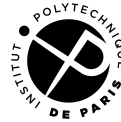


## Contour detection - mid-term checkpoint

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**Mentor:** Stéphane Maviel (CEO Vinci/Diane<sup>1</sup>)

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 in the CAD software.



## 1 Context

Vinci 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 team 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. They have shared with us 9 geojson exports of floor plans.

## 2 Methods

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

1. **Graph** Transform the list of lines into a graph and construct polygons [3] then cluster the lines to create the polygons[1].
2. **CNNs** 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.

## 3 Results

The first experiments of clustering are not conclusive. The detection with CNN works well on well closed rooms but fails on open doors, see fig. 1.

## 4 Conclusion

Our main issue is that this project is not a machine learning problem. With less than 10 items to work on, they need a tailored solution on a very specific case with very high accuracy. This is highly challenging.

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<sup>1</sup>Diane is Vinci's inside Startup tasked to find numerical solutions to ease the work of Vinci collaborators.

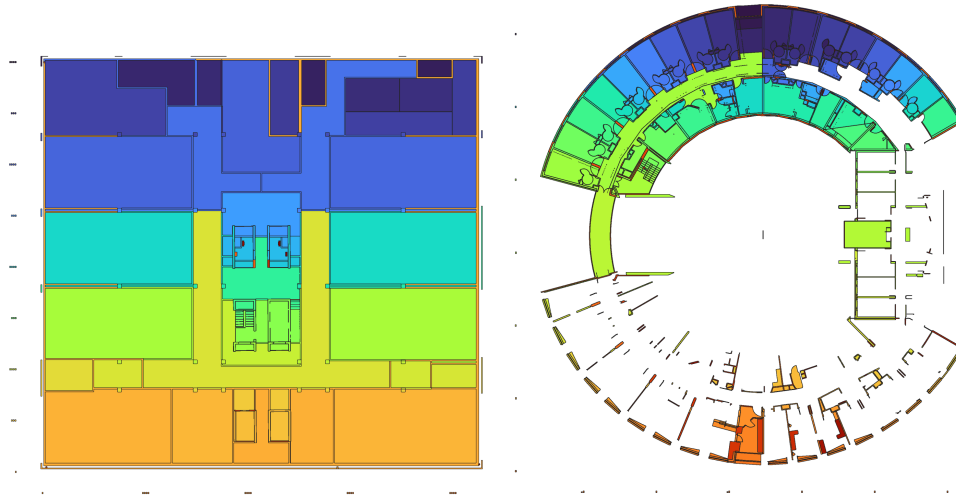


Figure 1: Actual results of room detection with a CNN. Left: well closed rooms. Right, rooms with open doors are not detected.

**Organization within the team** After a first diverging phase where every one has tried different methods, we are now focusing on the two paths described in section 2. We are meeting every week to discuss our progress and share our results. We are also using a shared git repository to share our code and results<sup>2</sup>.

## 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.

<sup>2</sup>Private :<https://github.com/waddason/CapstoneContour>