Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
Technical University of Munich

3D geometry reconstruction from floor plan layouts using Generative Adversarial Networks (GAN)

Project Characteristics

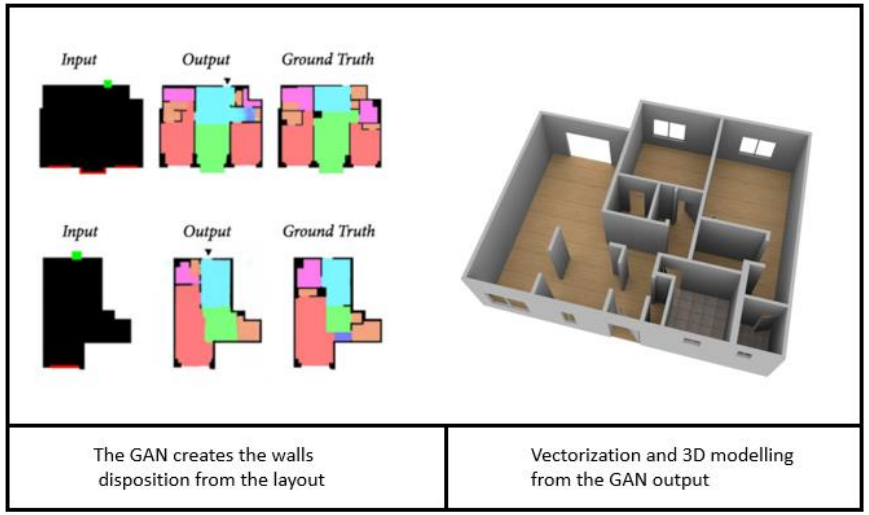
Modeling:
Mathematics:
Programming:
Science:

Description

This project aims to utilize Generative Adversarial Networks (GANs) to reconstruct 3D geometry from 2D layouts. The GAN architecture will consist of two main components: a generator and a discriminator. The generator will be trained to generate the interior elements of the floor plan from the apartment layout, while the discriminator will be trained to distin-guish between the generated interior elements and the ground truth image. The generator and discriminator will be trained in an adversarial manner to improve the quality of the predictions [1][3].
The input of the architecture is the generic layout of the apartment or building. The neural network learns how to generate plausible walls and doors disposition in the layout. Neural Networks require a great amount of data to learn effectively to recreatethe disposition of the walls and other elements in the floor plan, a fundamental part of the project is to create the dataset for the model to learn.The final part of the project is to vectorize the output of the GAN using heuristic methods or implementing an additional neural network [2]. The output of the whole architecture is a simple 3D reconstruction of the floor plan geometries (walls, doors and windows).

Tasks:

- Researching and literature review state-of-the-arts ML methods and Generative Adversarial Networks
- Create the dataset for the apartments' layout (walls, windows and doors) in a manual or semi-automatic way
- Implementation of the GAN architecture, training and vectorization of the results
- 3D reconstruction of the geometries using a 3D modelling tool



Supervisor

Andrea Carrara, Chair of Computational Modeling and Simulation

[1] Zhu, J. Y., Park, T., Isola, P., & Efros, A. A. (2017). Unpaired Image-to-Image Translation Using Cycle-Consistent Adversarial Networks. *Proceedings of the IEEE International Conference on Computer Vision*, *2017-October*. https://doi.org/10.1109/ICCV.2017.244
[2] Dodge, S., Xu, J., & Stenger, B. (2017). Parsing floor plan images. *Proceedings of the 15th IAPR International Conference on Machine Vision Applications, MVA 2017*. https://doi.org/10.23919/MVA.2017.7986875
[3] Isola, P., Zhu, J.-Y., Zhou, T., & Efros, A. A. (2016). *Image-to-Image Translation with Conditional Adversarial Networks*. http://arxiv.org/abs/1611.07004
[4] Chaillou, S. (2020). ArchiGAN: Artificial Intelligence x Architecture. In *Architectural Intelligence* (pp. 117–127). Springer Nature Singapore. https://doi.org/10.1007/978-981-15-6568-7_8