

Generative Design in Landscape Architecture

Comparison of a rule-based and a data-driven approach

Graduate



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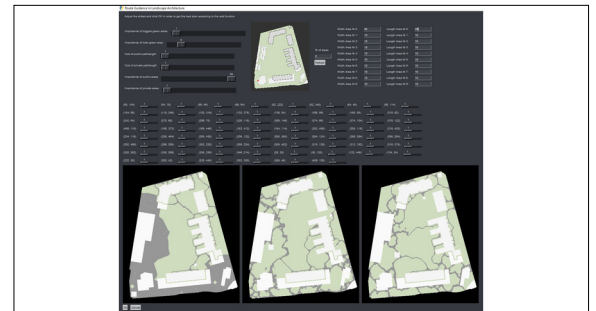
Introduction: Generative design includes the development and layout of components and the design of creative elements, such as artwork, photographs, music, or architecture through algorithms, especially artificial intelligence. Its potential is immense, and recent results have shown that models such as generative adversarial networks can solve a wide variety of tasks with high quality. To this day, computer-aided design in landscape architecture is still in its infancy even though it is increasingly used in similar domains such as architecture or open space planning.

Definition of Task: After getting familiar with landscape architecture and its requirements, rules for evaluating a given design have to be defined. Further, a rule-based generative design approach has to be developed. The generated plans shall be evaluated and compared using a scoring function. A few of these plans will be picked by the landscape architect, further improved, and visually matched with his design for comparison. In a second phase, a data-based algorithm such as a generative adversarial network shall be used to generate new designs. The two algorithms shall be optimized and compared.

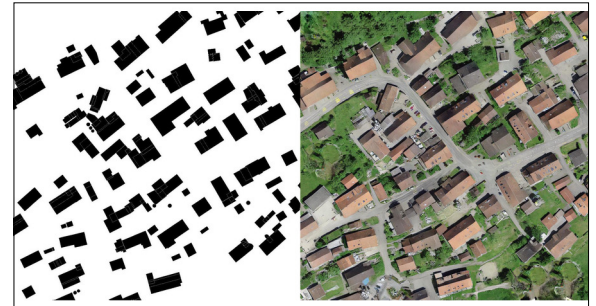
Result: The first part yields a framework that generates a path for a defined building area which can be adjusted and evaluated using an interactive GUI. It is a first step in the direction of computer-aided design in landscape architecture. Such a framework could be used as a source of inspiration for a landscape architect in the initial phase of a project. For the second part, two datasets were created and various data-driven approaches tested. Using these datasets, a StyleGAN was trained, which is now able to create aerial images that are hardly distinguishable

from reality. Further, a pixel2style2pixel model for latent space encoding and manipulation of the pretrained StyleGAN model was tested but did not yield the desired results. As an alternative, a pix2pixHD framework based on a conditional GAN was trained. This allows creating aerial images conditioned on a mask image that designates the buildings' position.

Graphical user interface for path generation
Own presentation



Created aerial image conditioned on the building mask
Own presentation



Artificial aerial images created with the StyleGAN2
Own presentation



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Subject Area

Software and Systems