

Software Lab:

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Image Localization With Room Layout Prediction

Description

Successful deployment of a mobile robot in indoor GPS-Denied environments depends on accurate localization systems. Presently, several indoor localization techniques already exist. While some of them depend on sensors that have to be installed strategically in known locations on the building (such as Beacons Tags), other less expensive and more user-friendly methods rely only on sensors onboard the robot.

Localization with only the sensors onboard is also possible with current techniques but requires maps generated from data gathered with identical sensor modality used for localization. Moreover, collecting accurate data usually requires tiresome work done by specialists.

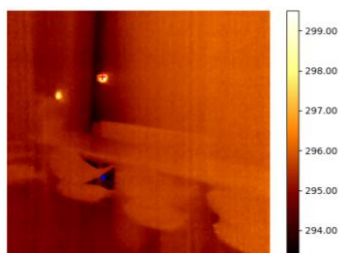
In an effort to address these challenges, your task is to implement a camera-based localization system that allows a robot to estimate its pose given a BIM model. The main focus is the prediction of room layout edges from RGB and Thermal camera images. These edges will allow you to find the robot pose matching the extracted edges to the given model.

Task

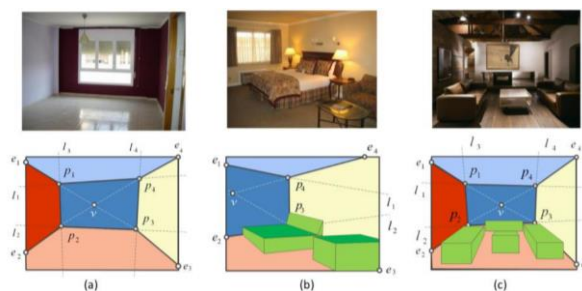
- Implement pipeline to automatically label the room layout in the real-world images.
- Train and evaluate a deep learning algorithm to perform Layout prediction in RGB and Thermal images.
- Optimize camera pose in near real-time with BIM Model and VP/VL extraction.



Image Localization with Floor Plans [1]



Example of Thermal Image



Examples of room layouts in RGB images [2]

Supervisors

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References

- [1] Boniardi, Federico; Valada, Abhinav; Mohan, Rohit; Caselitz, Tim; Burgard, Wolfram (2019): Robot Localization in Floor Plans Using a Room Layout Edge Extraction Network. <http://arxiv.org/pdf/1903.01804v2>. VIDEO: <https://www.youtube.com/watch?v=8pa4MUqkjc>
- [2] Bincy P Mathew. (2020). Review on Room Layout Estimation from a Single Image. *International Journal of Engineering Research And*, V9(06), 1068–1073. <https://doi.org/10.17577/ijertv9is060820>
- [3] Zou, C., Su, J. W., Peng, C. H., Colburn, A., Shan, Q., Wonka, P., Chu, H. K., & Hoiem, D. (2021). Manhattan Room Layout Reconstruction from a Single 360° Image: A Comparative Study of State-of-the-Art Methods. *International Journal of Computer Vision*, 129(5), 1410–1431. <https://doi.org/10.1007/s11263-020-01426-8>