



Machine Learning And Architectural Design

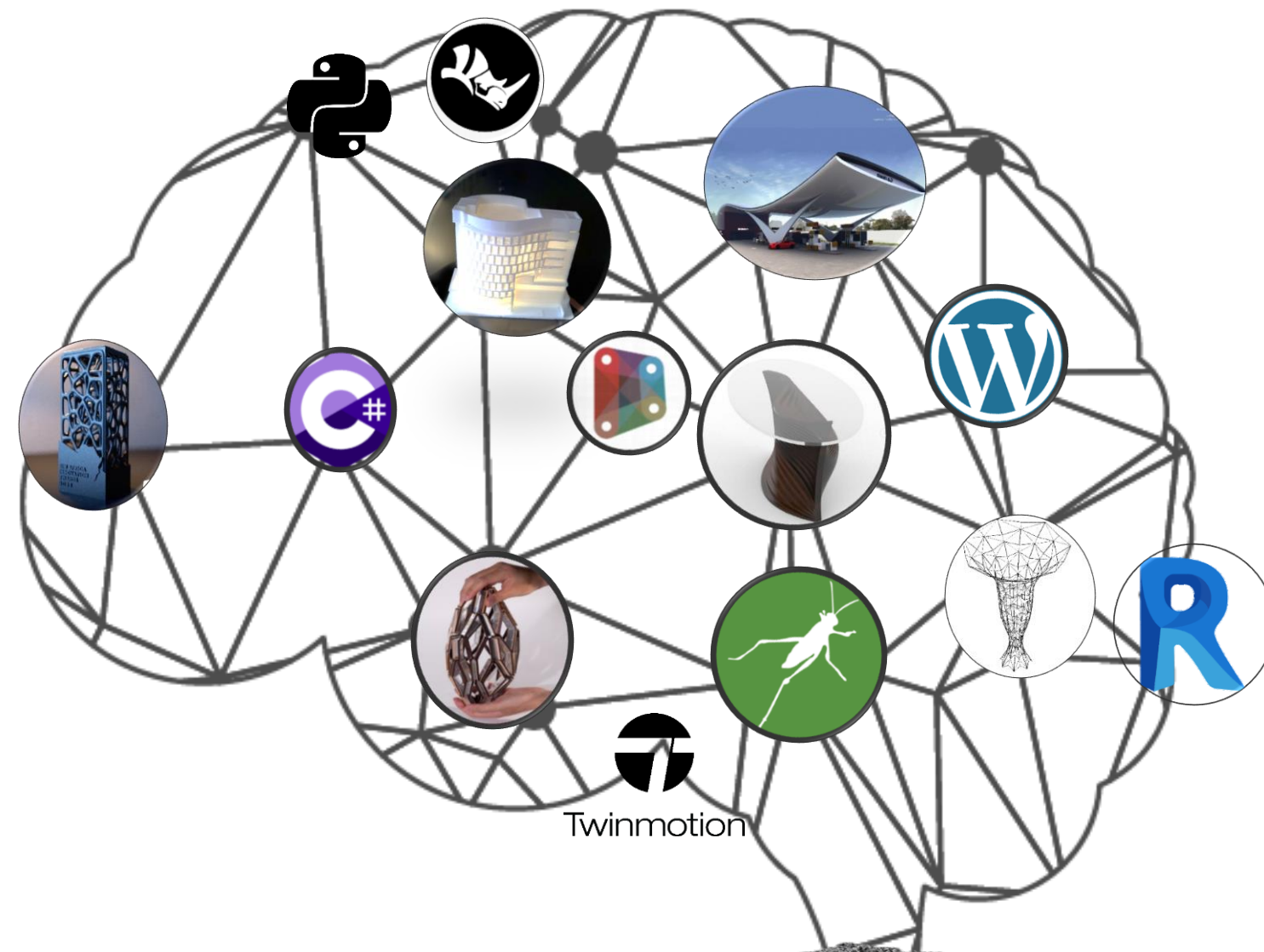
CREATIVE ARCHITECTS 2021

By Victoria Akpezi Ikede

www.akpezi.com

Instagram: @theakpezi

LinkedIn: Victoria Ikede



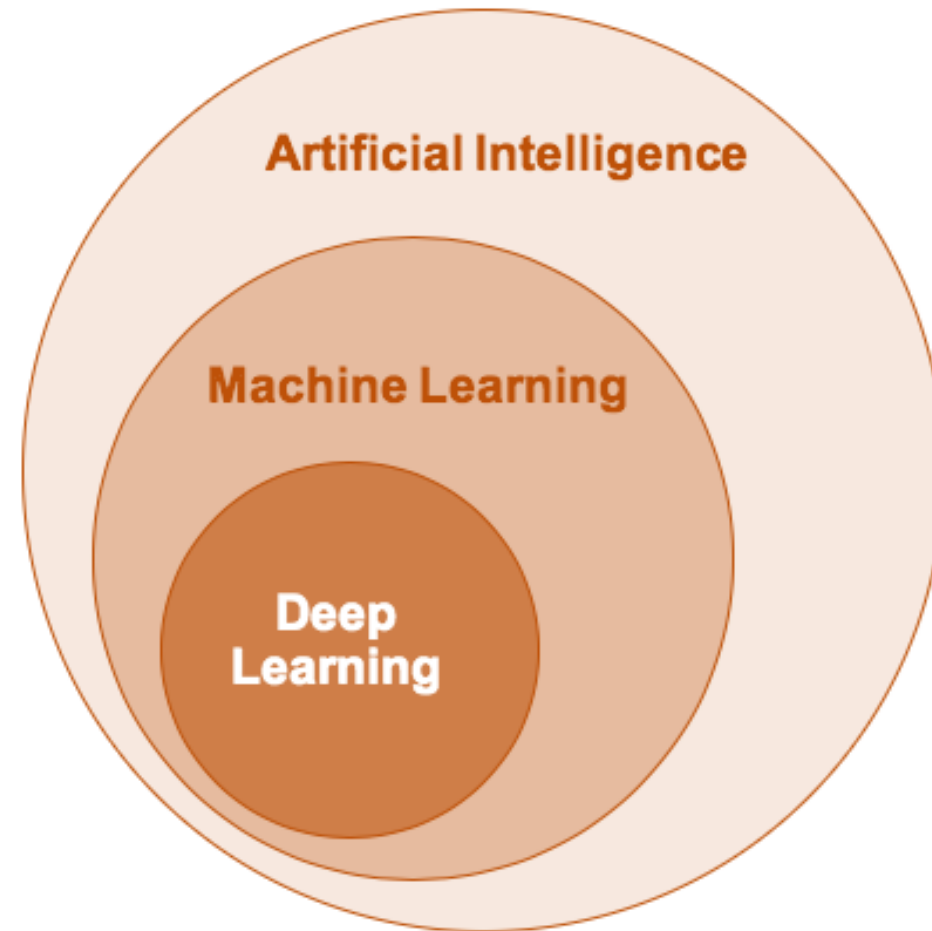
About Me



**What does it mean to
be creative?**

**How will creatives
respond to machines
joining the workforce?**

A visual explanation of the field of AI



Machine Learning:

Training computers with large amounts of data to discover latent patterns and relationships that may not be apparent to humans looking at the data independently.

Deep Learning:

A subset of Machine Learning where algorithms are programmed to make more intelligent predictions from data similar to the human brain in the form of neural networks.

Artificial Intelligence:

A program that can reason, act and adapt.

Self deciding. Mimics the intelligence of humans.

**MACHINE
LEARNING APPS
YOU KNOW,**

**(AND PROBABLY
USE)**

Siri, Alexa

Google Translator

**Facebook (You trained their
Model by tagging all your
friends).**

**YouTube, Spotify and other
Automatic music playlists**

The four Machine Learning Models:

Supervised

Semi-Supervised

Unsupervised

Reinforcement

Supervised



Unsupervised



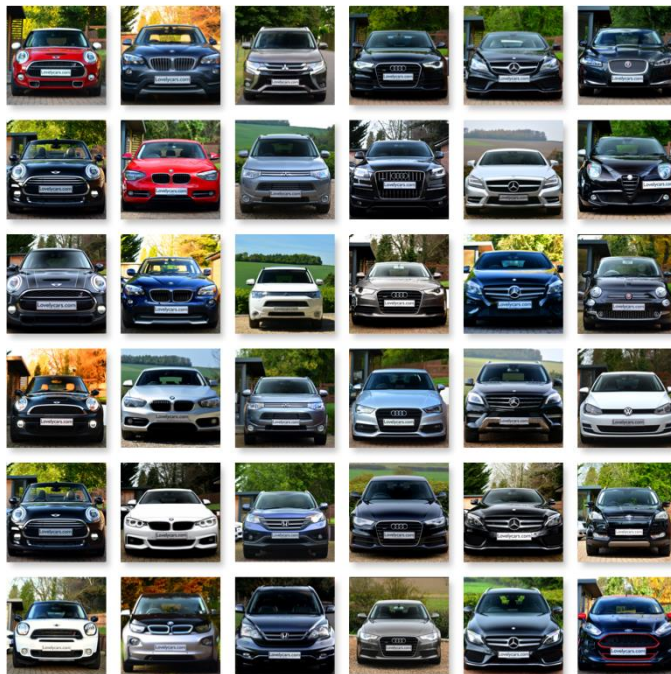
Reinforcement



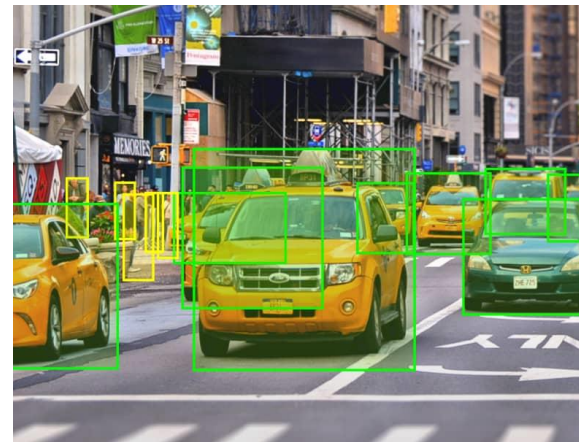
Supervised Learning

Machines learn through algorithms defined as neural networks that mimic the human brain.

SPECIFY A TRAINING SET

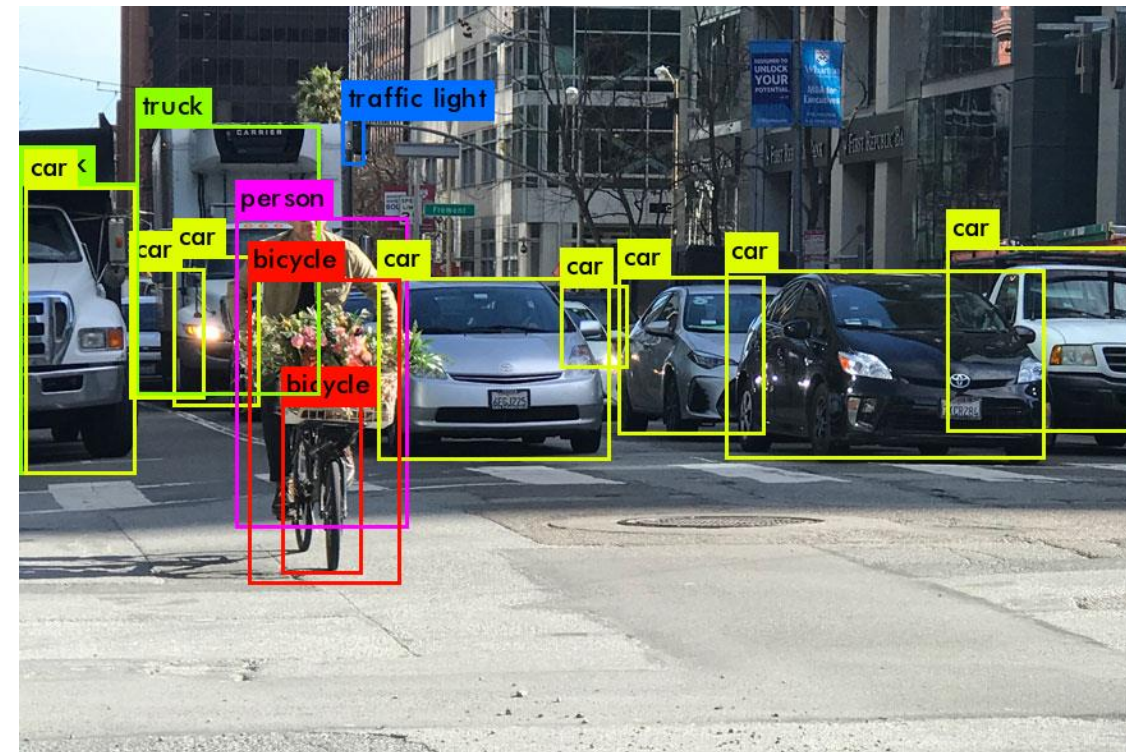


THIS IS WHAT A CAR
LOOKS LIKE

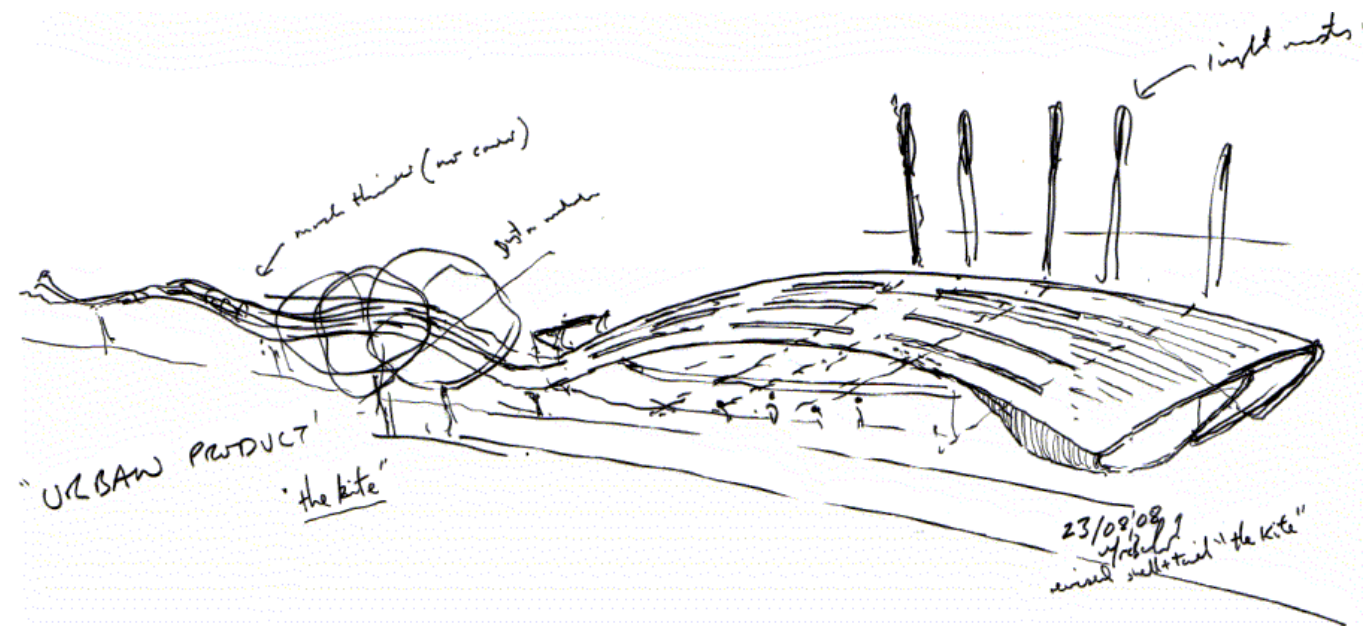


SORT THROUGH
DIFFERENT MEANS OF
ROAD TRANSPORT

PREDICT & CATEGORIZE



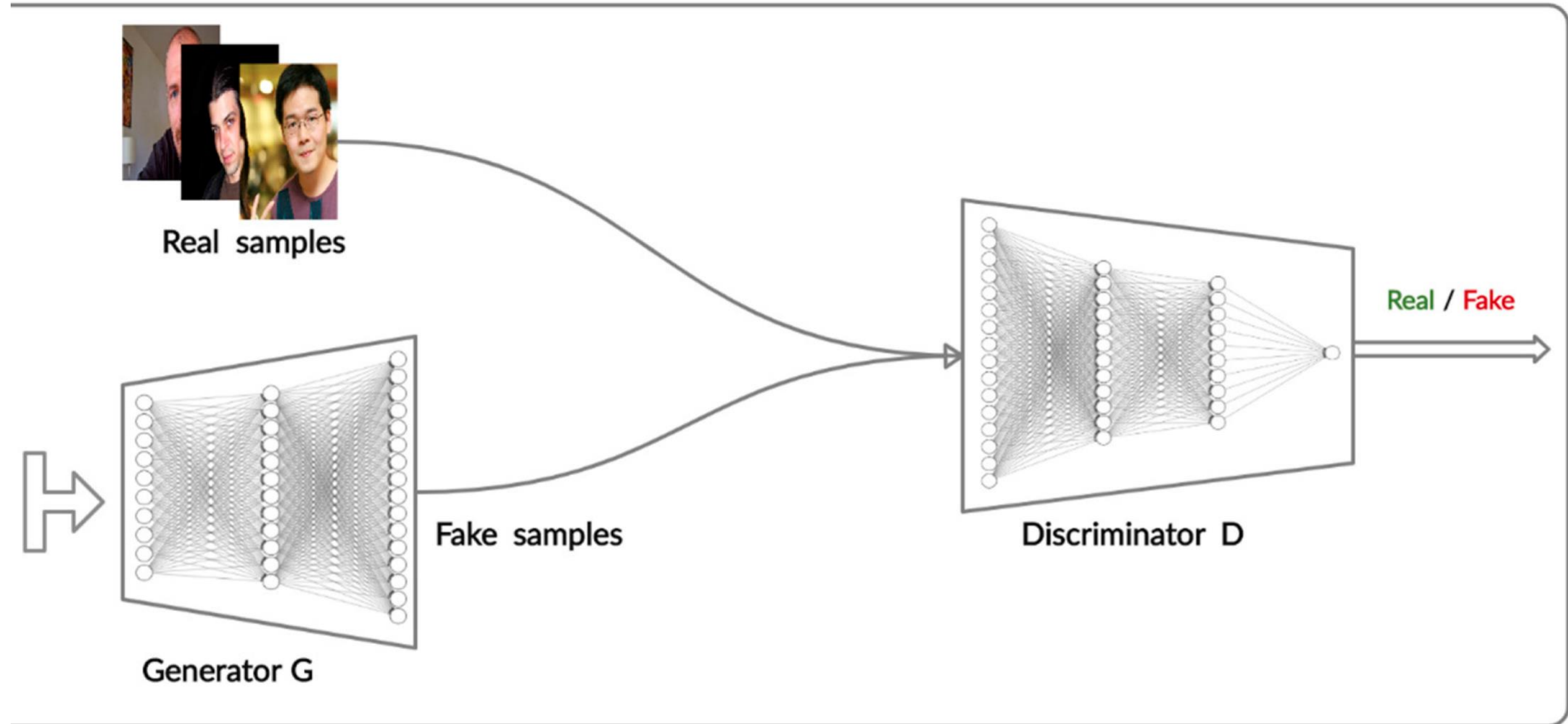
DISTINGUISH CARS AND NOT CARS



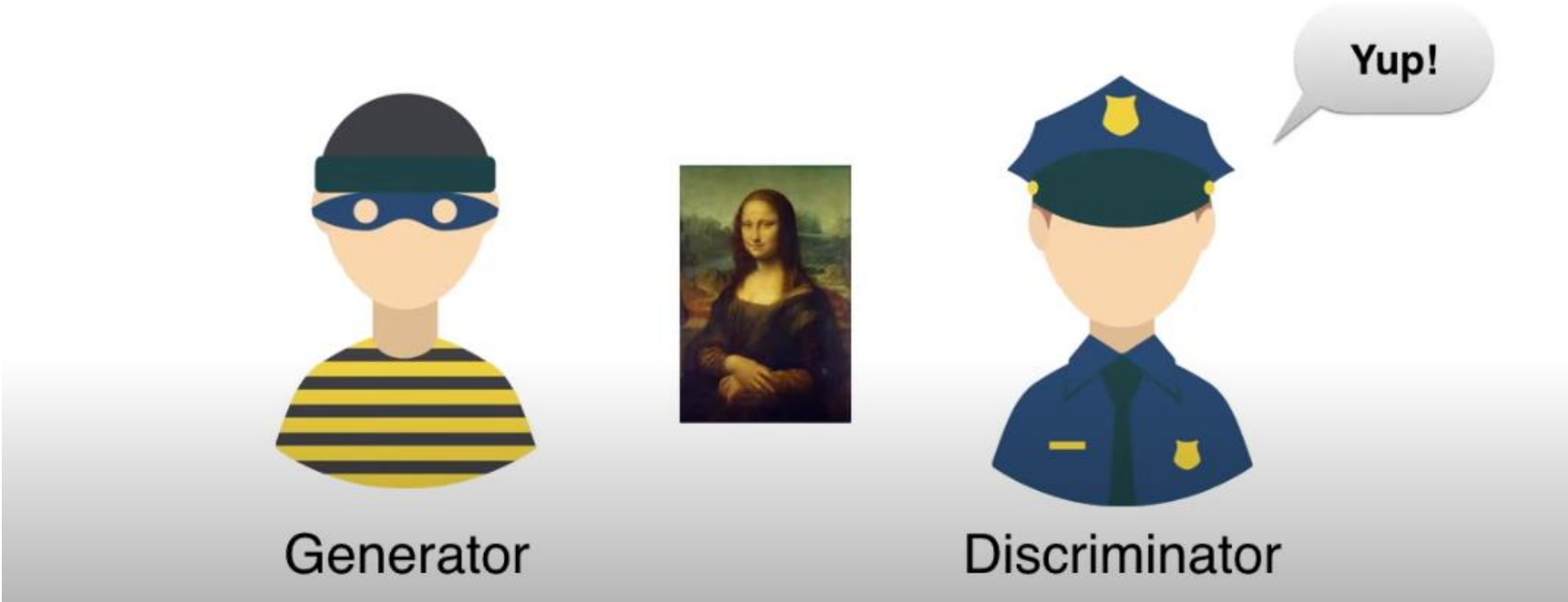
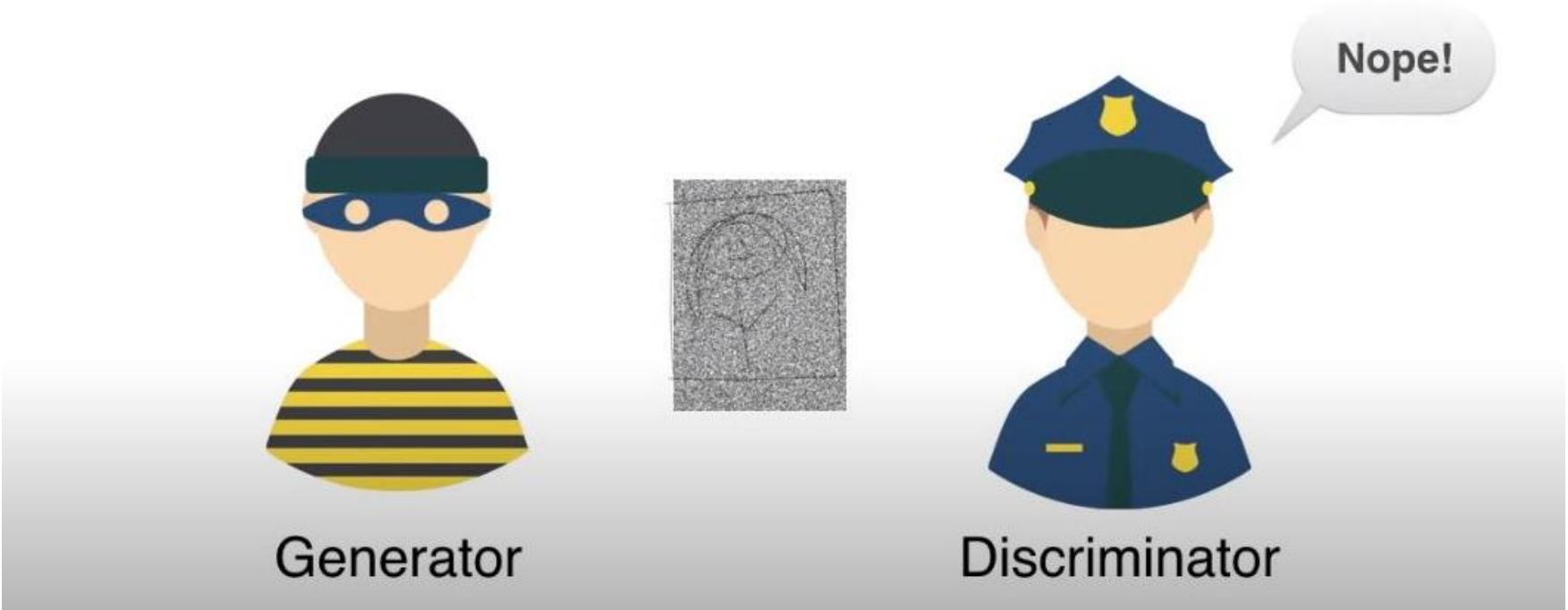
Semi-Supervised Learning

One can compare this to a professor-student relationship in design studio: the student presents design work to the professor. The professor examines, critiques the design and points out shortcomings. The student then iterates on the design and presents it to the professor again. This loop of iterations continues until the professor passes the design as satisfactory. Ideally, at a certain maturity level, the student is then able to generate satisfactory designs without the help of the professor.

GENERATIVE ADVERSARIAL NETWORKS (SEMI SUPERVISED LEARNING)

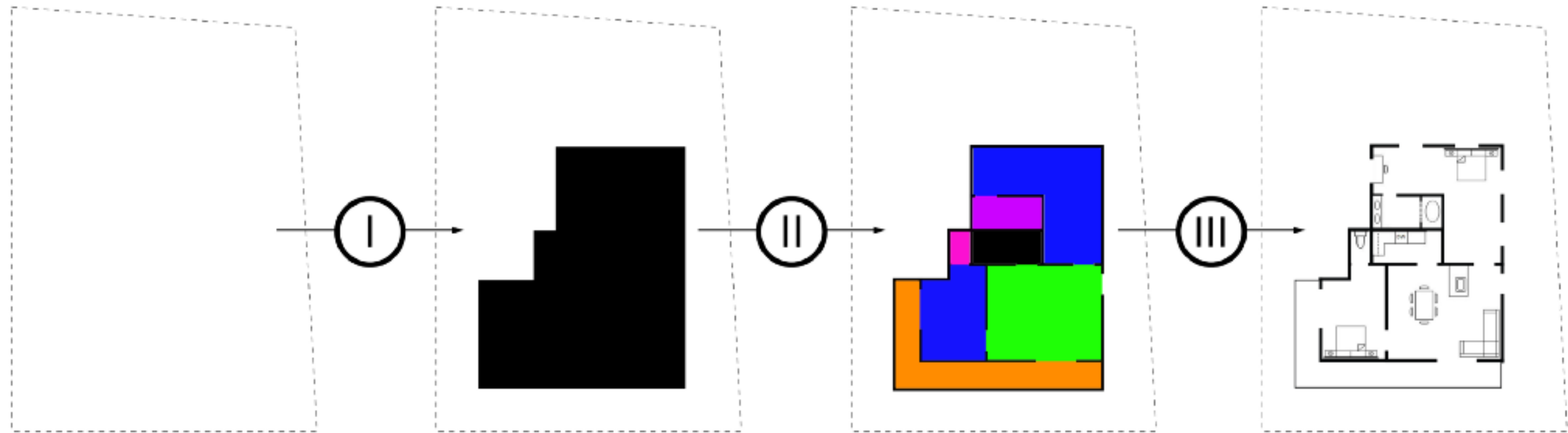


GENERATIVE ADVERSARIAL NETWORKS (SEMI SUPERVISED LEARNING)



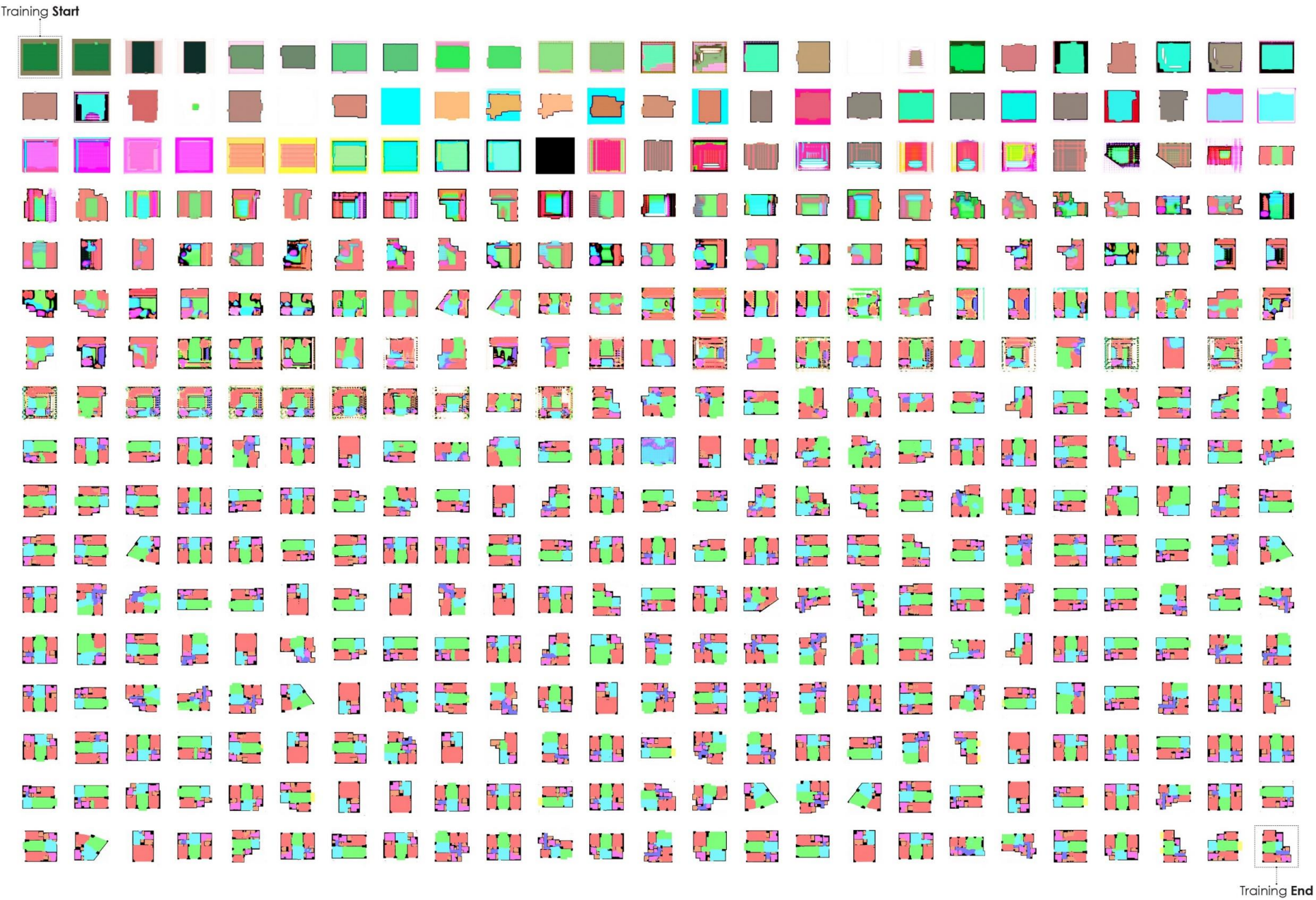
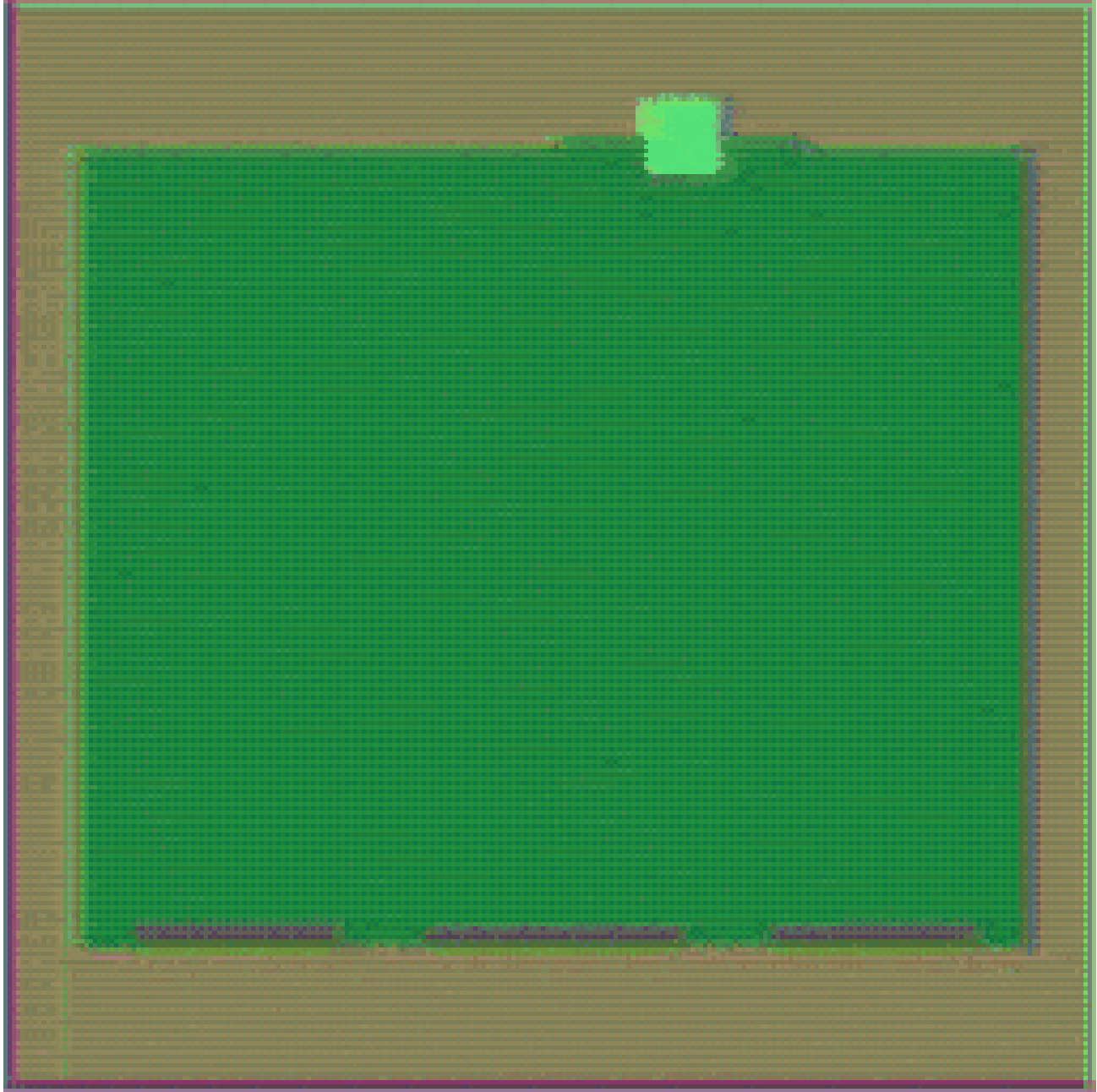
Source: Luis Serrano on Youtube

HOW DOES A MACHINE LEARN TO **CREATE** A BUILDING?



A project by [Stanislas Chaillou](#),
Harvard Graduate School of Design
<https://towardsdatascience.com/ai-architecture-f9d78c6958e0>

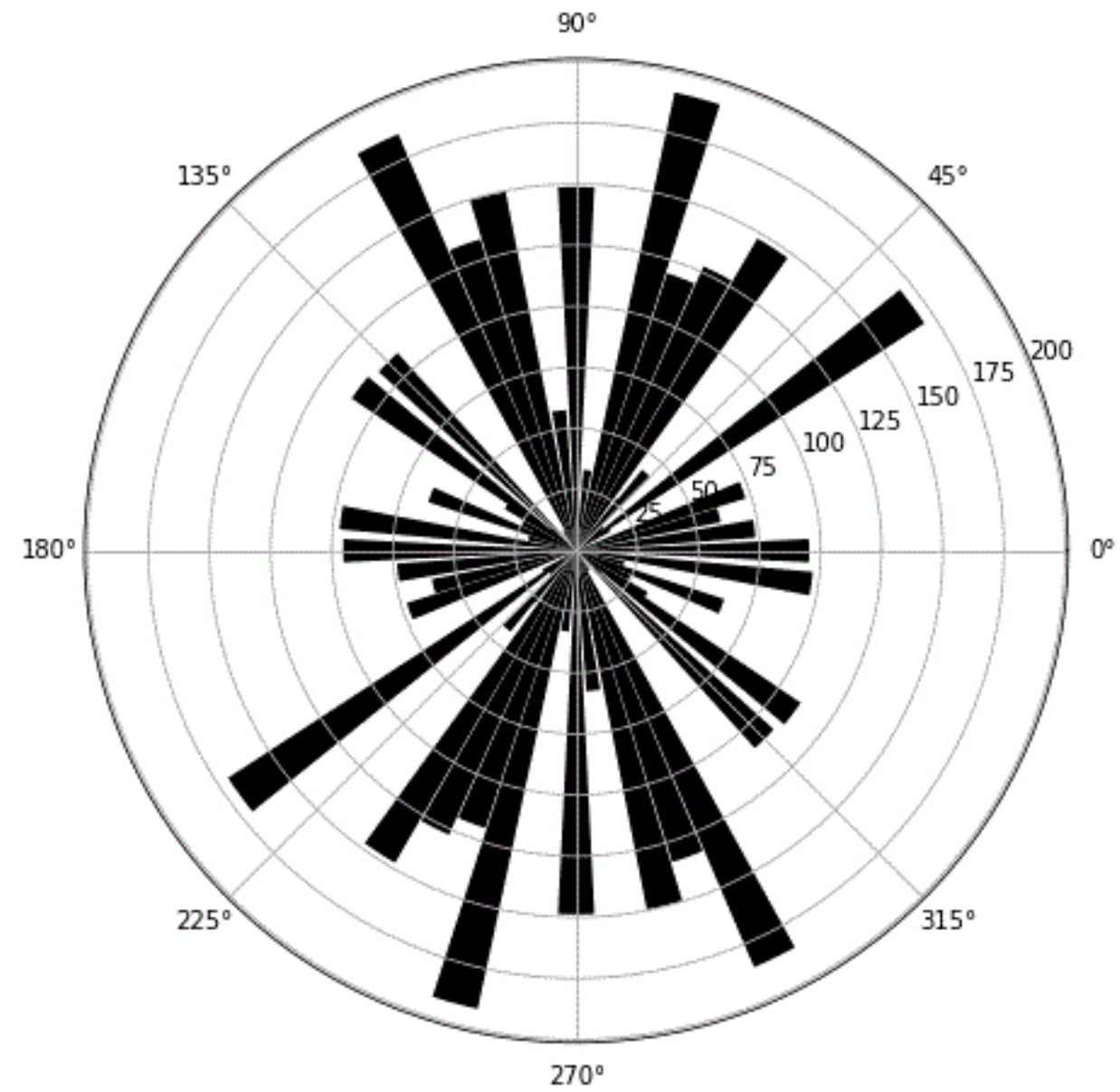
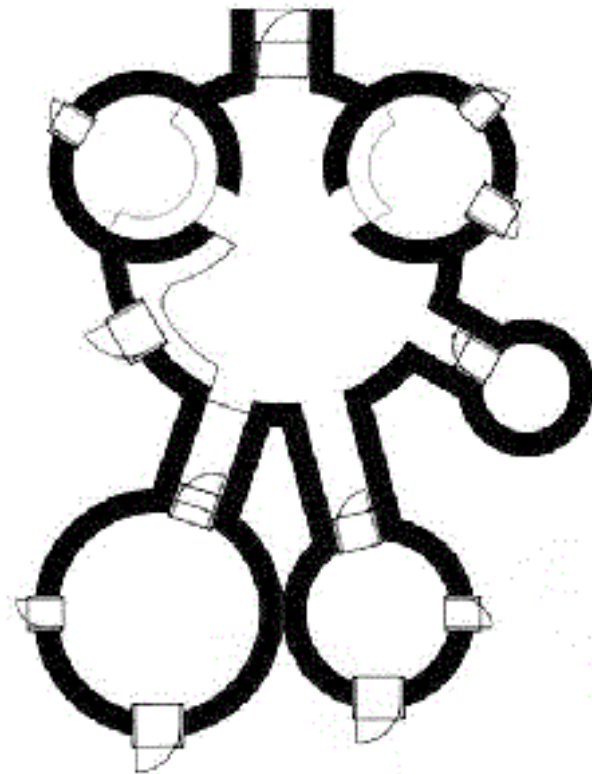
TRAIN IT BY GIVING IT SEVERAL-HUNDRED GOOD FLOOR PLANS



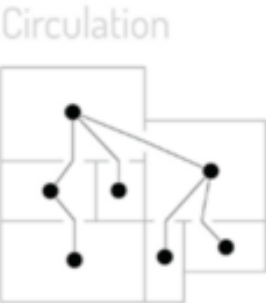
TRAINING DATASET FOR SPACE PROGRAM

Source: [Stanislas Chaillou](https://towardsdatascience.com/ai-architecture-f9d78c6958e0), Harvard Graduate School of Design <https://towardsdatascience.com/ai-architecture-f9d78c6958e0>

TEACH IT ABOUT ORIENTATION



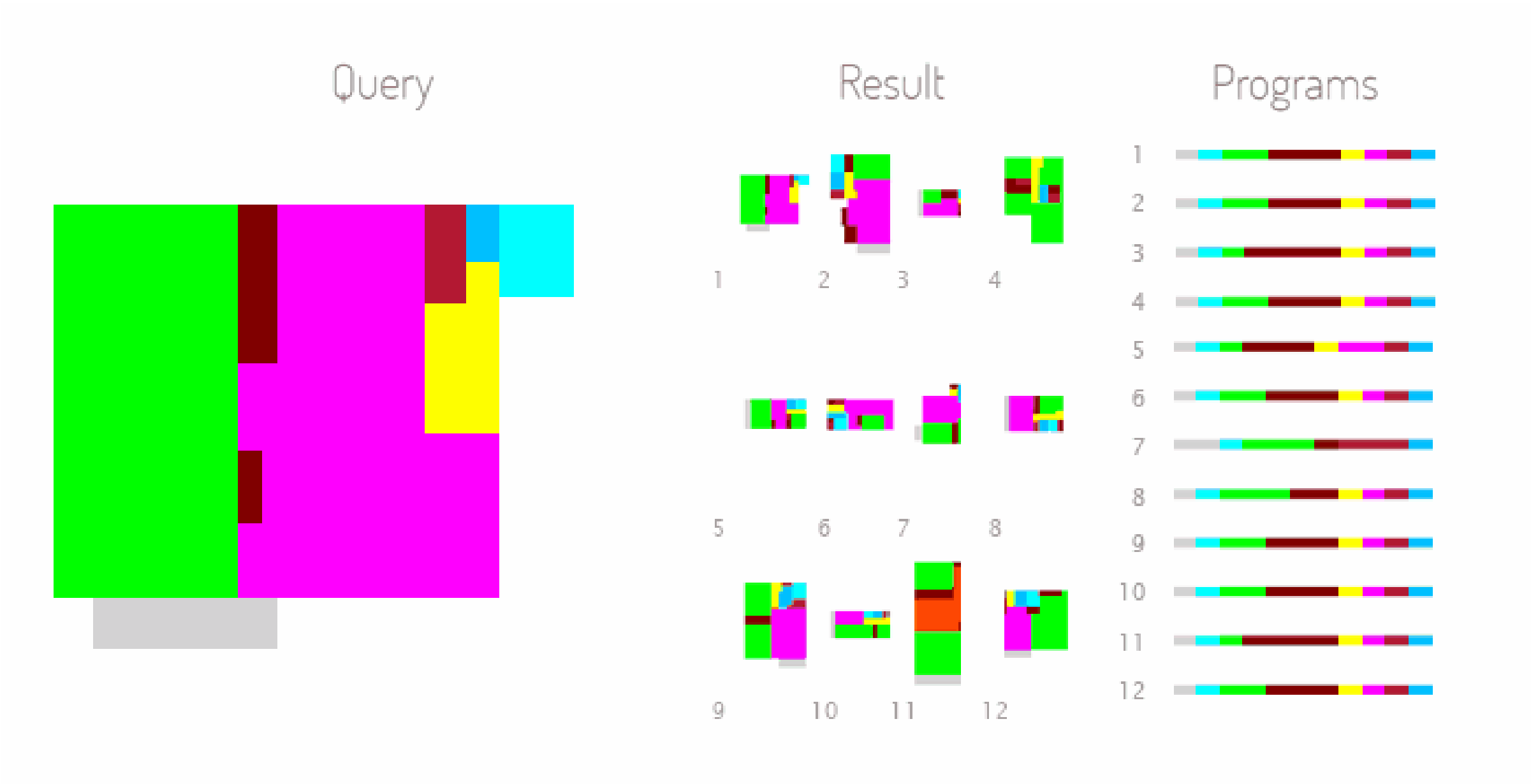
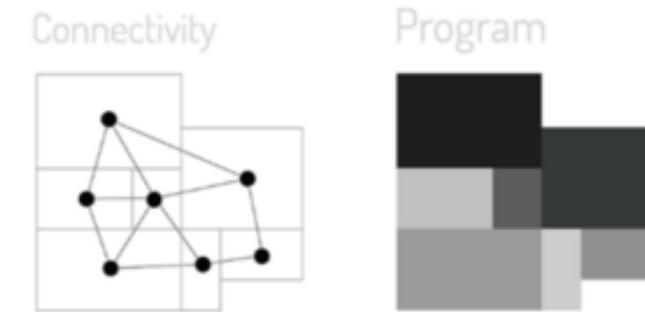
TRAIN IT TO FURNITURE LAYOUTS AND CIRCULATION



Legend 1	Legend 2	Legend 3	Legend 4
<ul style="list-style-type: none">VoidFloorBathtub ToiletSink	<ul style="list-style-type: none">VoidFloorCTop	<ul style="list-style-type: none">VoidFloorCarpetAChairDeskChairStandTable	<ul style="list-style-type: none">VoidFloorBedAChairStandClosetNStand

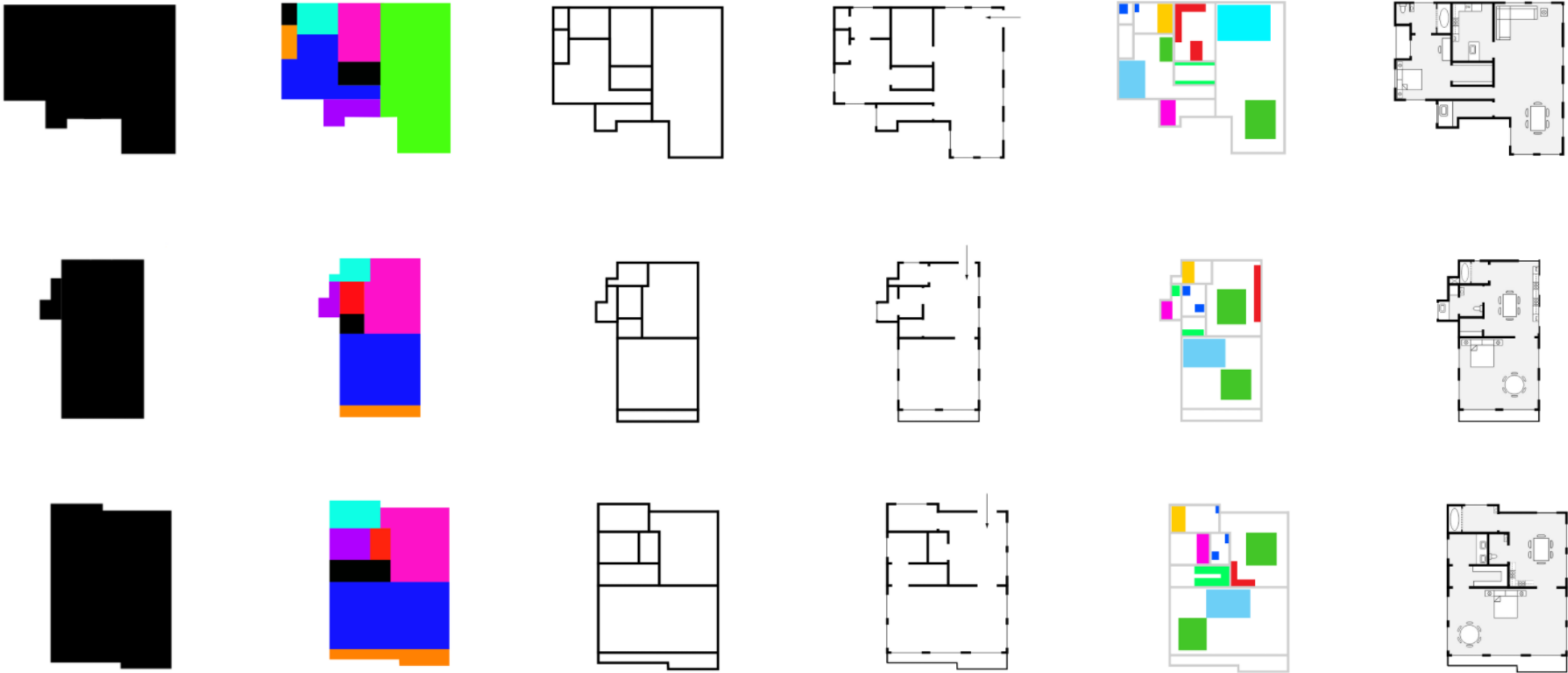
Source: [Stanislas Chaillou](https://towardsdatascience.com/ai-architecture-f9d78c6958e0), Harvard Graduate School of Design <https://towardsdatascience.com/ai-architecture-f9d78c6958e0>

TRAIN IT TO UNDERSTAND CONNECTIVITY AND PROGRAM

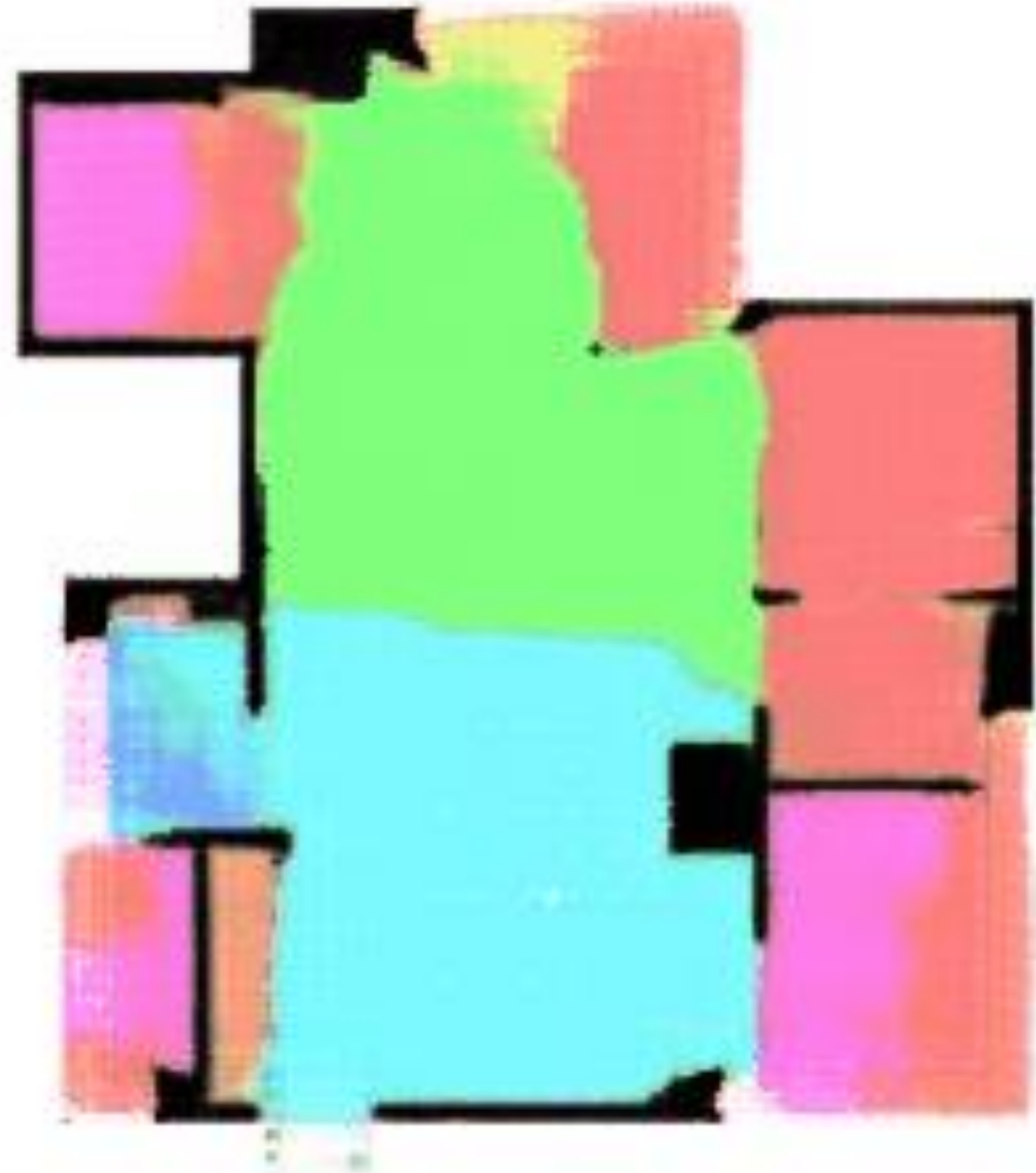


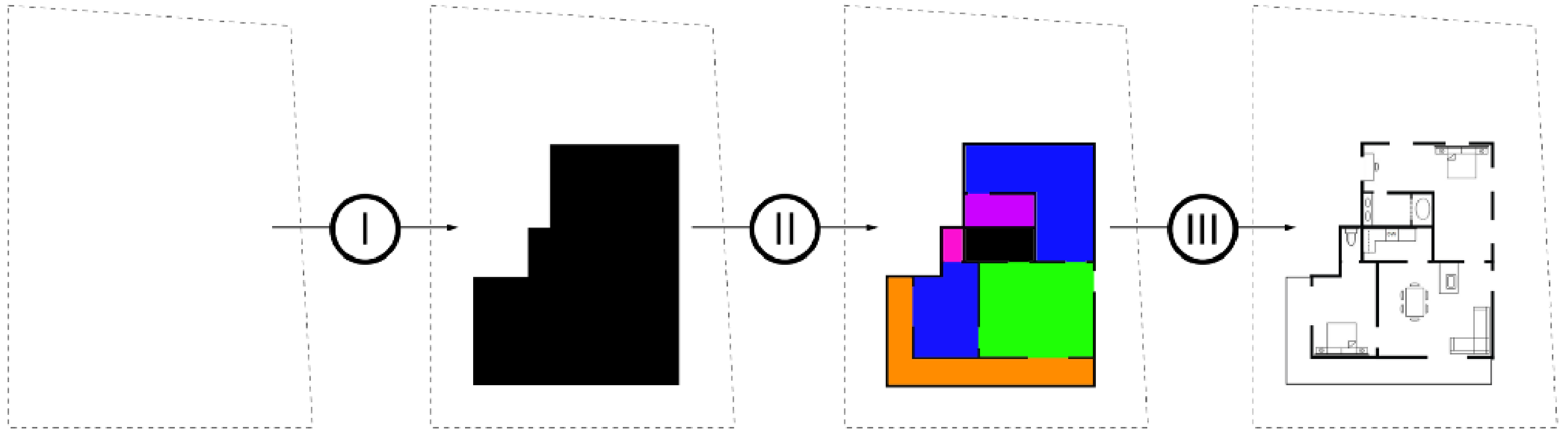
USE COLOURS TO REPRESENT GRAPHICAL ELEMENTS

B. Layout Assistant



GENERATE OPTIONS

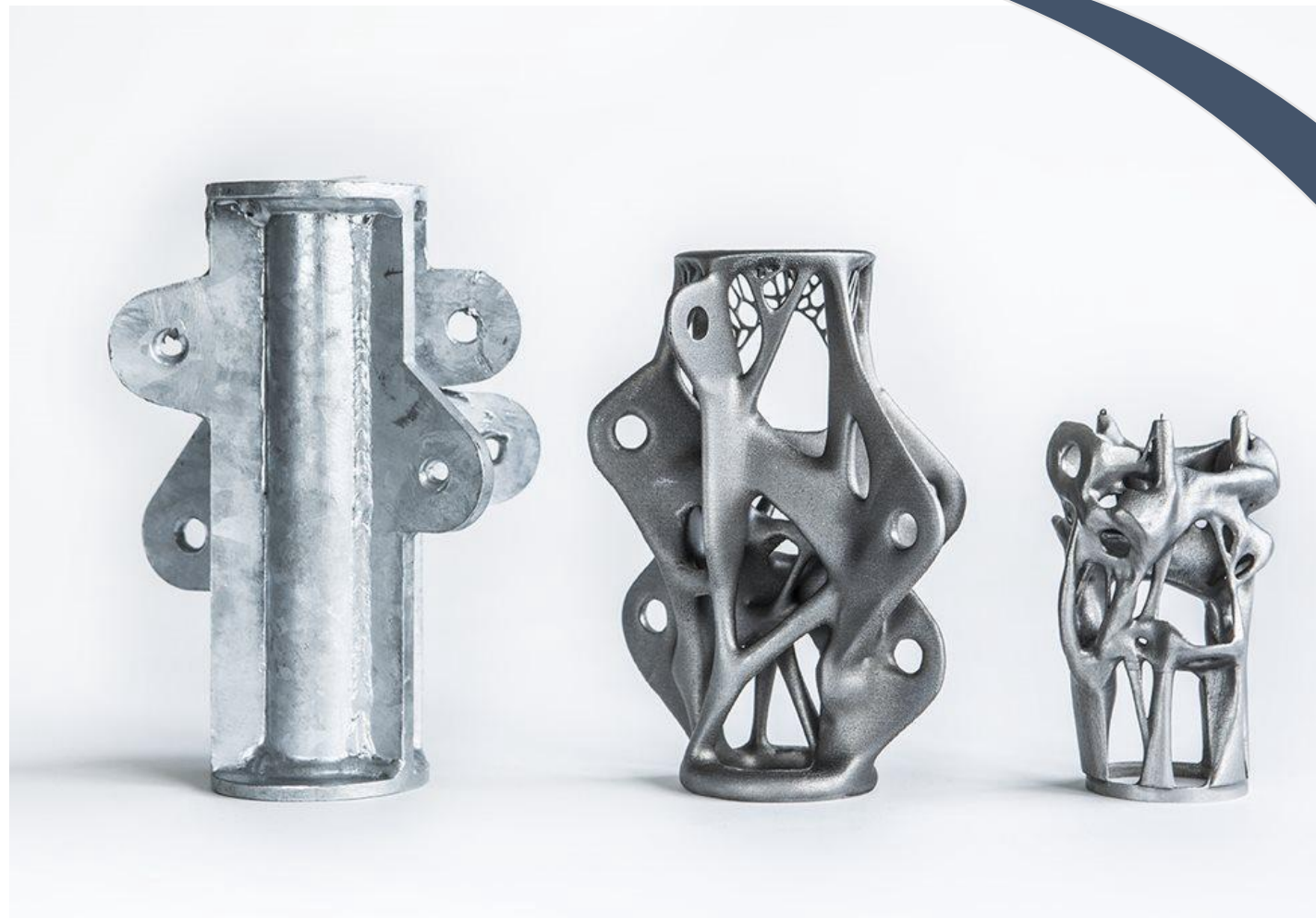




A project by [Stanislas Chaillou](https://towardsdatascience.com/ai-architecture-f9d78c6958e0),
Harvard Graduate School of Design
<https://towardsdatascience.com/ai-architecture-f9d78c6958e0>

TOOLS TO GET YOU STARTED

Define Constraints



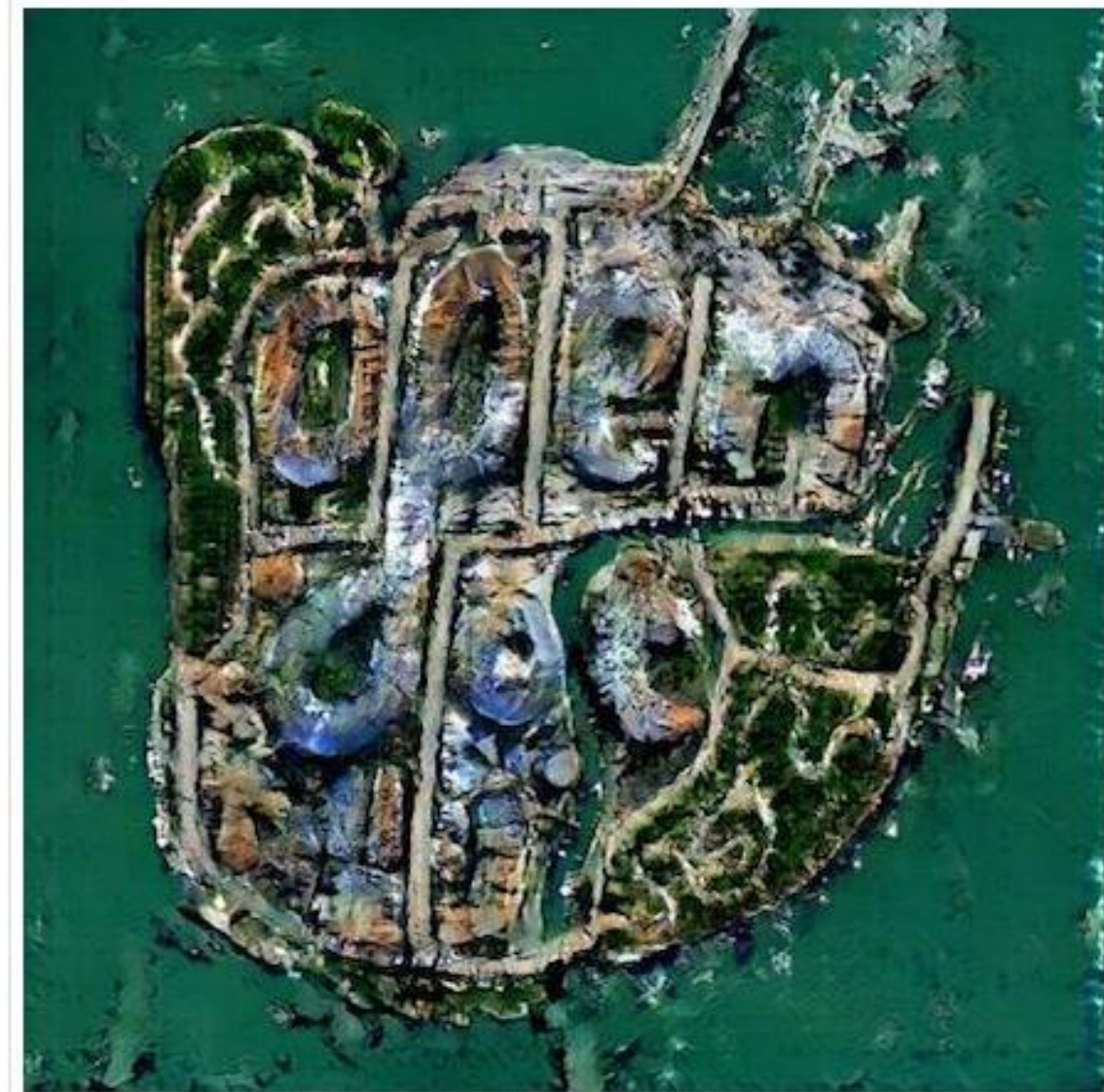
Generate & Evaluate Options

Optimize for best fit

PIX2PIX



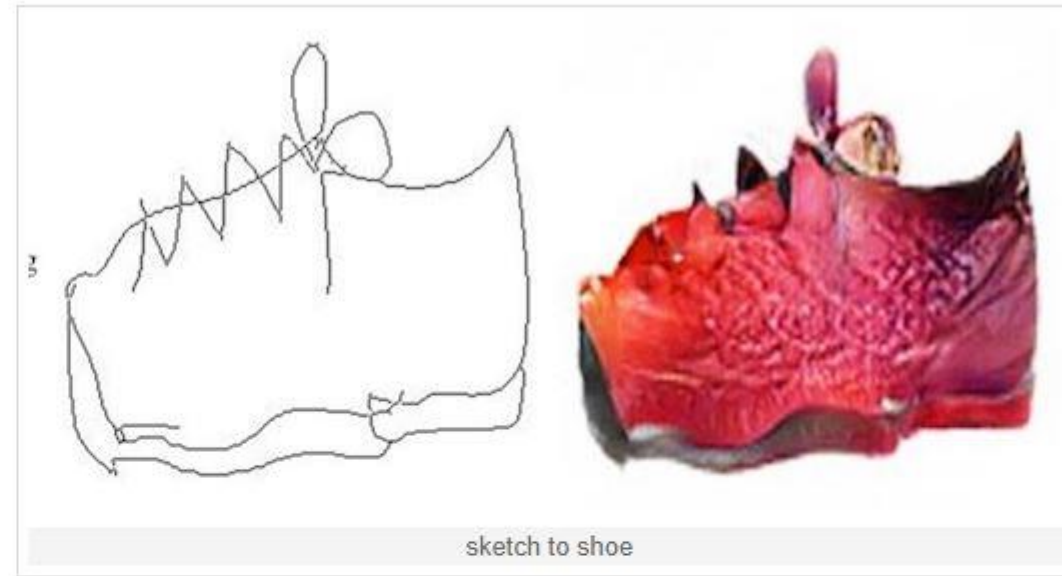
Handdrawn input



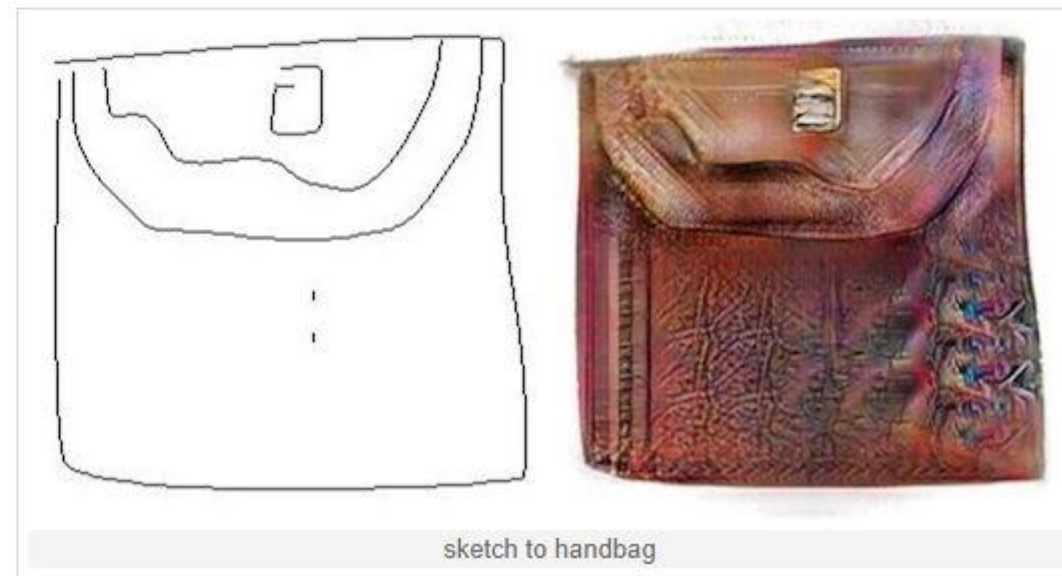
Handdrawn input generating Venice satellite image

PIX2PIX

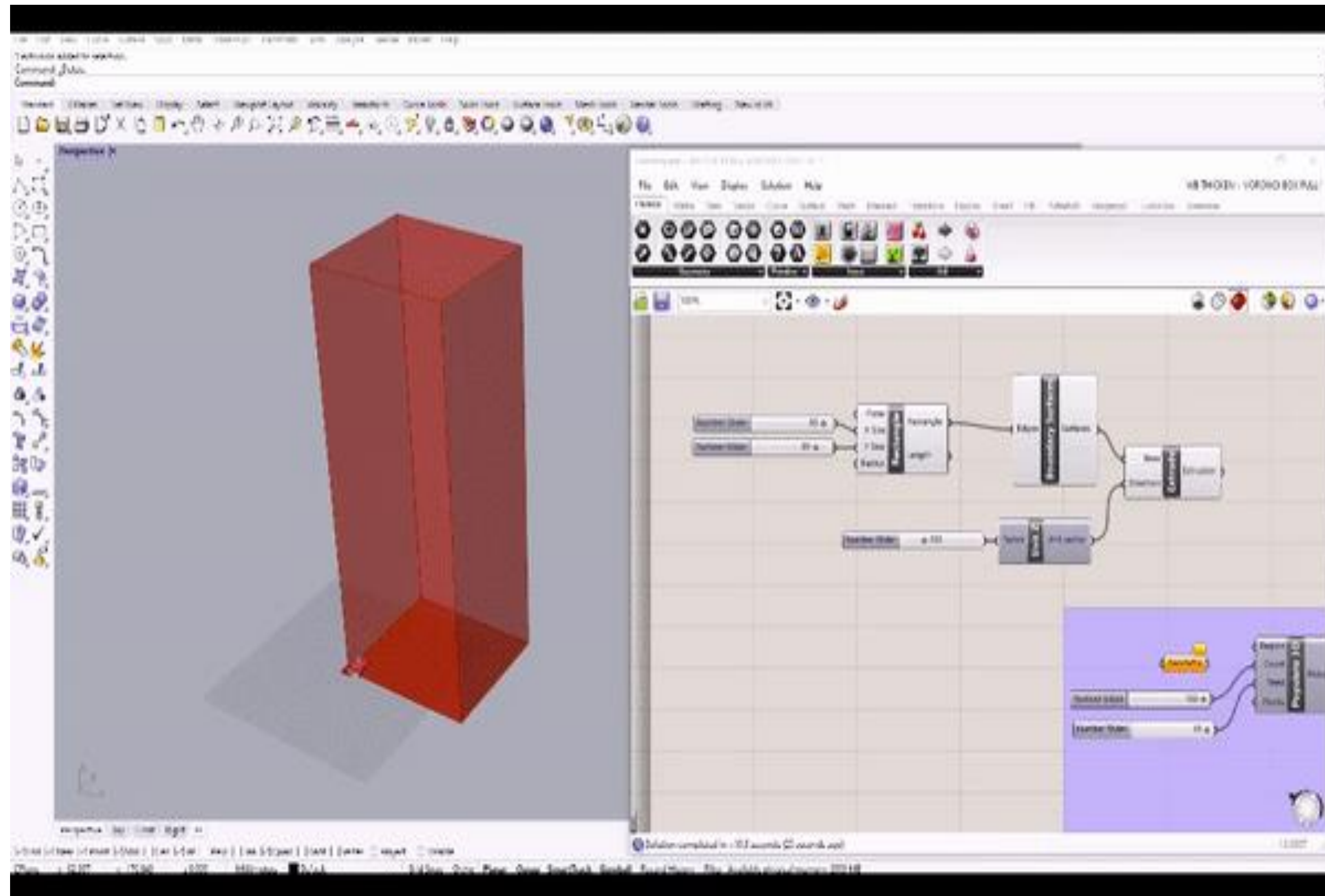
Here are some samples of sketches being turned into shoes.

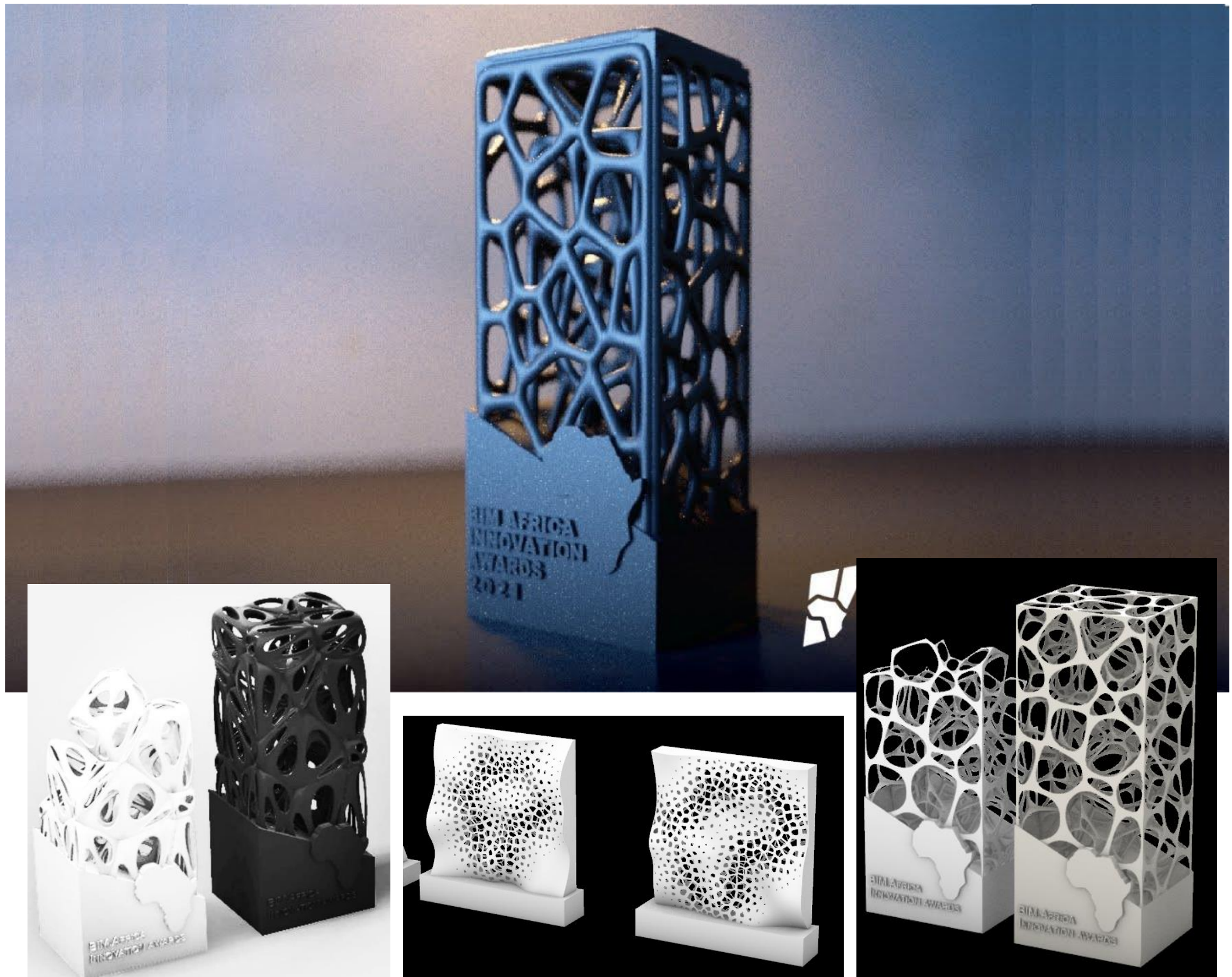


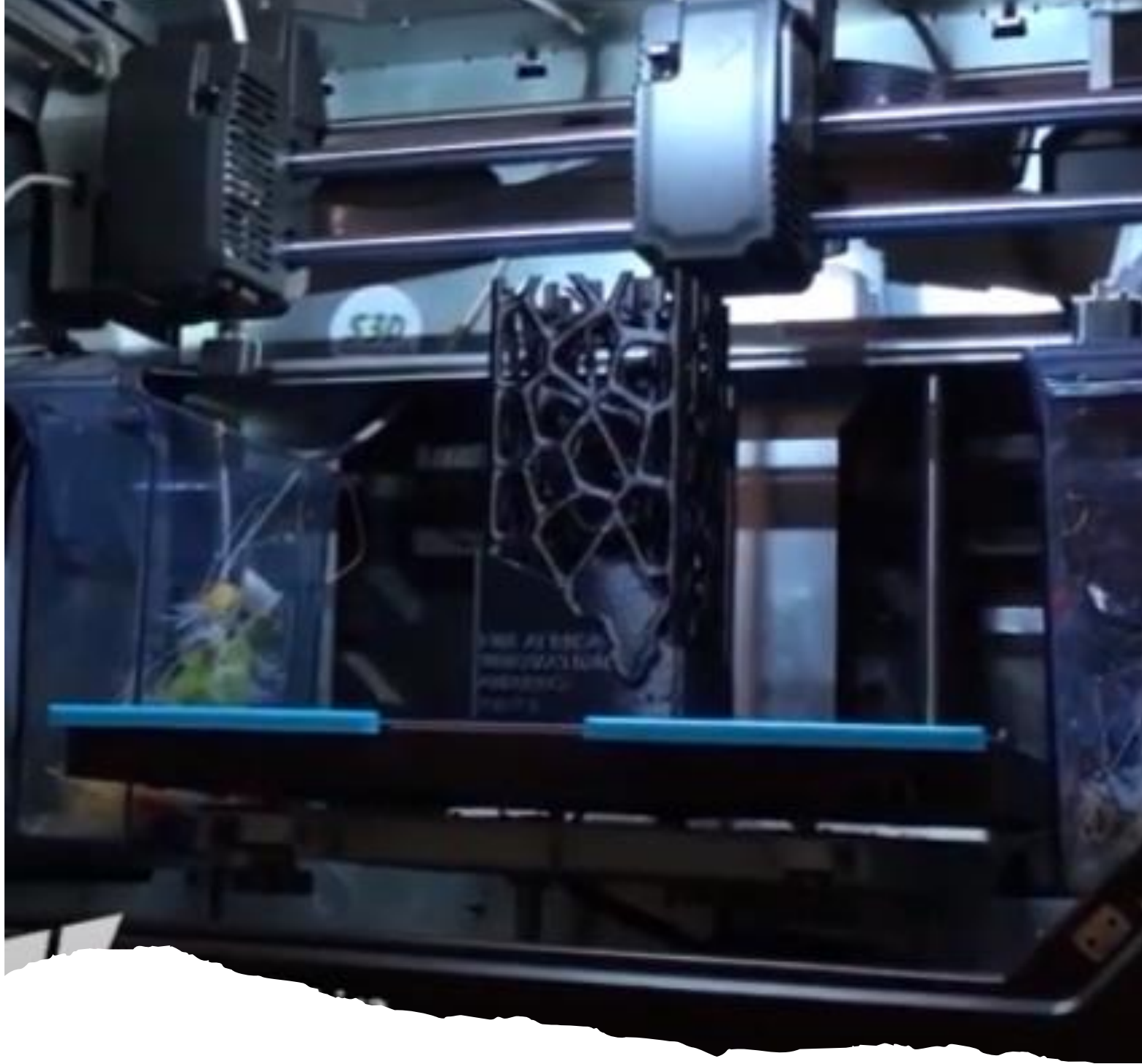
As well as sketches being turned into handbags.



RHINO+GRASSHOPPER

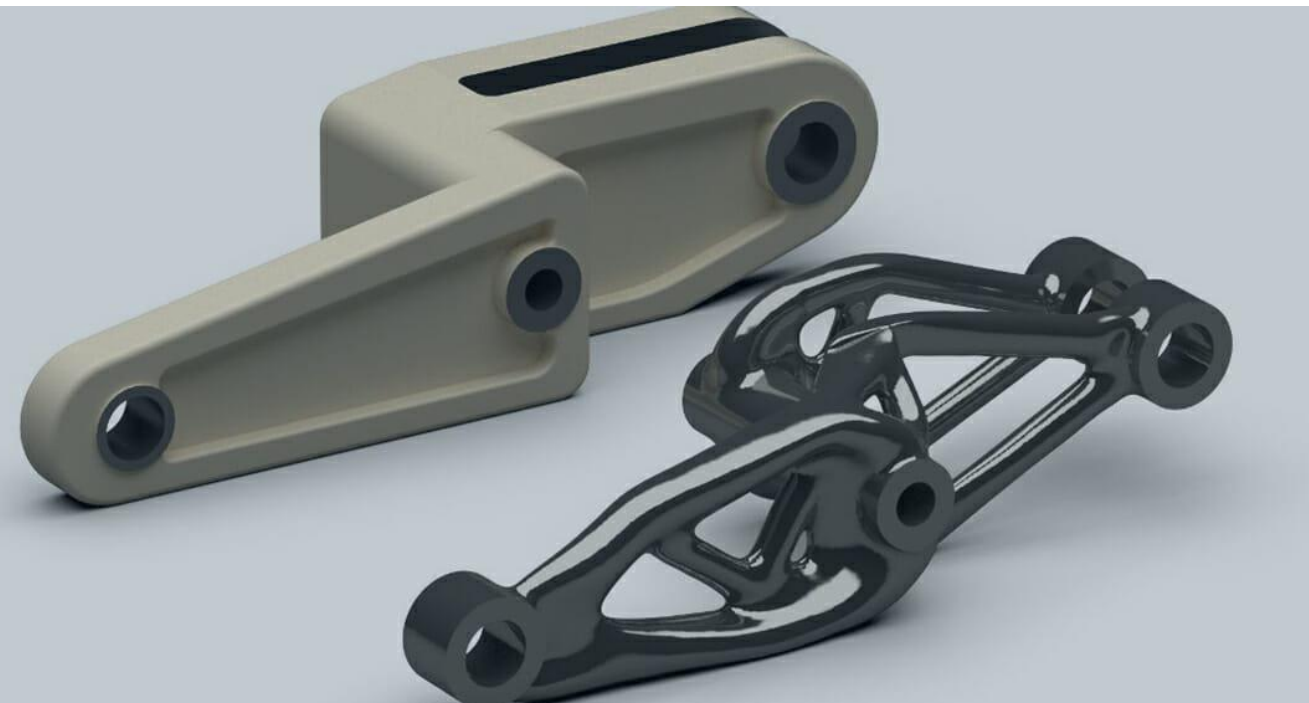
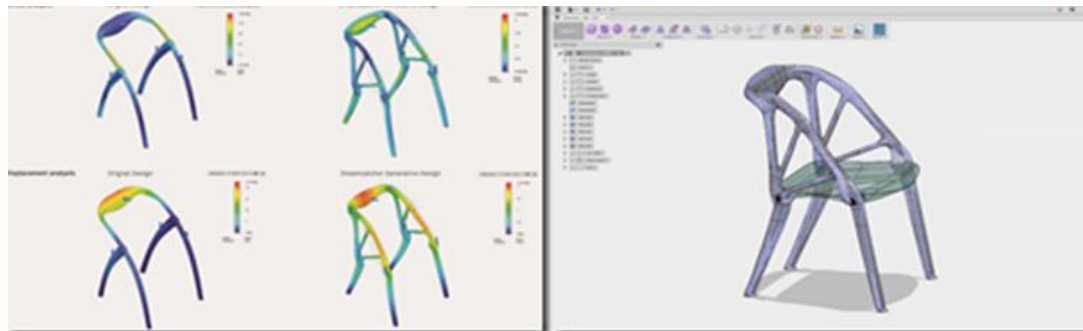






RHINO+GRASSHOPPER+3DSLICER

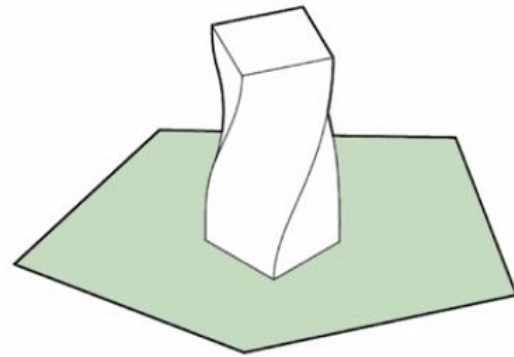
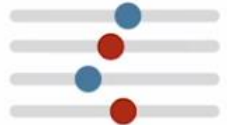
FUSION 360



REVIT GENERATIVE DESIGN

Optimize

2. Constraints



OPTIMIZE:

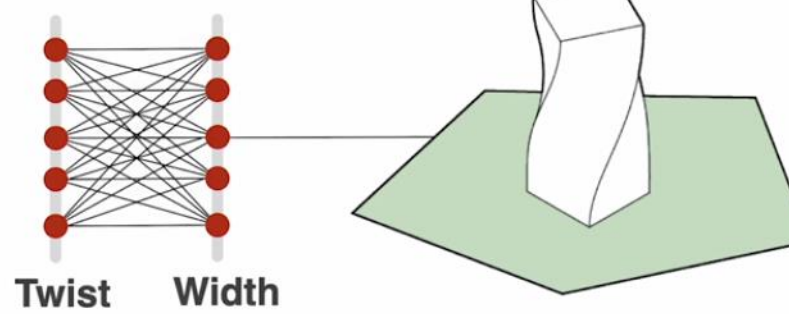
Improve design solutions based on the specified criteria

Set variables and objectives, generate options that give scenarios based on variables

Goals are well defined

Cross Product

1. Constrained variables

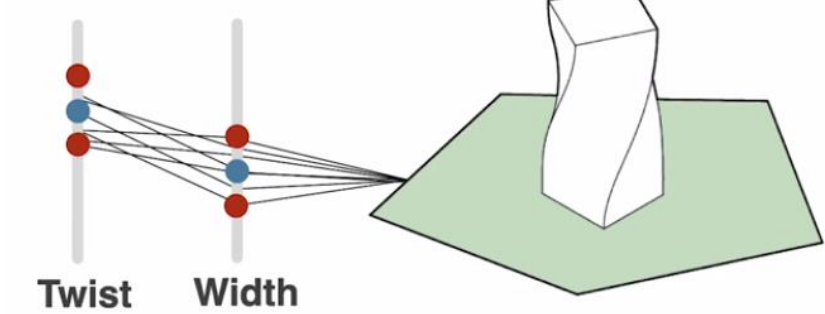


CROSS PRODUCT:

Generates every solution possible within the bounds of the criteria we have set.

Like This

1. Variables



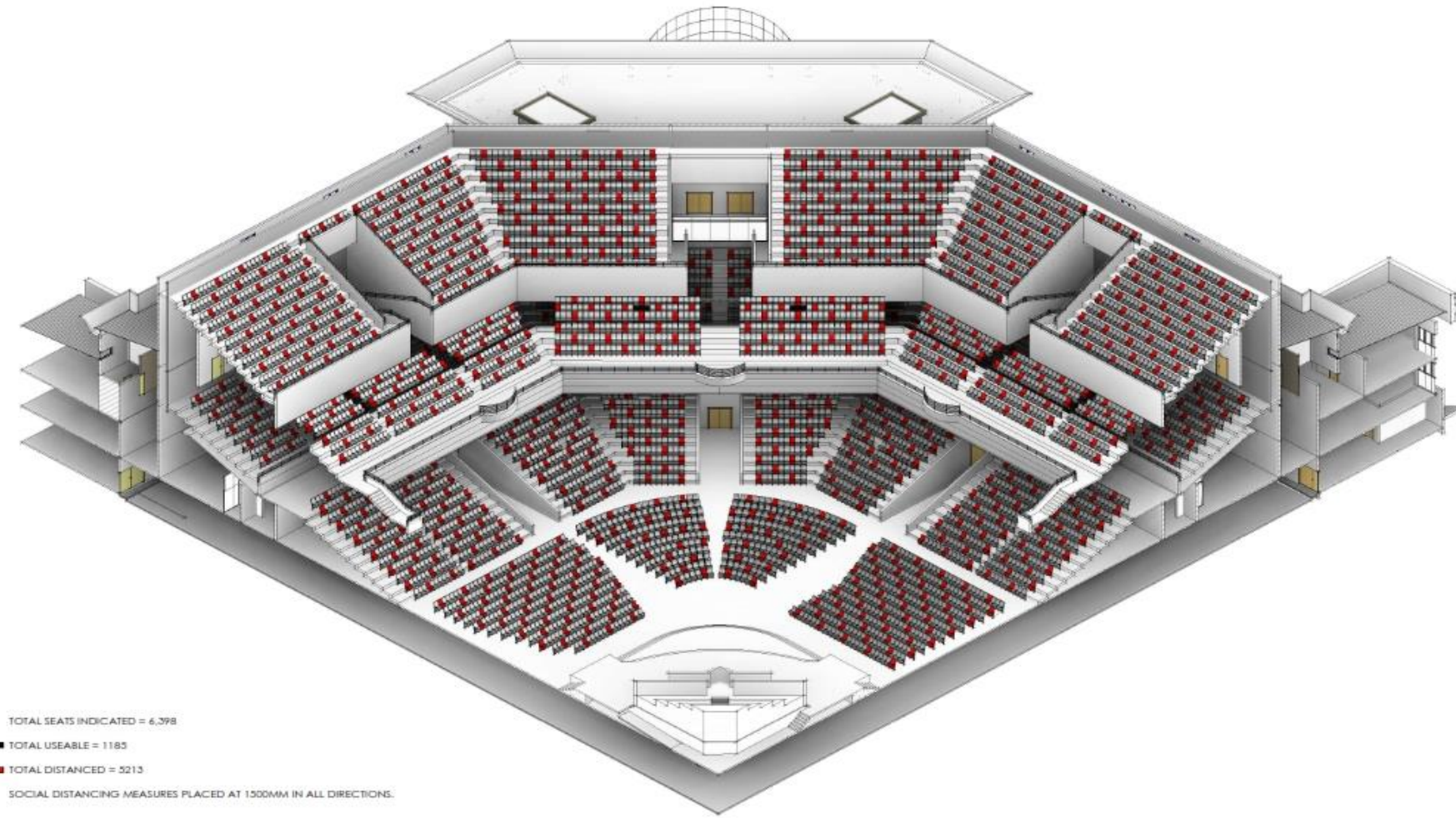
RANDOMIZE:

- Set constraints and variables with no specific goals and get random solutions
- Useful when a goal is undefined

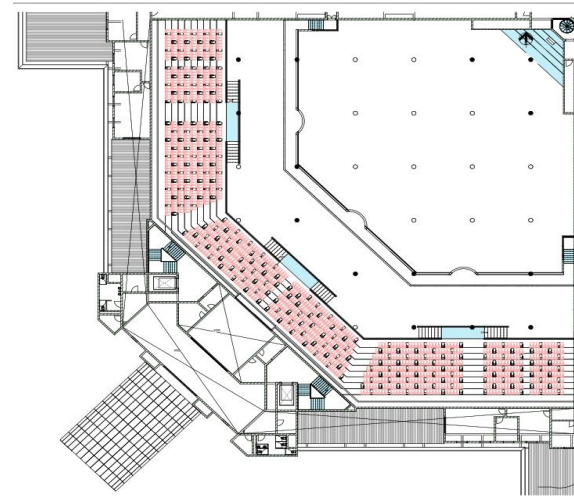
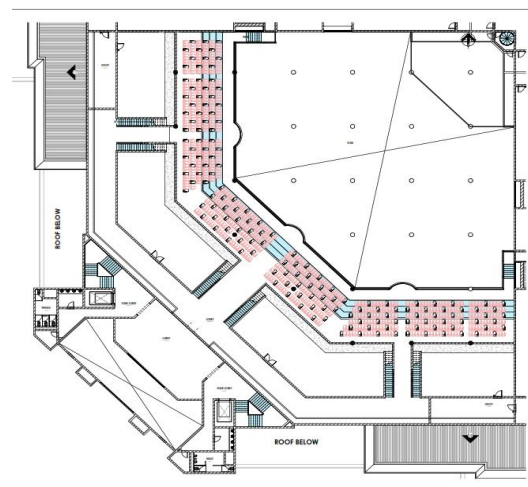
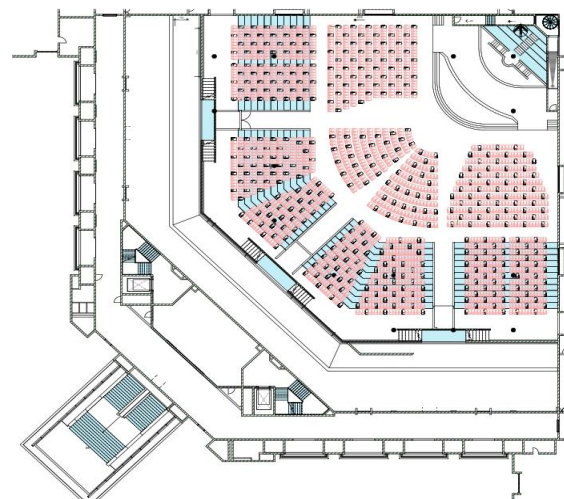
LIKE THIS:

- Used to finetune a solution that is close to being conclusive.

REVIT + DYNAMO



TOTAL SEATS INDICATED = 6,298
TOTAL USEABLE = 1185
TOTAL DISTANCED = 5213
SOCIAL DISTANCING MEASURES PLACED AT 1500MM IN ALL DIRECTIONS.



COVID-19 PHYSICAL DISTANCING CALCULATIONS



So,

Machines are joining the
workforce,

What is our creative response?

