

Software Lab:

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A hybrid Convolutional Neural Network for door and window detection in indoor environments using the multi-sensors datasets

Description

Today, due to the development of smart cities, the need for the automated creation of digital twins of buildings has increased. Generation and improv digital twinning of buildings require rich semantics and coherent geometry information of buildings elements. In this regard, one of the main tasks is to simultaneously detect the location of basic elements (e.g., door, window, etc.) in the scene and recognize their type (in terms of construction material, number of openings, etc.). Achieving a high level of automation and accuracy in this task requires the development of intelligent methods and the use of multi-sensors datasets.

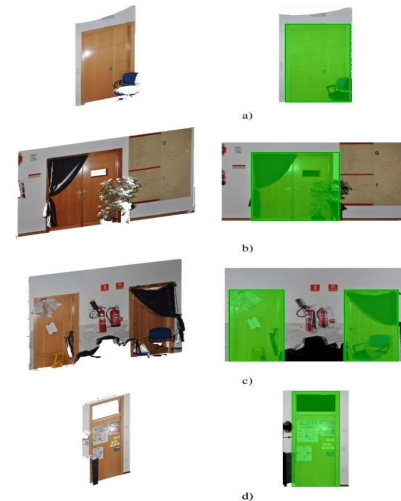


Figure 1: Door detection in indoor environments [1]

Task

Develop a hybrid Convolutional Neural Network for localization and recognizing the type of door and window in indoor environments using the 3D colored point clouds and RGB images:

- Get to know the deep learning networks architectures.
- Get to know the methods of points and images annotation [2], [3].
- Get familiar with deep learning for Image and point cloud fusion [4].
- Test the implementation and evaluate efficiency on multi-sensors datasets of the TUM campus.

Supervisor

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References

- [1]. Quintana Galera, Blanca & Prieto, Samuel & Adan, Antonio & Bosché, Frédéric. (2018). Door detection in 3D colored point clouds of indoor environments. *Automation in Construction*. 85. 146–166. [10.1016/j.autcon.2017.10.016](https://doi.org/10.1016/j.autcon.2017.10.016). <http://dx.doi.org/10.1016/j.autcon.2017.10.016>
- [2]. O' Mahony, Niall & Campbell, Sean & Carvalho, Anderson & Krpalkova, Lenka & Riordan, Daniel & Walsh, Joseph. (2019). Point Cloud Annotation Methods for 3D Deep Learning. 1-6. [10.1109/ICST46873.2019.9047730](https://doi.org/10.1109/ICST46873.2019.9047730). <http://doi.org/10.1109/ICST46873.2019.9047730>
- [3]. Khaing, Phyu & Yu, May. (2019). A Survey in Deep Learning Model for Image Annotation. *International Journal of Computer (IJC)*. 32. 54-63.
- [4]. Zhang, Rui & Li, Guangyun & Li, Minglei & Wang, Li. (2018). Fusion of images and point clouds for the semantic segmentation of large-scale 3D scenes based on deep learning. *ISPRS Journal of Photogrammetry and Remote Sensing*. 143. [10.1016/j.isprsjprs.2018.04.022](https://doi.org/10.1016/j.isprsjprs.2018.04.022). <http://dx.doi.org/10.1016/j.isprsjprs.2018.04.022>