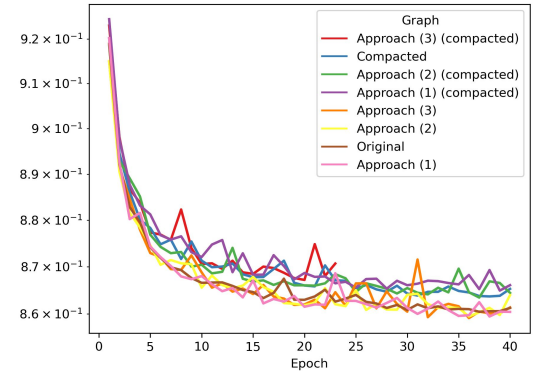
Compaction results



London

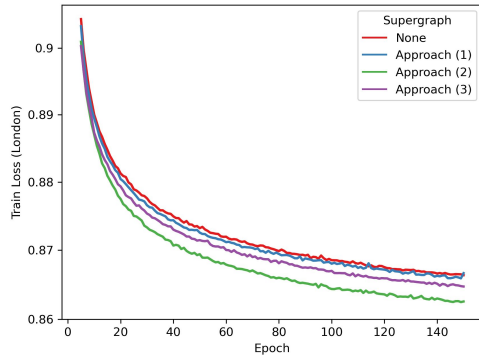


Melbourne

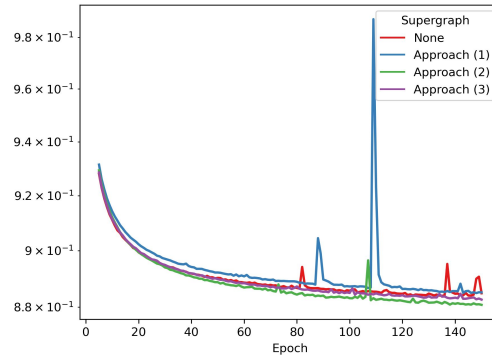


Madrid

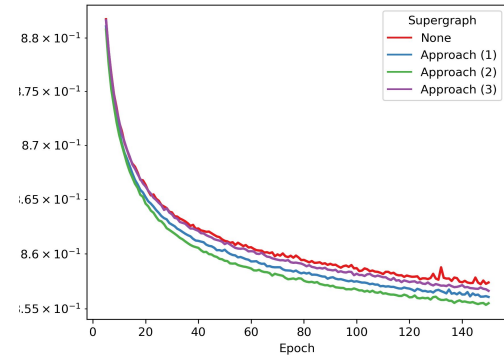
Hierarchical results



London

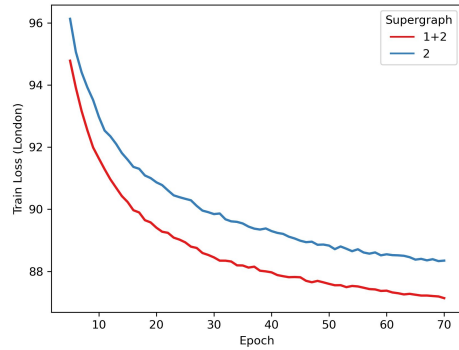


Melbourne

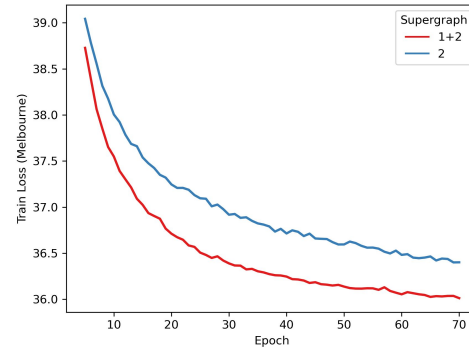


Madrid

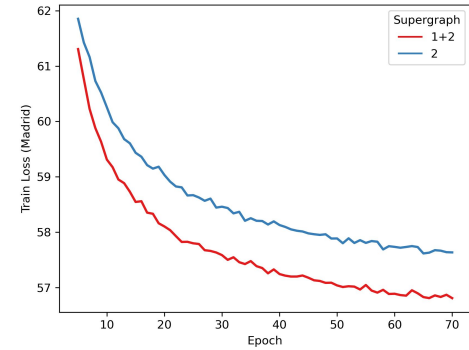
ETA results



London



Melbourne



Madrid