

F³Loc: Fusion and Filtering for Floorplan Localization

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1. Motivation

AR/VR Applications

Autonomous Mobile Robots

SLAM (loop closure)

Prebuilt 3D models

costly storage and maintenance

Floorplan

easily accessible, lightweight, long term

VS

2. Contributions

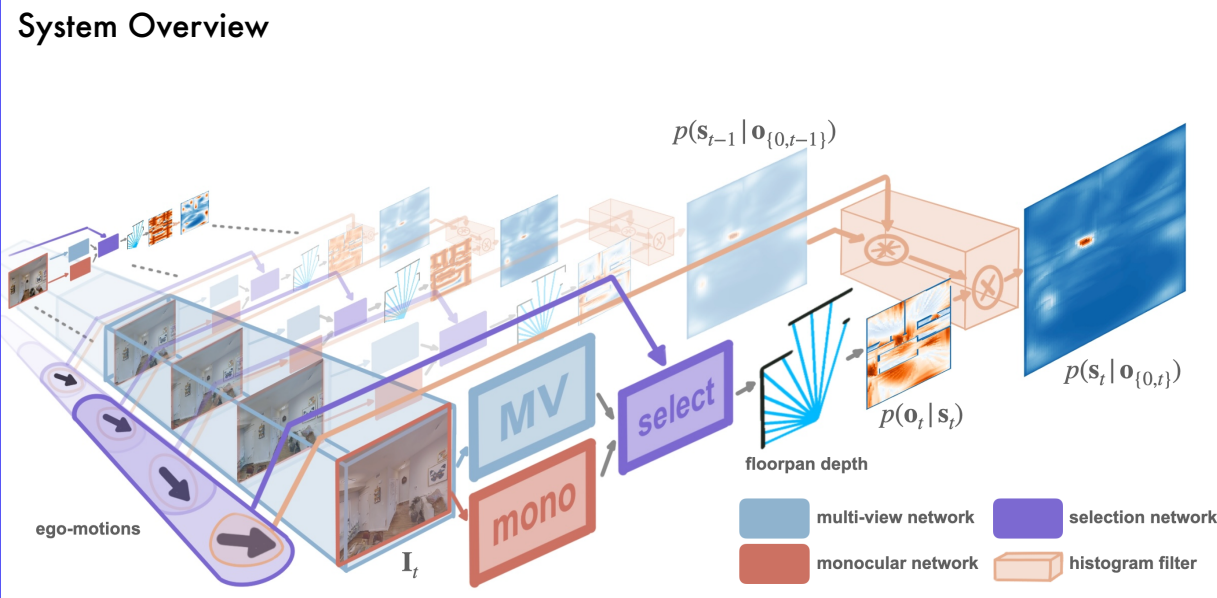
a A novel **1D ray representation** reflecting the 2D floorplan representation.

b Propose to **fuse monocular and multi-view** observations based on ego-motions.

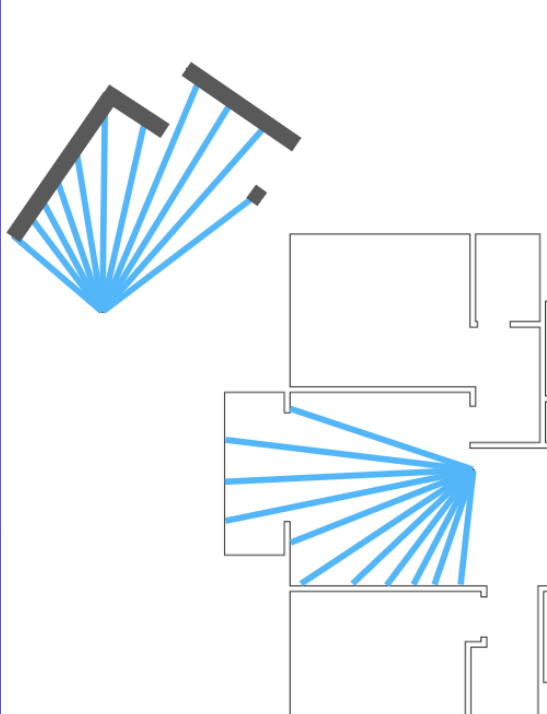
c **Virtual rollpitch** data augmentation to cope with non-zero roll-pitch angles.

- A novel **1D ray representation** reflecting the 2D floorplan representation.
- Propose to **fuse monocular and multi-view** observations based on ego-motions.
- **Virtual rollpitch** data augmentation to cope with non-zero roll-pitch angles.
- A novel and efficient **histogram filter as grouped convolution** from ego-motion.
- Full system **outperforms the SOTA methods** in both accuracy and efficiency and a real world experiment illustrates its **potential for practical applications**.
- **A large indoor dataset**, composed of floorplans and both short and long sequential observations in 119 Gibson indoor environments.

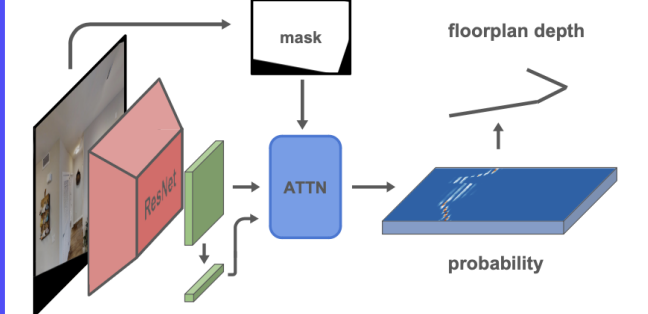
3. Method



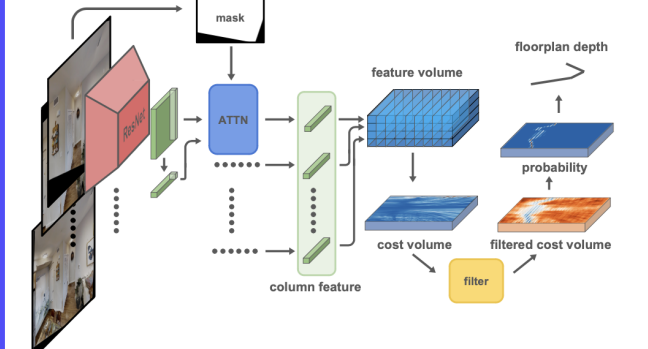
Localize with Rays



Monocular Network



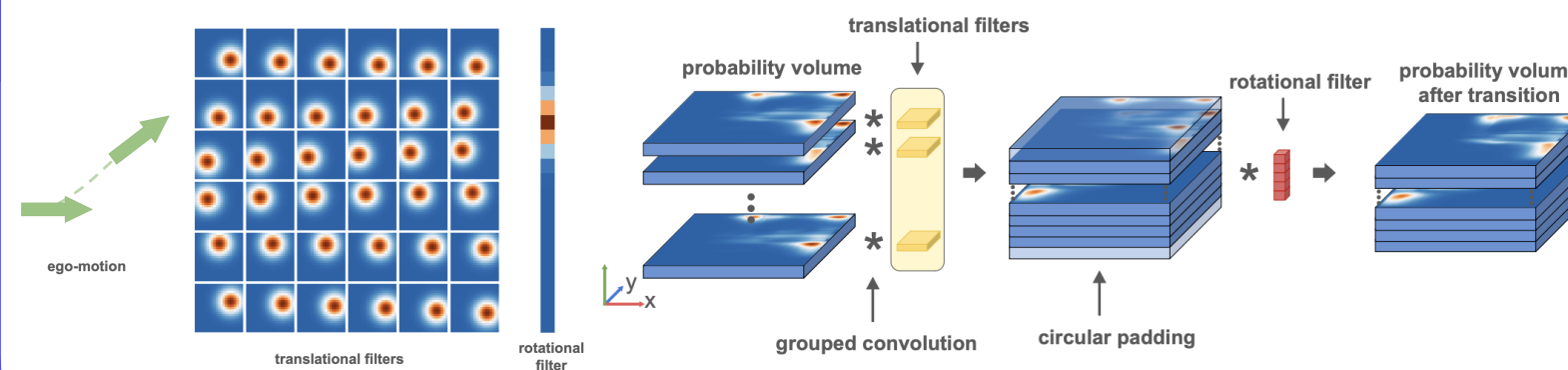
Multi-view Network



Virtual Roll Pitch



Transition as Grouped Convolution



4. Results

R@	Gibson(f)				Structured3D			
	0.1m	0.5m	1m	1m30°	0.1m	0.5m	1m	1m30°
PF-net	0	2.0	6.9	1.2	0.2	1.3	3.2	0.9
LASER	0.4	6.7	13.0	10.4	0.7	6.4	10.4	8.7
Ours _s	4.7	28.6	36.6	35.1	1.5	14.6	22.4	21.3
Ours _m	13.2	40.9	45.2	43.7	-	-	-	-

R@	Gibson(g)			
	0.1m	0.5m	1m	1m30°
PF-net	1.0	1.9	5.6	1.9
LASER	0.7	7.0	11.8	9.5
Ours _s	4.3	26.7	33.7	32.3
Ours _m	9.3	27.0	31.0	29.2
Ours _s	10.5	34.3	39.6	38.0
Ours _f	12.2	39.4	44.5	43.2

Table 1. Comparison between our observation model and the baselines.

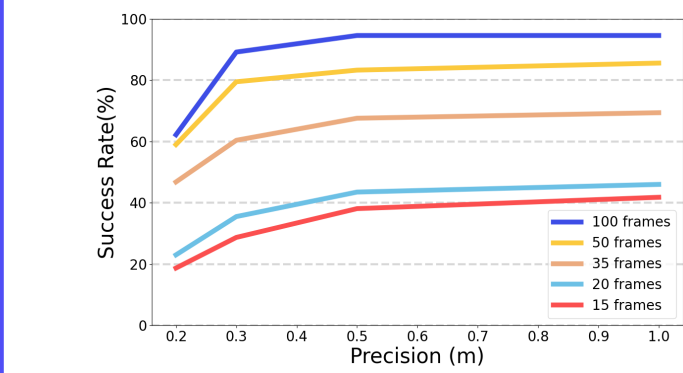
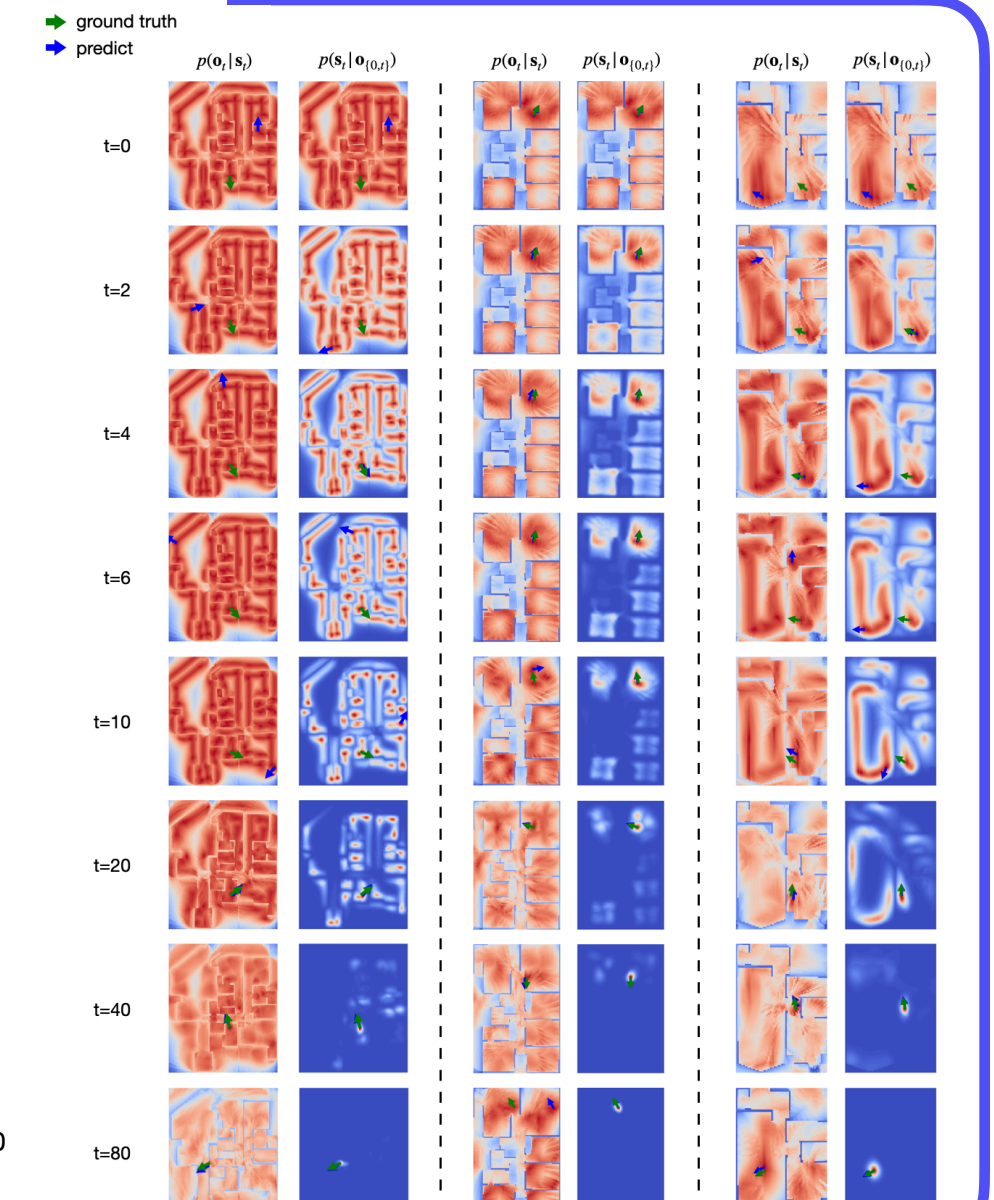
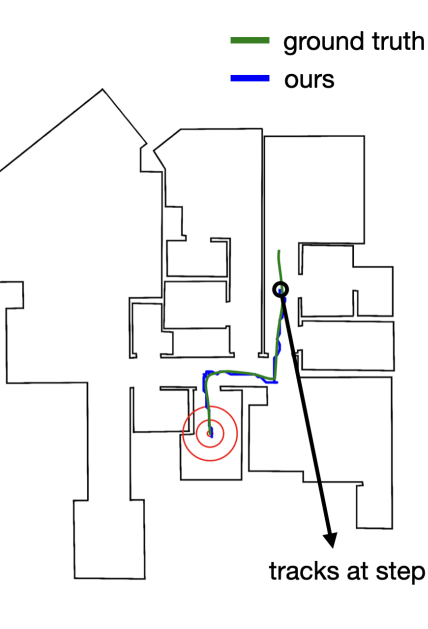
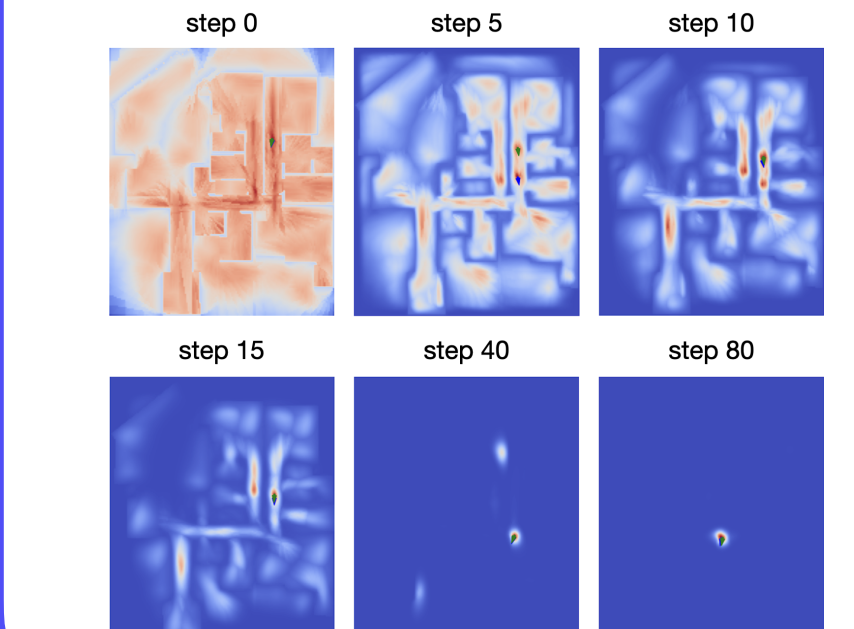
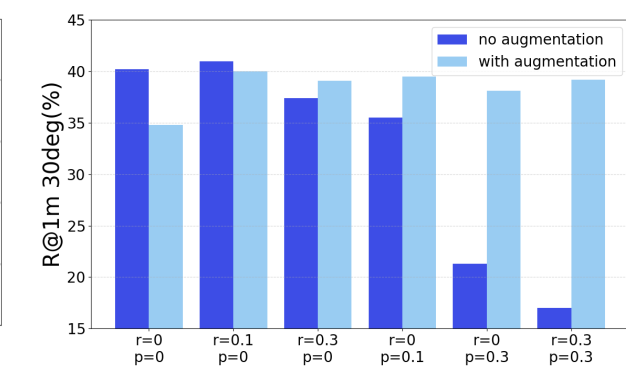


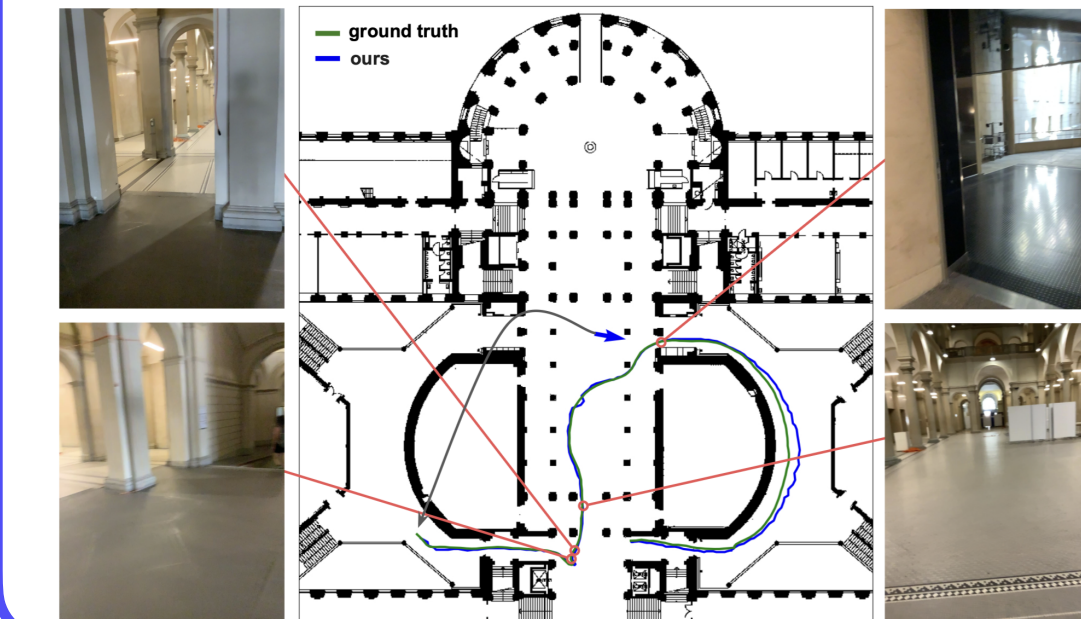
Table 2. Complement single and multiview.



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5. Real-world Experiment



6. Conclusions

- Practical system on consumer hardware 💰
 - ➔ Perspective RGB + non-upright camera
 - SOTA performance in accuracy 🎯 and speed ⚡
 - Opens door to real-world deployment in challenging scenes 🏠
- Future Work**
- Only geometric cues ➔ Utilize semantic information 📖
 - Lack of large real world data with floorplans 😞
 - ➔ Collect large scale real world dataset 📁

