

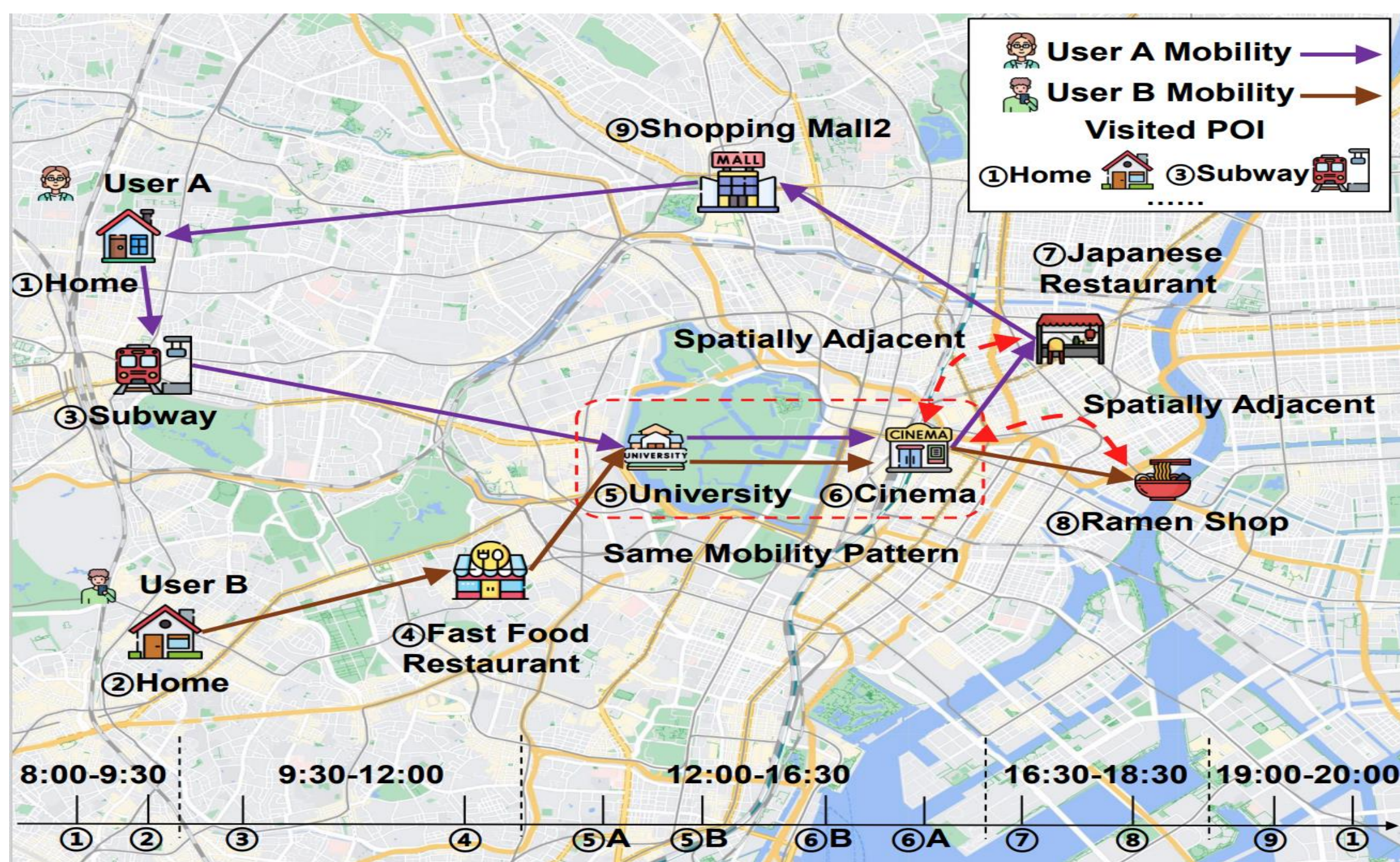
Revisiting Mobility Modeling with Graph: A Graph Transformer Model for Next Point-of-Interest Recommendation

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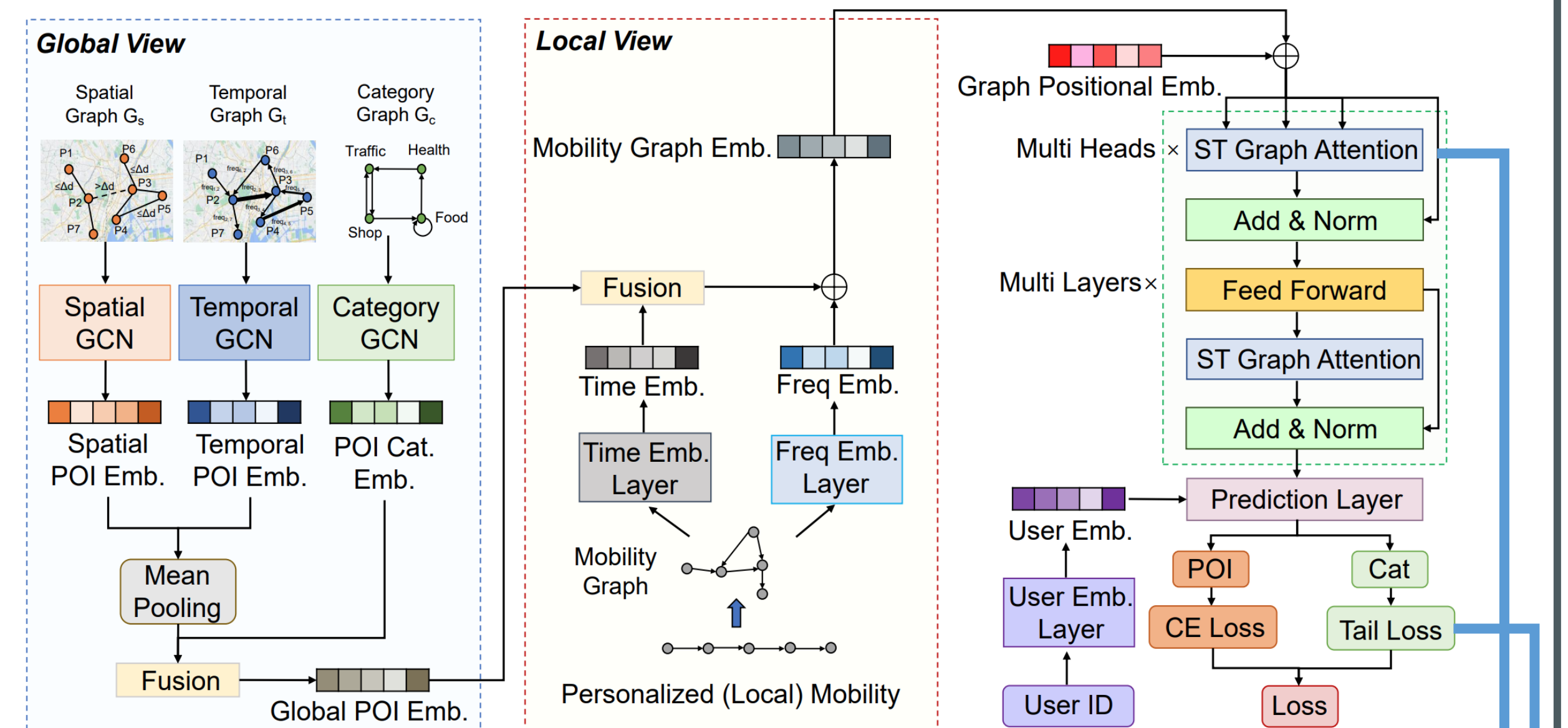
Problem: Complex Mobility

- How to integrate spatial and temporal modeling effectively?
- Personalized POI recommendation.
- Long-tail problem.



Model: Mobility Graph Transformer

- Global view modeling all users' mobility.
- Local Mobility Graph-based Transformer.
- Tail loss from category level.

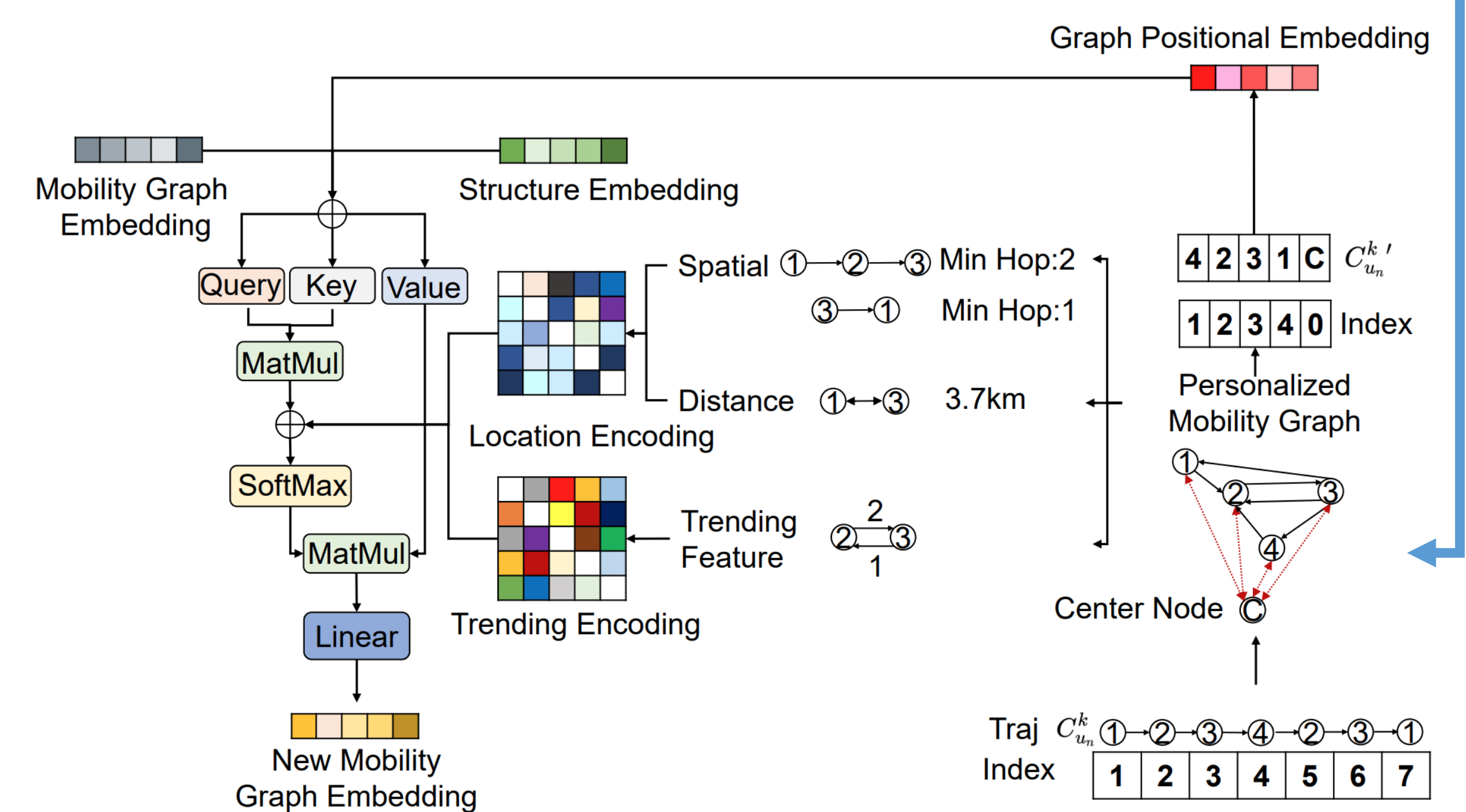


Dataset: Human Mobility & Car

- Open source: Gowalla-Nevada and Foursquare-Tokyo.
- Private: Toyota-Tokyo. Toyota cars can record GPS information and engine start and stop state to determine check-in behavior.

Dataset	Gowalla-NV	Foursquare-TKY	Toyota-TKY
Duration	2009.02~2010.10	2012.04~2013.02	2021.05~2022.04
#Users	1,080	2,261	995
#POIs	3,679	7,855	8,011
#Categories	253	291	49
#Check-Ins	87,828	363,163	539,755
#Trajectories	6,869	44,669	51,880
#POIs / User	35	38	106

	Gowalla			Foursquare-TKY			Toyota		
	Acc@1	Acc@5	Acc@10	Acc@1	Acc@5	Acc@10	Acc@1	Acc@5	Acc@10
MC	0.0225	0.0523	0.0668	0.0387	0.0769	0.0925	0.0190	0.0318	0.0365
LSTM	0.0591	0.1396	0.1841	0.0944	0.2199	0.2809	0.1305	0.2309	0.2925
ST-RNN	0.1149	0.1277	0.1362	0.0245	0.0885	0.1131	0.0221	0.0443	0.0634
DeepMove	0.0732	0.1710	0.2265	0.1601	0.3299	0.3996	0.1614	0.2970	0.3702
Flashback	0.0703	0.1618	0.2136	0.1283	0.2867	0.3506	0.1853	0.3294	0.3934
LSTPM	0.0883	0.1971	0.2617	0.1806	0.3844	0.4659	<u>0.1918</u>	<u>0.3584</u>	<u>0.4409</u>
STAN	0.0746	0.2005	0.2508	0.1156	0.3063	0.4110	0.0800	0.2320	0.3200
GETNext	<u>0.1353</u>	<u>0.2516</u>	<u>0.2896</u>	<u>0.2017</u>	<u>0.4173</u>	<u>0.4940</u>	0.1062	0.2093	0.2581
Ours	0.1690	0.2733	0.3112	0.2209	0.4298	0.4945	0.2634	0.4297	0.4999



$$\mathcal{L}_{tail} = \frac{1}{n} \sum_{i=1}^n \left[-\alpha(1-\sigma(x_i))^k y_i \log(\sigma(x_i)) - (1-y_i)\beta\sigma(x_i)^k \log(1-\sigma(x_i)) \right]$$

- Evaluations: Accuracy@1, 5, 10, NDCG@1, 5, 10, and MRR.
- Baselines: Markov Chains, LSTM, ST-RNN, DeepMove, Flashback, LSTPM, STAN, GETNext (**SOTA**).

	Gowalla			Foursquare-TKY			Toyota		
	NDCG@5	NDCG@10	MRR	NDCG@5	NDCG@10	MRR	NDCG@5	NDCG@10	MRR
MC	0.0389	0.0437	0.0399	0.0602	0.0653	0.0316	0.0259	0.0274	0.0475
LSTM	0.1007	0.1151	0.1031	0.1598	0.1796	0.1567	0.1861	0.2040	0.1864
ST-RNN	0.1206	0.1232	0.1226	0.0577	0.0655	0.0552	0.0340	0.0403	0.0370
DeepMove	0.1240	0.1419	0.1255	0.2494	0.2721	0.2405	0.2319	0.2556	0.2311
Flashback	0.1175	0.1343	0.1203	0.2116	0.2324	0.2033	0.2616	0.2822	0.2574
LSTPM	0.1441	0.1648	0.1456	0.2877	0.3142	0.2758	<u>0.2790</u>	<u>0.3056</u>	<u>0.2752</u>
STAN	0.1388	0.1549	0.1321	0.2116	0.2452	0.2039	0.1557	0.1838	0.1548
GETNext	<u>0.1967</u>	<u>0.2084</u>	<u>0.1908</u>	<u>0.3160</u>	<u>0.3408</u>	<u>0.3017</u>	0.1600	0.1759	0.1586
Ours	0.2234	0.2356	0.2174	0.3344	0.3544	0.3165	0.3510	0.3737	0.3437