Contour detection

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Architects are drawing floor plans using a CAD software. These files are used by engineers to plan and conduct the construction of the building. In this process, additional measures are needed such as the room size or adjacency. The goal of this project is to develop a tool that can automatically detect the contours of the rooms in the floor plan and draw it back into their CAD software.

1 Context

Vinci's engineers are dealing with a different floor plan for every project they are working on. Every plan has its own drawing style and the contours of the rooms are often mixed with other lines, but they need this information to plan the location of smoke detectors, fire extinguishers, and other facilities in the building. The goal of this project is to develop a tool that can automatically detect the contours of the rooms in the floor plan and draw back the polygons in the CAD software as a vector layer for further automatic processing. Diane's teams have already worked on this problem and developed a first version of the tool that is too slow and not accurate enough. They are looking for other approaches to improve it.

Datasets   We were given examples of GeoJson[2] exports of CAD plans. The first dataset was composed of 9 GeoJson exports of floor plans : the geometric description of the drawing lines. The second dataset exported the floor plans of 5 whole buildings, including width of walls, and the contours of the actual rooms as a target.

2 Methods

After a first phase of data cleaning we have focused on two different paths to solve the problem:

1. **Geometric process** Transform the list of lines into a graph and construct polygons [3] then cluster the lines to create the polygons[1]. This path relies on the geometric libraries `shapely` and `geopandas`.

2. **Image segmentation** Using a dense literature review[2], we spotted some successful uses of CNNs[4]. This same paper also provides the list of datasets of floor plans as image we can use. Ultimately, this path lead to the segmentation of the floor plans into rooms.

3 Results

3.1 The metric to use

Text of the subsection.

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[1]Diane is Vinci's inside Startup tasked to find numerical solutions to ease the work of Vinci collaborators.

[2]The current standard for GeoJson format was published in August 2016 by the Internet Engineering Task Force (IETF), in RFC 7946.

3.2 The results

4 Conclusion

Summarize and discuss the main findings. What are the limitations?
Are the experiments conclusive? With more time, what else would you have tried?

Organization within the team   The project initially started in the office of Vinci/Diane for a brainstorming session. Since then, we have been working remotely in a smooth way, meeting with Vinci/Diane at the beginning of each Thursday afternoon. We were using a shared git repository to share our code and results[3].

After a first quick diverging phase where every one has tried different methods and dug into the data, we have split in teams of two to focus on two paths described in section 2.

References

[1] Bernardino Domínguez, Ángel-Luis García-Fernández, and Francisco Feito. Semiautomatic detection of floor topology from cad architectural drawings. *Computer-Aided Design*, 44:367–378, 05 2012.

[2] Pablo N. Pizarro, Nancy Hitschfeld, Ivan Sipiran, and Jose M. Saavedra. Automatic floor plan analysis and recognition. *Automation in Construction*, 140:104348, 2022.

[3] Martin Schafer, Christian Knapp, and Samarjit Chakraborty. Automatic generation of topological indoor maps for real-time map-based localization and tracking. *2011 International Conference on Indoor Positioning and Indoor Navigation*, pages 1–8, 2011.

[4] Jaeyoung Song and Kiyun Yu. Framework for indoor elements classification via inductive learning on floor plan graphs. *ISPRS International Journal of Geo-Information*, 10(2), 2021.

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[3]Private: https://github.com/waddason/CapstoneContour

A Additional details on X

B Additional information on X