Zero-Shot Multi-View Indoor Localization via Graph Location Networks

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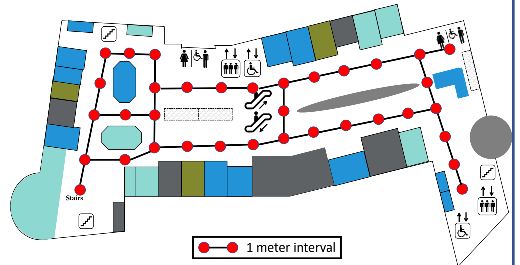
Background & Motivation

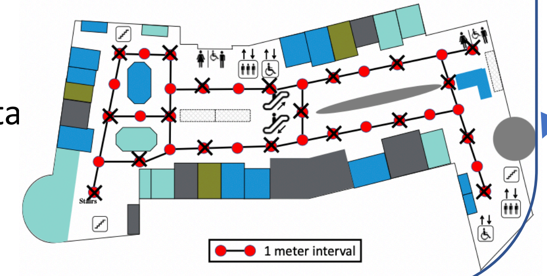
We aim to provide an infrastructure-free, image-based indoor localization system.

[Motivation I] Feature Propagation between Views: Existing works working on panorama images. Shouldn't we treat these views **differently**?

[Motivation II] Reduce Costs with zero-shot Learning

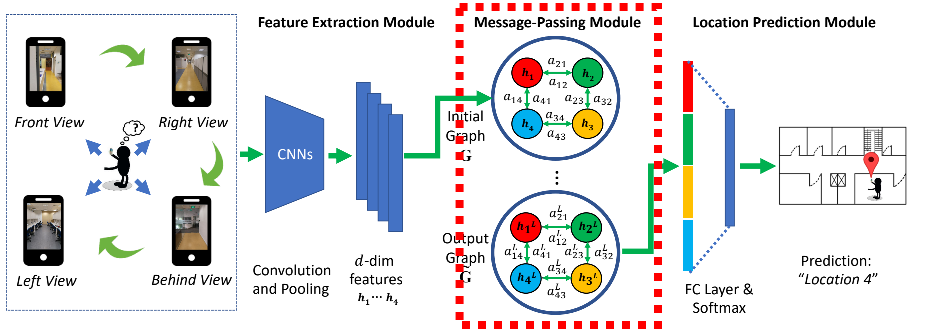
We assume the unseen locations are in-between seen locations. Thus, the training data is reduced by ~50%





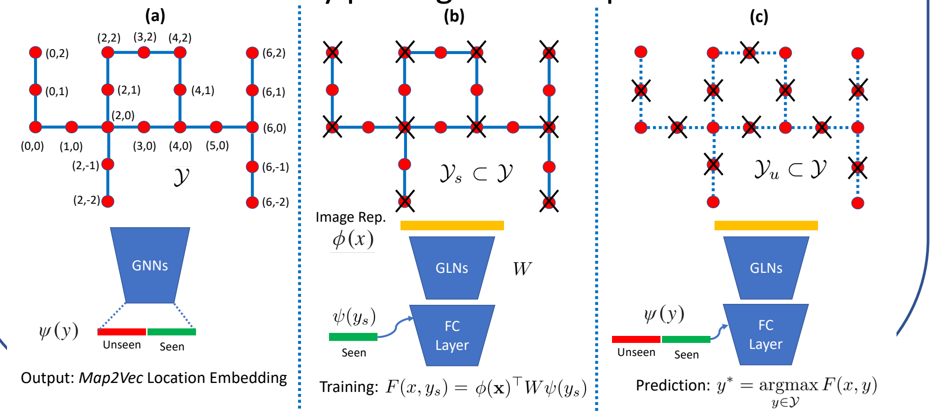
Methodology

We propose a **multi-view image-based localization method** that utilizes Graph Neural Networks (GNNs) to propagate distinct features of different views. Message-passing with GNNs



Zero-Shot Indoor Localization: A Three-step framework:

1. Train *Map2Vec* location embeddings (*seen* & *unseen* data)
2. Train an inloc system w/ compatibility function (*seen* data)
3. Perform Inference by picking the most probable location

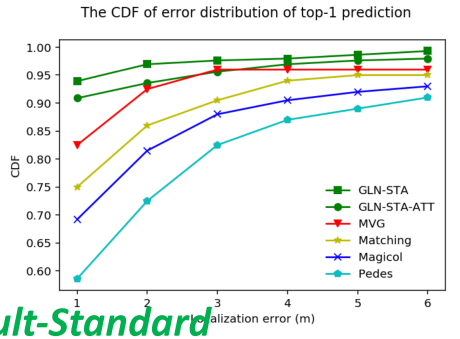


Experiments & Results

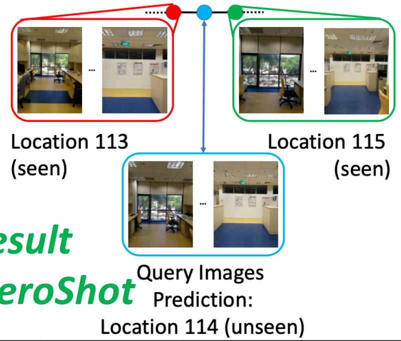
We experimented our proposed approach on 2 datasets:

1) **ICUBE: existing dataset of an office**
2) **WCP: additional dataset at shopping center**

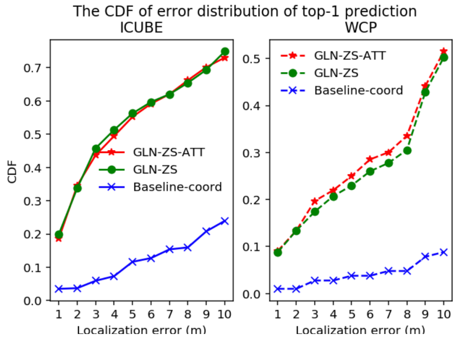
Dataset	Method	Meter-level Accuracy
ICUBE	Pedes [23]	58.30%
	Magicol [39]	69.20%
	Matching [30]	75.00%
	MVG [26]	82.50%
	GLN-STA	**93.92%**
	GLN-STA-ATT	**90.88%**
MALL-1†	Sextant [11]	47%
MALL-2‡	GeoImage [24]	53%
WCP	**GLN-STA**	**79.88%**
	GLN-STA-ATT	**79.88%**



Result-Standard



Result -ZeroShot



Dataset	Method	Recall@k					CDF@k					MED
		k=1	k=2	k=3	k=5	k=10	k=1	k=2	k=3	k=5	k=10	
ICUBE	Baseline-coord	0.00	0.01	0.02	0.03	0.03	3.53	3.73	5.96	11.65	23.95	23.00
	GLN-ZS	8.12	14.40	22.78	30.89	**46.60**	**19.90**	33.77	**45.81**	**56.28**	**74.87**	**3.76**
	GLN-ZS-ATT	**8.38**	**14.92**	**23.30**	**32.20**	45.81	18.59	**34.55**	43.71	55.24	73.04	4.09
WCP	Baseline-coord	0.00	0.00	0.00	0.00	0.00	1.01	1.01	2.78	3.79	8.84	27.00
	GLN-ZS	**2.02**	**6.06**	7.83	12.37	**24.75**	8.84	**13.38**	17.42	22.98	50.25	9.97
	GLN-ZS-ATT	**2.02**	4.55	**8.33**	**13.64**	24.50	**9.09**	**13.38**	**19.70**	**25.00**	**51.52**	**9.93**