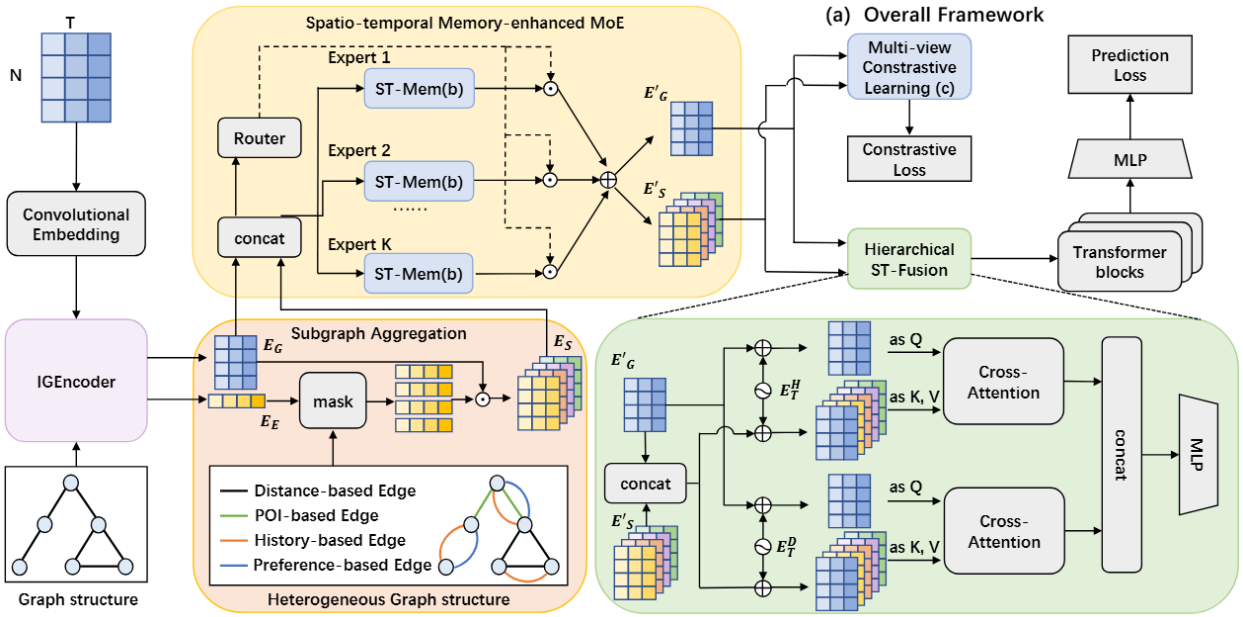
Decoding Citywide Electric Vehicle Charging Dynamics with Multi-View Heterogeneous Spatio-temporal Graph Networks

Jiaming LENG, Chao WANG, Qi ZHANG, Jianyao HU, Bing YIN, Yanyong ZHANG

Frontiers of Computer Science, DOI: 10.1007/s11704-025-51732-y

Problems & Ideas

- Problems of charging station usage forecasting:
  - Spatial dependency is highly heterogeneous.
  - Multi-scale temporal patterns are challenging to capture
  - Spatio-temporal factors interact in complex ways.
  - Charging network dynamically evolve.
- Ideas: Model the charging network with multi-view heterogeneous graphs and a spatiotemporal memory-enhanced MoE module, enabling experts to specialize in distinct spatiotemporal behaviors.



Main Results

- Overall performance:
  - MHSTGN achieves state-of-the-art performance on four datasets and eight baselines, with some baseline methods becoming unsuitable in the scenario of new charging station deployment.

Model	Shenzhen		Hefei		Hf-Exp		Hf-Dep	
	MAE	RMSE	MAE	RMSE	MAE	RMSE	MAE	RMSE
STGCN [3]	2.733	5.082	1.537	2.706	3.765	6.457	3.759	6.437
ST-SSL [4]	1.361	2.736	1.392	2.936	3.715	6.739	3.990	7.055
DDGCRN [5]	1.285	2.390	1.237	2.169	3.205	5.574	–	–
STwave [6]	1.200	2.510	1.438	2.836	3.092	5.474	–	–
HGT [7]	1.512	2.707	1.532	2.294	3.120	5.081	3.455	5.508
PDG2Seq [8]	1.196	2.293	1.206	2.101	3.772	6.612	–	–
PAG [9]	1.343	2.826	1.249	2.267	3.762	6.887	–	–
PIAST [10]	1.354	2.879	1.224	2.206	3.531	6.644	–	–
MHSTGN (ours)	**1.159**	**2.115**	**1.158**	**1.859**	**2.948**	**4.604**	**3.056**	**4.742**