

Automated Foundation Structure Identification from Floorplans using Deep Learning

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Floorplan understanding is critical for architectural design, reconstruction, and urban planning. Accurate detection of foundation structures help to determine the stability and the functionality of buildings. We present a deep learning framework for automated foundation structure identification based on a multi-head U-Net with a ResNet encoder, that jointly segmentations foundation-lines and junction heatmaps. The proposed approach was evaluated on a real-image dataset of 1,000 floorplans annotated with foundation structure lines and junction points. The framework achieved a precision of 0.9438 and a recall of 0.9484 for junction detection, as well as an intersection-over-union (IoU) of 0.8806 for foundation-line segmentation. These results outperform other segmentation models, including DeepLab-v3+ (precision 0.9273, recall 0.9329, IoU 0.8569) and the vanilla U-Net (precision 0.3731, recall 0.6804, IoU 0.5784), demonstrating robust learning across diverse layout configurations. Qualitative analysis shows accurate localization of key junctions and coherent foundation structure predictions across diverse floorplans. This work contributes a practical pipeline for real-image dataset preparation, a multi-task architecture tailored to foundation cues, and empirical evidence supporting its effectiveness for structural recognition. Future work will involve curating and annotating more diverse real-world floorplans to fine-tune the model and extending the system to explicitly map connections between junctions and foundation structures for enhanced structural reasoning and downstream engineering applications.

Keywords: foundation detection, floor plan segmentation, junction analysis, floor plan analysis, heatmap segmentation