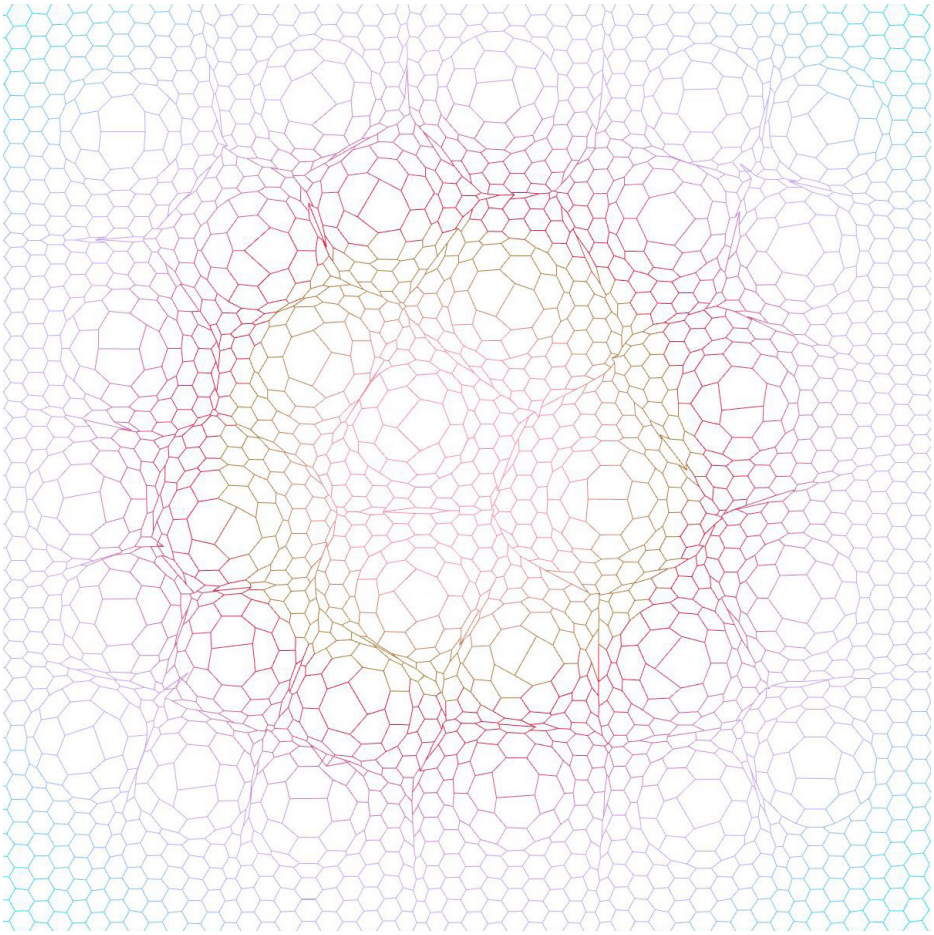
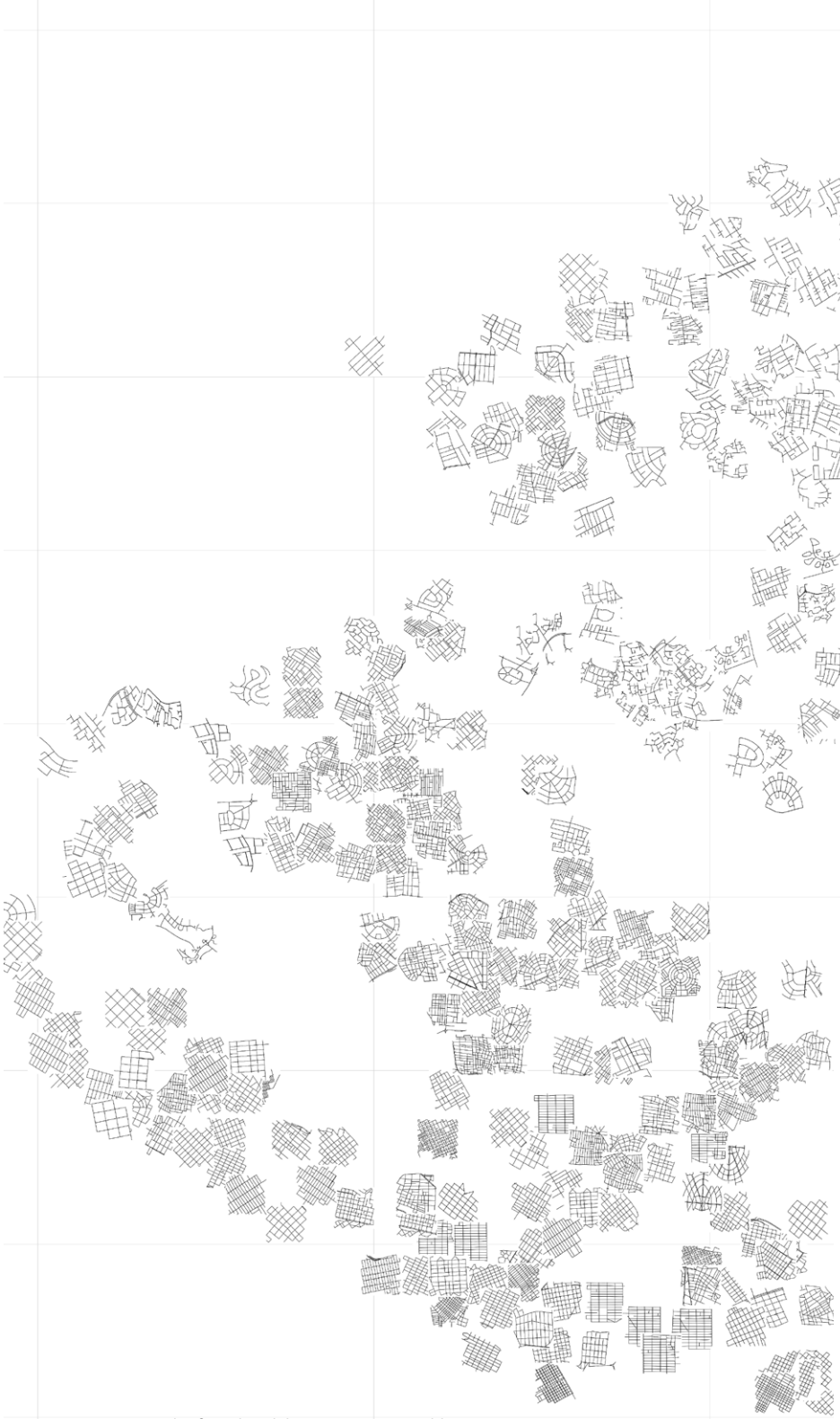


Erida Bendo
PORTFOLIO

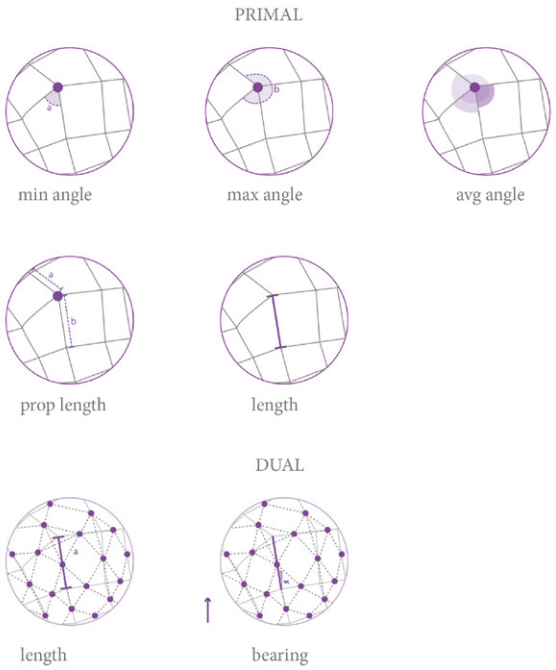
CONTENT

1. ANALYZING STREET NETWORKS THROUGH GRAPH MACHINE LEARNING

a project of IAAC, Institute for Advanced Architecture of Catalonia developed at Masters in Advanced Computation for Architecture and Design (MaCAD) in 2021/2022
by student: Erida Bendo and faculty: David Andres Leon



tsne visual of embeddings generated by UGRAPHEMB

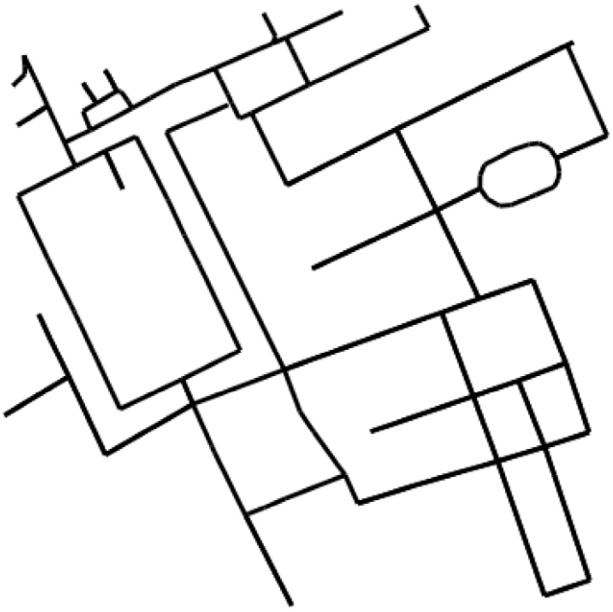


2 ways of encoding street networks

Urban road networks are reflections of several environmental, social, and economic factors evolving with different speeds at different times. Sometimes these factors are linearly related and traceable, in other cases street patterns remain formal manifestations.

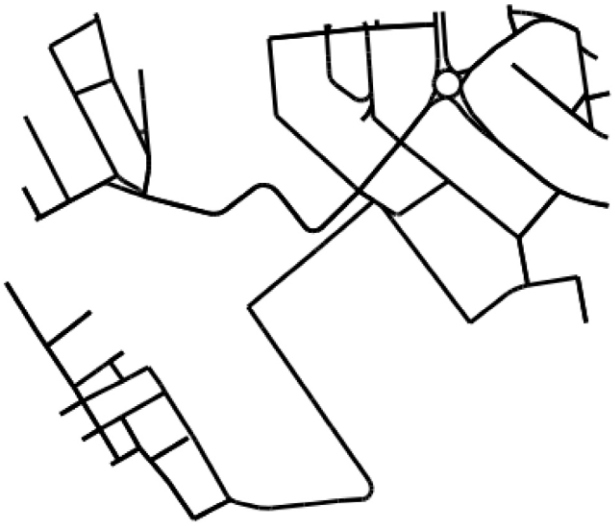
This study represents an attempt of analyzing the geometric properties of street networks, through graph machine learning. Through unsupervised and supervised models, two ways of encoding them are tested: representing streets as graphs with the primal and dual approach. It concludes with some advantages and disadvantages of each encoding method and further opens a discussion on the prospects of using graph machine learning methods when analyzing or generating street patterns.

0 Gridiron
1 Fragmented Parallel
2 Warped Parallel
3 Loops and Lollipops
4 Lollipops on a stick



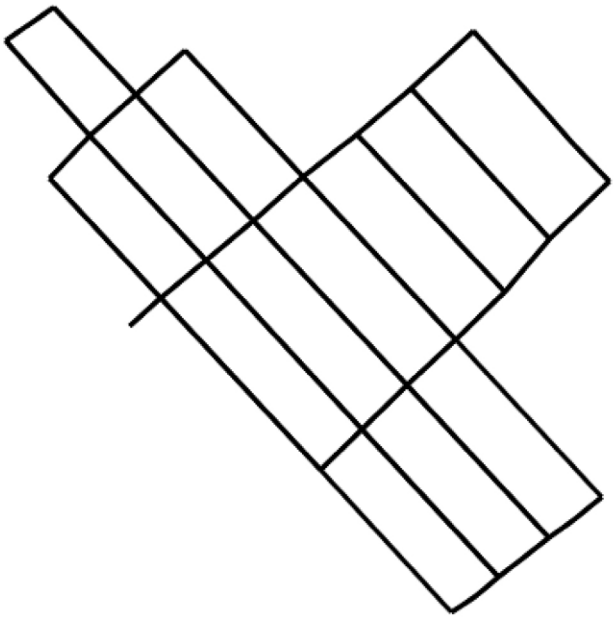
0 1 2 3 4

0.39 0.27 0 0.13 0.21



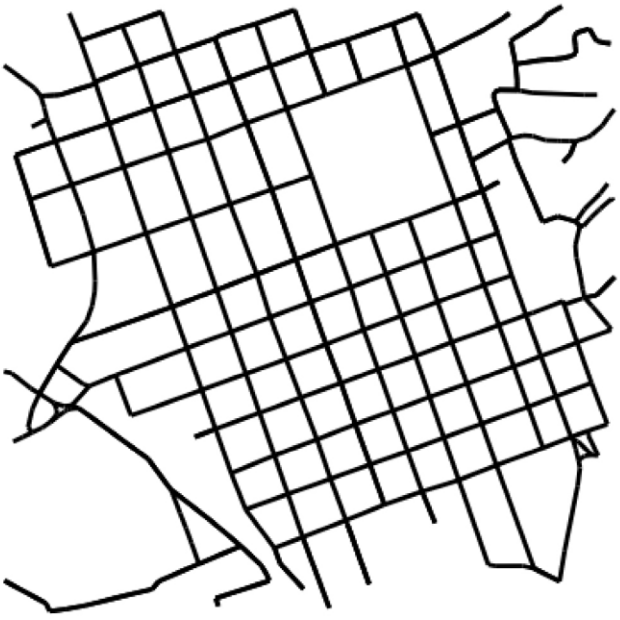
0 1 2 3 4

0.16 0.41 0 0.13 0.30



0 1 2 3 4

0.54 0.22 0 0.24 0



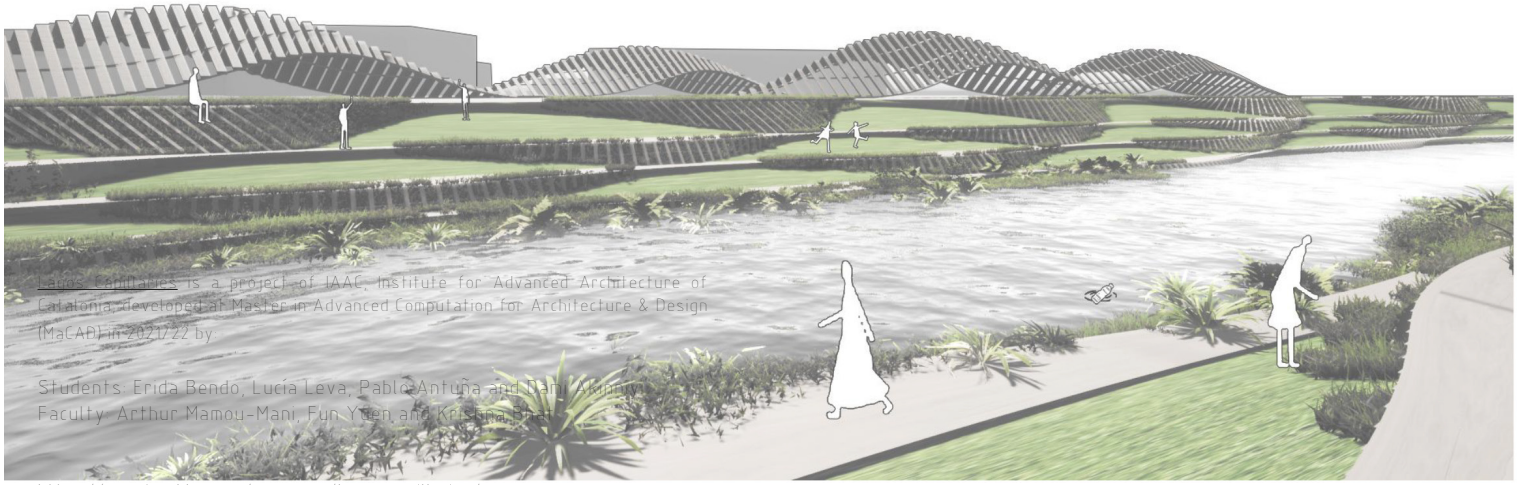
0 1 2 3 4

0.32 0.25 0 0.17 0.26

Through the DGCNN architecture a successful tipology classifier was built, classifying the street networks in either: gridiron, fragmented parallel, warped parallel, loops and lollipops or lollipops on a stick.

This suggests that the chosen features are relevant and can be used into generating street networks, a natural step of this study.

more info: https://www.iaacblog.com/programs/analyzing-street-networks-through-graph-machine-learning/
code: https://github.com/Eridaa/3.GraphML--Analyzing-street-networks-through-graph-machine-learning



https://www.iaacblog.com/programs/lagos-capillaries/

visual scripting in grasshopper
+evolutionary algorithms

2.LAGOS CAPILLARIES

naturalisation of the concrete drainage canals of Lagos.

×responsible for the design of the embankments and pavillions.

Waste collection & water purification

Environment rewilding

Strengthen community

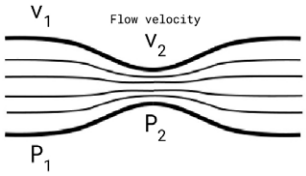
Lagos Capillaries is a project exploring the naturalisation of the concrete drainage canals of Lagos, Nigeria, within the framework of rewilding while creating spaces for community integration and productive urban landscapes for farming.

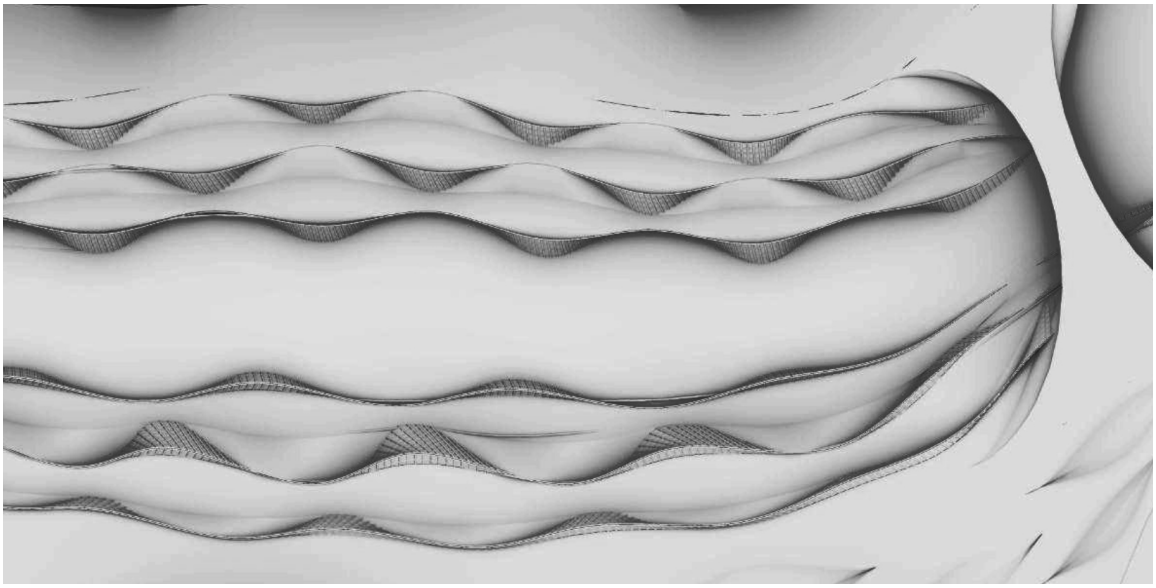
The first step towards terraforming the canal landscape consisted in optimising the canal geometry for rewilding and for ensuring community integration goals. We sought to redefine the upper and lower boundaries, and established connections in areas where the canal disconnects communities.

For the upper boundary, the setbacks and land area of the canal were maximised while minimising its length. With these goals, the canal geometry was optimised through an evolutionary solver.

Bernoulli's principles are referenced for establishing the lower boundary.

The narrower areas will have higher water velocities and will be water aeration zones and the wider areas will have slower water velocity and lamina flow which will get oxygenated water good for supporting flora and fauna. These narrower areas were planned under the bridges and wider areas in between bridges.

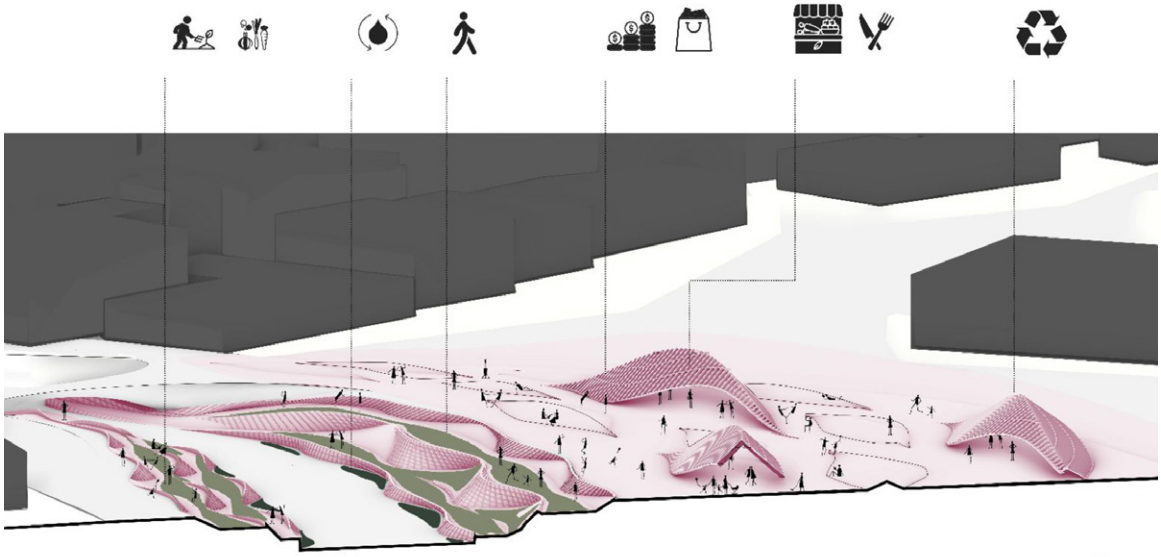


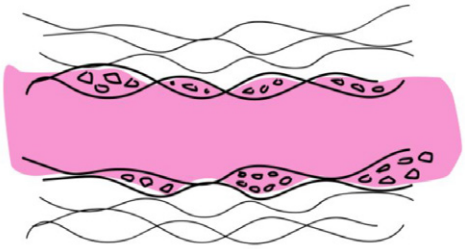


Three key points establish our approach to the canal bed area. Our intervention seeks to structurally reinforce the river banks, allowing spaces for bioremediation and urban farming.

We are inspired by braided river patterns, as a terra forming strategy, organically dividing spaces of different use.

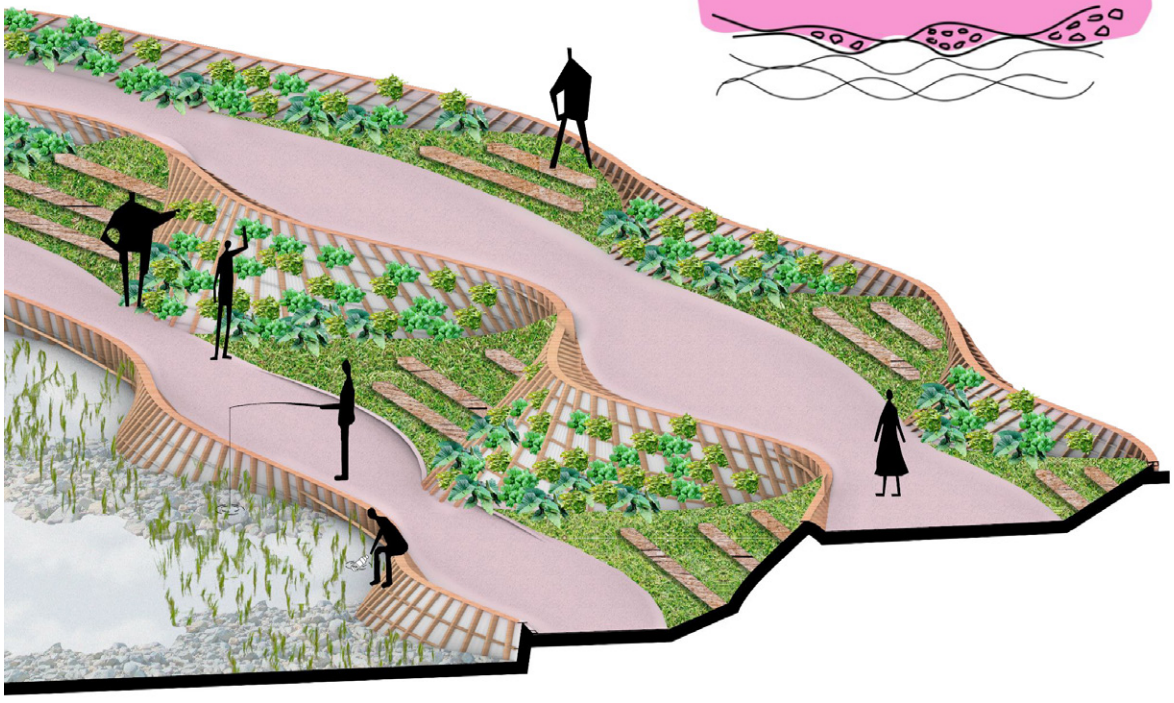
Starting from weaved curves a script is further refined into producing curved embankments. A variation which allows appropriate average surface for farming crops and that blends to the scale of the site is selected.





These woven curves, embedded below water level, are a final lattice module for a natural waste filter system. Here, rock boulders are arranged on a gravel bed within this unseen lattice such that waste gets trapped in the spaces between the rocks.

The riverbank becomes a new wetland ecosystem with plant and animal species native to Lagos. It will function as nature's kidneys by removing pollutants from the water. In addition, active bioremediation strategies included bio-attenuation by introducing bacteria and nutrients to mineralise organic pollutants.



"Dream Blankets is a project of IAAC, Institute for Advanced Architecture of Catalonia developed at Masters in Advanced Computation for Architecture and Design (MaCAD) in 2021/2022 by:

students: Dami Akinniyi and Erida Bendo

faculty: Rodrigo Aguirre and Hesham Shawqy (Assistant Faculty)

https://www.iaacblog.com/programs/dream-blankets/

3.DREAM BLANKETS

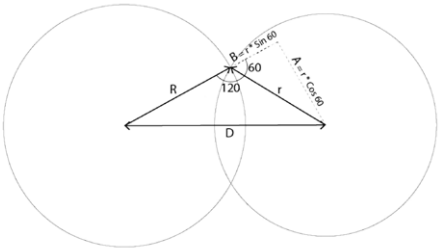
visual scripting in grasshopper
+evolutionary algorithms

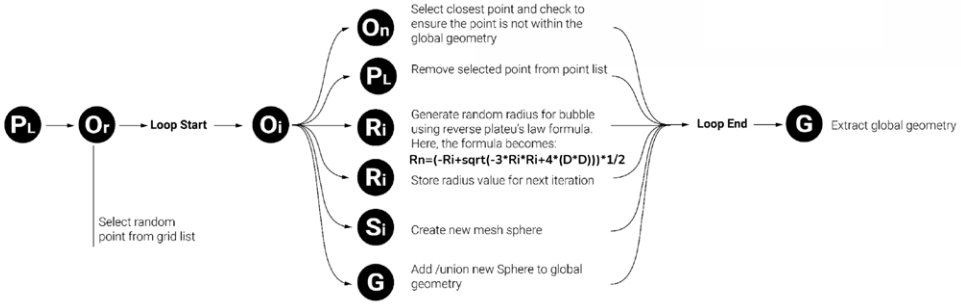
×responsible for the bubble research and optimization processes

01 Natural Systems & Computational Strategies Research

Bubble cluster formation workflow

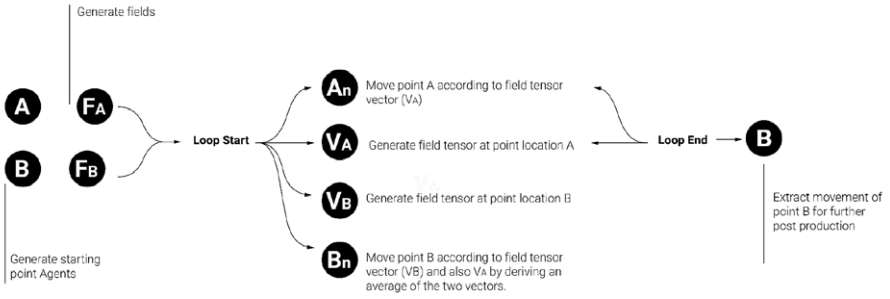
based on the geometric constraints of Plateau's laws for stable bubble clusters





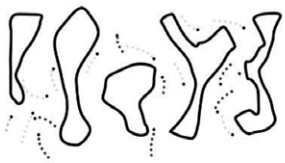
Self organising system workflow

our Reaction-Diffusion interpretation

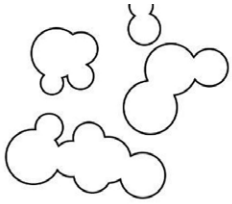


This workflow, employs a direct interpretation of the activator-inhibitor system with two sets of agents moving within different vector fields.

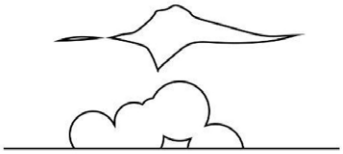
02 Design development



01 Generation of maze



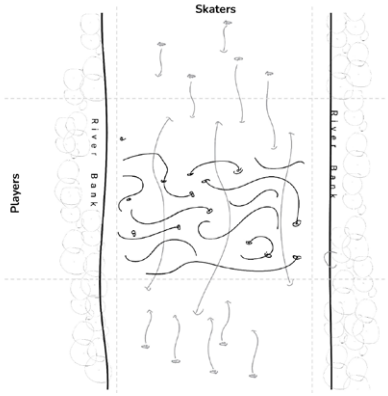
02 Bubble clusters



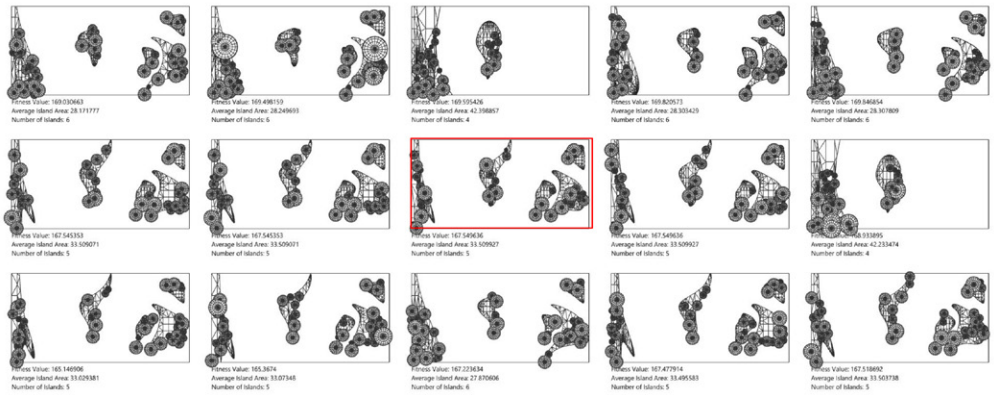
03 Draping through Kangaroo

We will be exploring strategies for form-finding and optimisation of 'warming-hut' pavilions located along the frozen Red River in Winnipeg, Manitoba.

We propose to construct a pavilion which would act as a 'warming hut'. a structure where visitors and passersby can rest and take shelter from icy winds, while playing and skating through in the long winter months of Northern American continent.



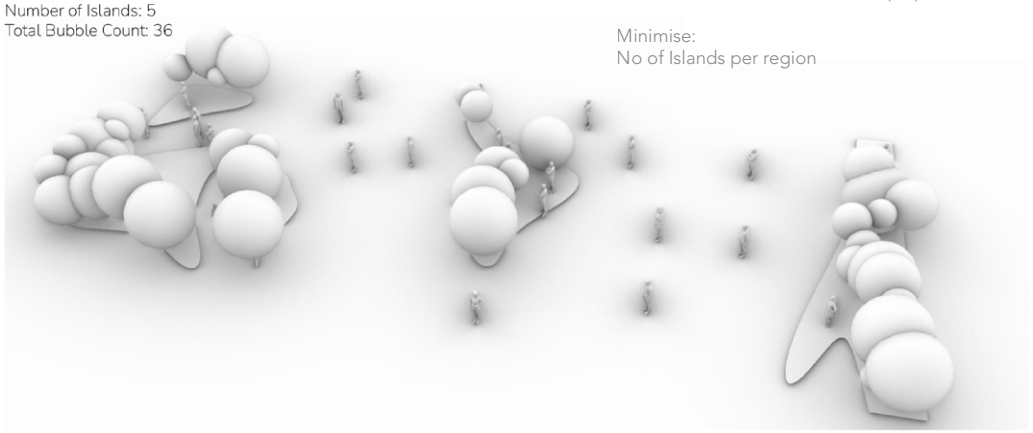
To generate the cluster islands for bubbles, we adopted our interpretation of self organising systems where agents A are seen as players and agents B skaters.

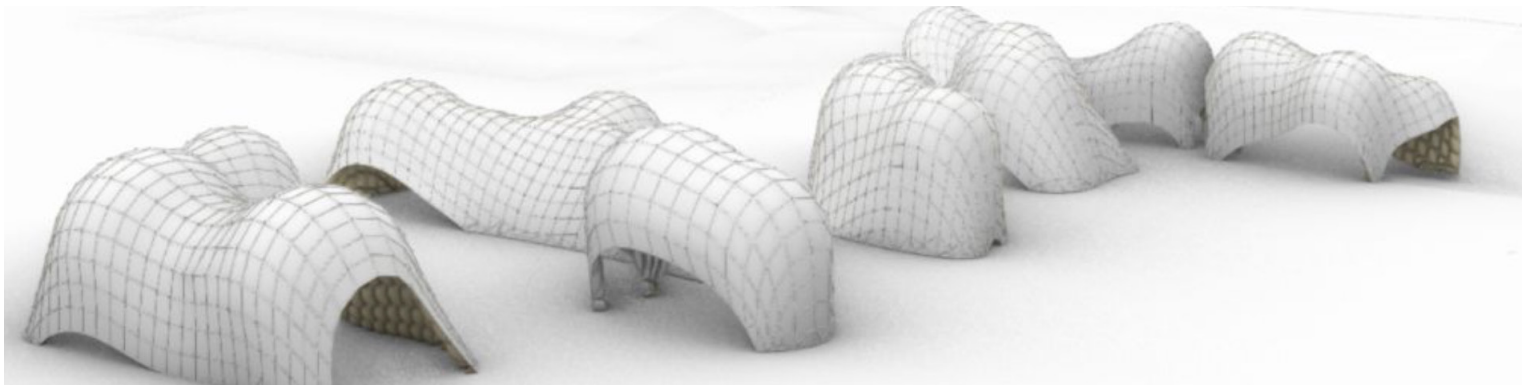


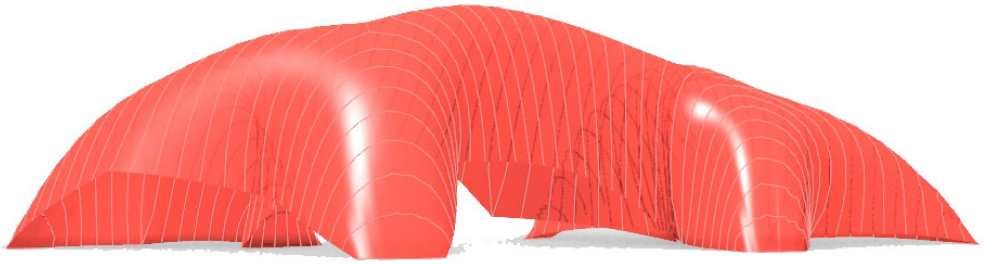
Fitness Value: 167.549636
Average Island Area: 33.509927
Number of Islands: 5
Total Bubble Count: 36

Maximise:
Island areas: 20% of chosen site (170 sqm)
Bubbles/Circle Ground area: 2 sqm/person

Minimise:
No of Islands per region





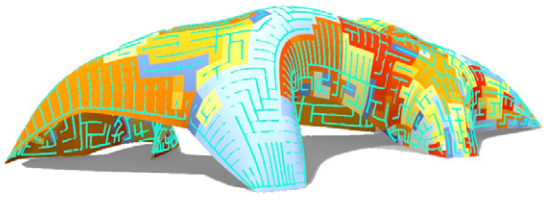


python- hops- GH workflow+
visual scripting in grasshopper

3 MESH OPTIMIZATION EXPERIMENTS

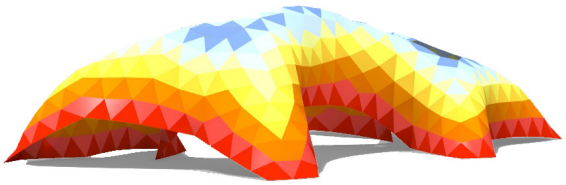
quadmesh shortest path algorithm 189 strips(1-82 pc)

Experimentations with the topology of mesh geometries with the purpose of fabrication, leveraging the graph theory algorythms in networkx and other ML python libraries such as scikitlearn.



minimum spanning trees 260 strips(1-100pc)

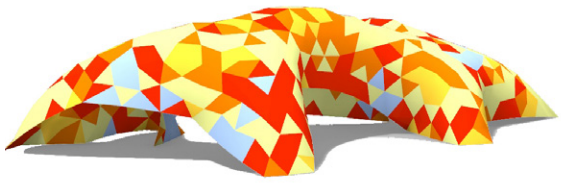
normal topology 10 strips(too long)



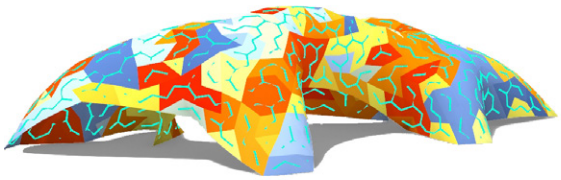
trimesh

normal topology

12 strips(too long)

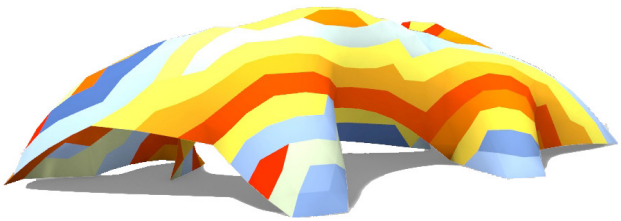


kmeans clustering



minimum spanning trees

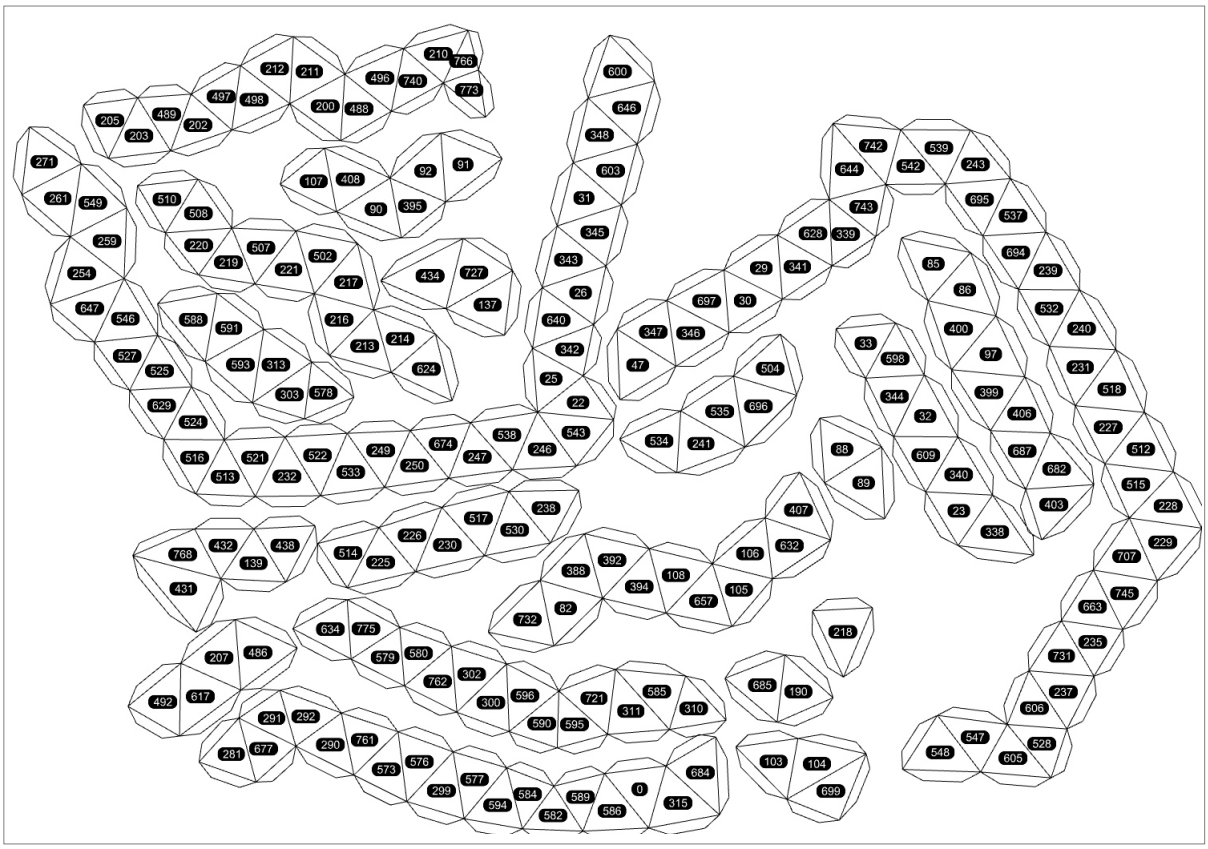
175 strips(1-39 pc)



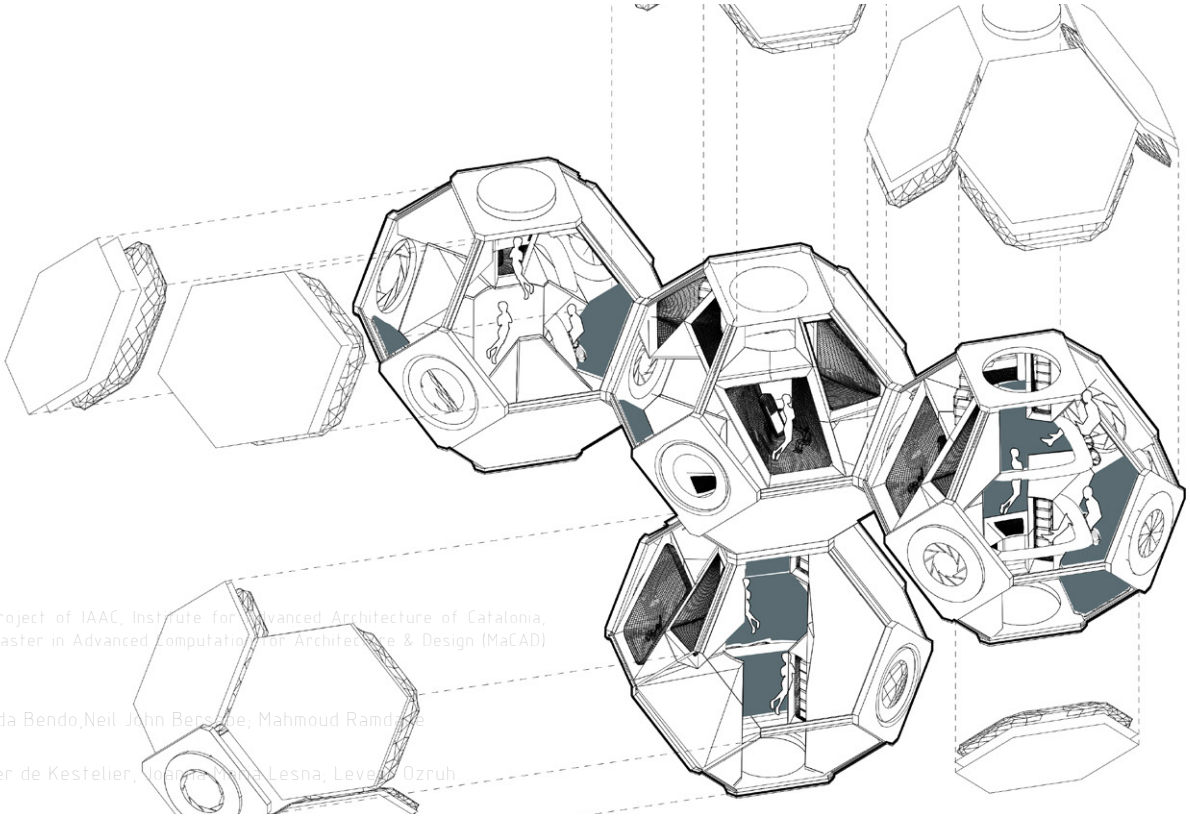
shortest paths algorithm

45 strips(1-63 pc)

Out of the analysis the triangular mesh is chosen, due to the planarity of the panels. The shortest path algorithm provides the most efficient way of fabricating with only 45 strips.



20 out of 45 strips
1-63 edgefaces



Life.Orb is a project of IAAC, Institute for Advanced Architecture of Catalonia, developed at Master in Advanced Computation for Architecture & Design (MaCAD) in 2021/22 by:

Students: Erida Bendo,Neil John Bersabe, Mahmoud Ramdan

Faculty: Xavier de Kestelier, Ioana Maria Lesna, Levent Ozruh

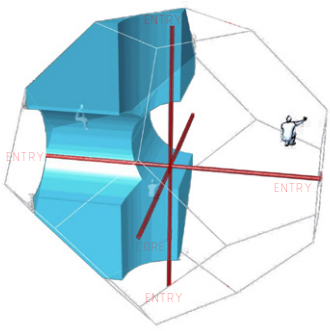
https://www.iaacblog.com/programs/life-orb-orbit-living-bimsc/

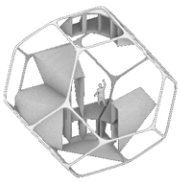
4.LIFE.ORB

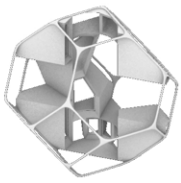
Living compartments of a space station in the lower earth orbit.

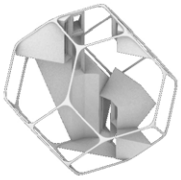
×responsible for the programmatic compartments and BIM documentation.

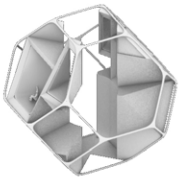
visual scripting in grasshopper
+evolutionary algorithms
+RhinoInsideRevit





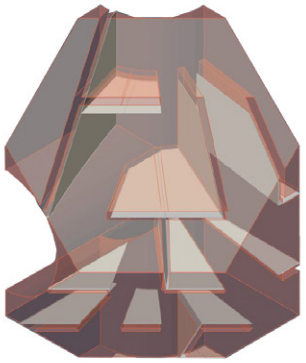


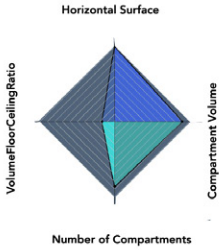




First scenario:
6 entry points

Life.Orb seeks is a living compartment configurator designed for a space station. Based on the ideal volume per person for missions of 5 months and above from the Celentano curve, the user can plug the needed functional units in the octahedronal scheleton, which then are further optimised through an evolutionary solver.





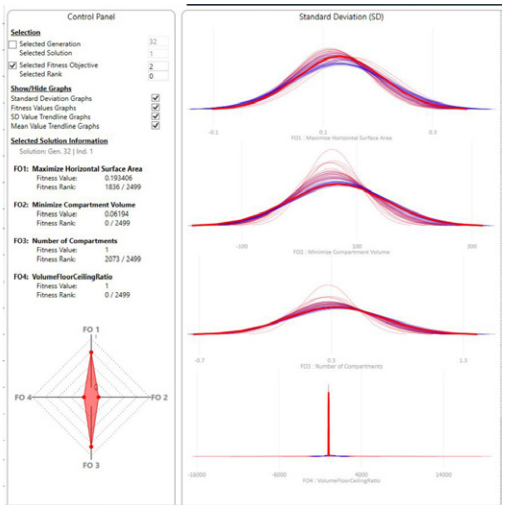
Generation 0 // Ind.13

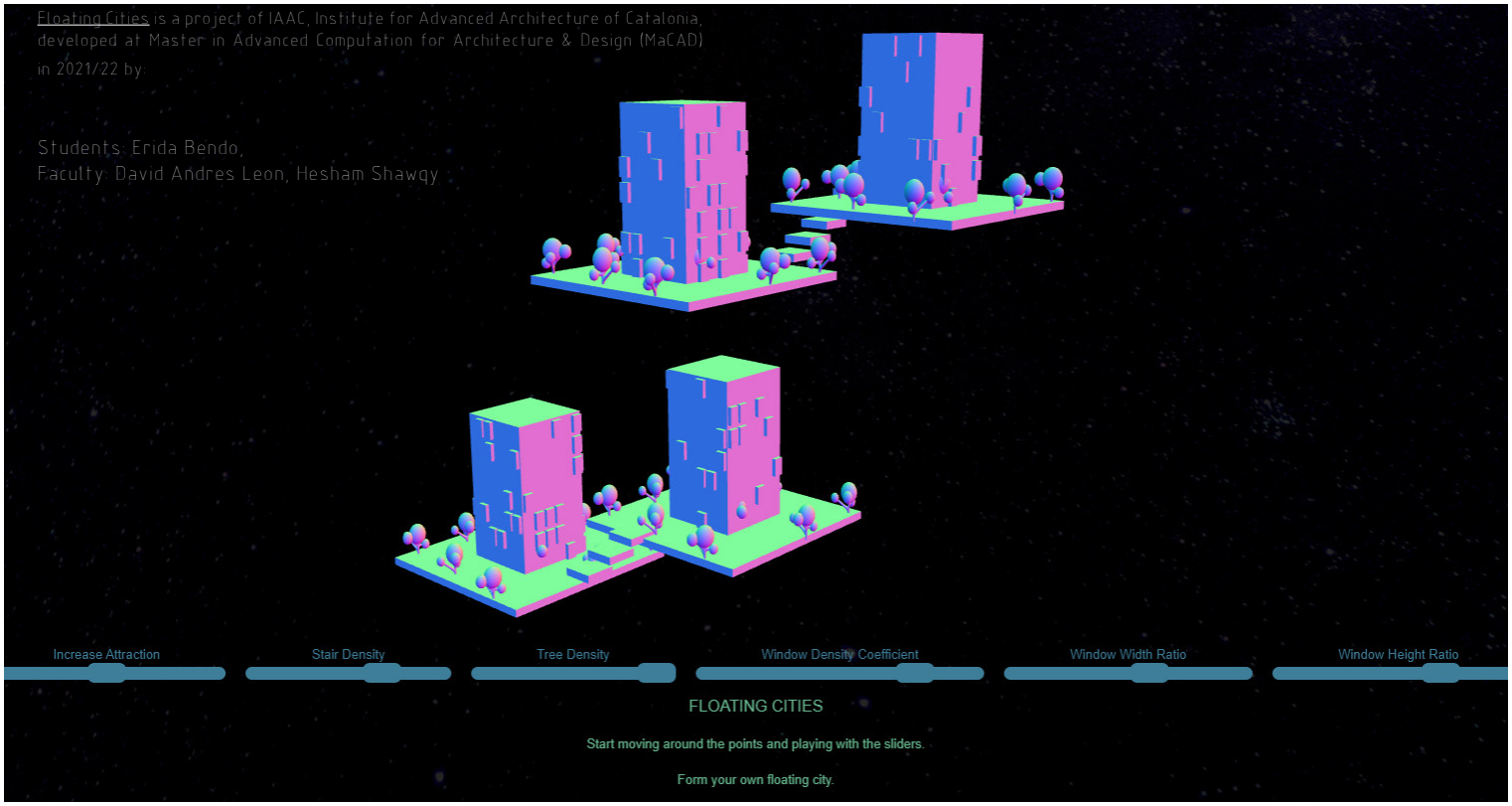
Horizontal Surface Area
Rank: 2478 / 2500
Fitness Value: 3.270571

Compartment Volume
Rank: 2241 / 2500
Fitness Value: 196.675525

Number of Compartments
Rank: 2148/2500
Finess Value: 1

VolumeFloorCeilingRatio
Rank: 371/2500
Fitness Value: 1





https://www.iaacblog.com/programs/floating-cities/

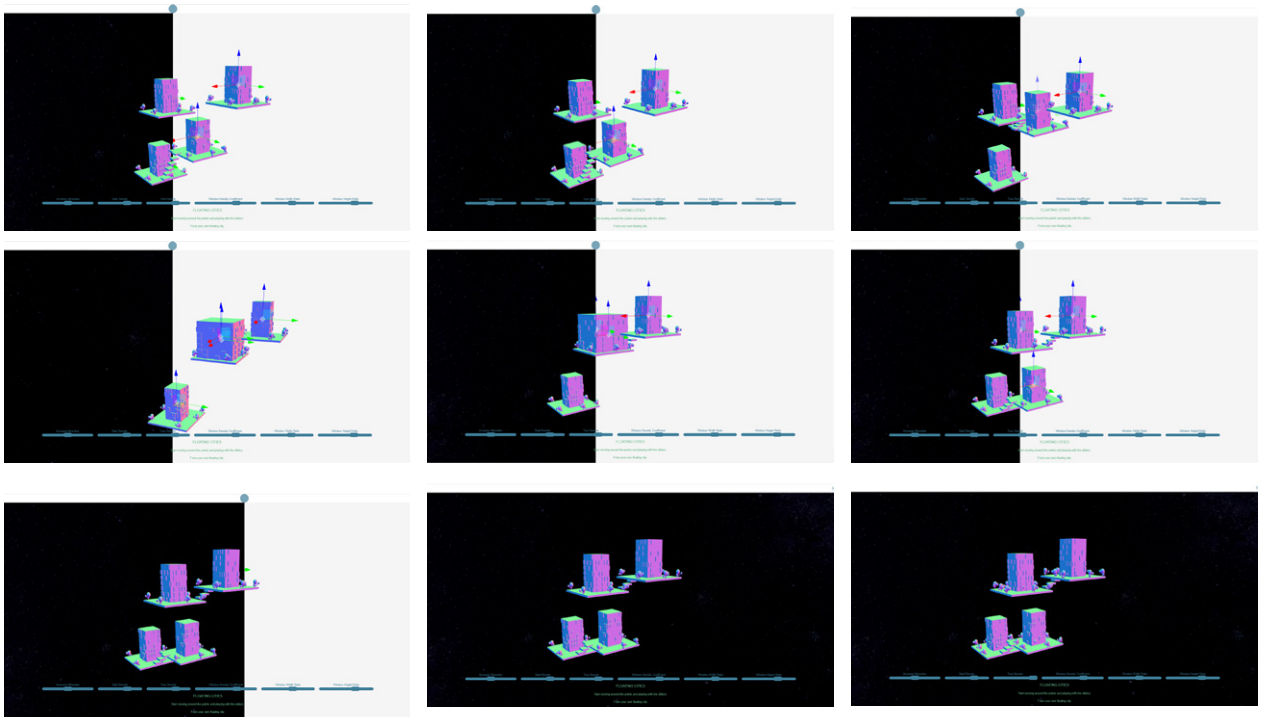
javascript,HTML,CSS
+RhinoCompute

5.FLOATING CITIES

Floating Cities is an interactive browser game, intended for users of all ages. Through moving the building blocks and working with sliders, the user is able to generate different geometrical configurations.

The project was created using Grasshopper3d for Rhino, ThreeJS, Javascript, HTML, and RhinoCompute.

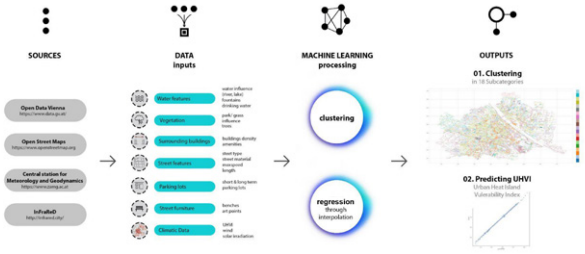
Access to the app
https://bimsc22-testproject.herokuapp.com/examples/Floating%20Cities/



6. SOME MACHINE LEARNING APPLICATIONS.

IDENTIFAI

an AI webapp for residents + municipalities to unveil the potentials of their streets.



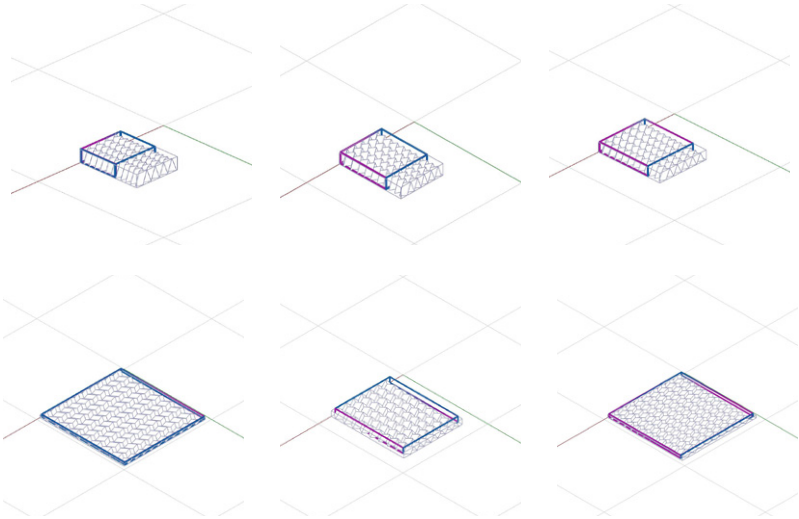
more info on: https://www.iaacblog.com/programs/identifAI/

GENERATED CREATIVITY

The intersection of architecture with artificial design is challenging the notions of creativity and agency.

What if a simple fast sketch can be more than that?

more info on: https://www.iaacblog.com/programs/generated-creativity/



PREDICTING DISPLACEMENT OF ORIGAMI METAMATERIALS

This is a project that explores the potential of machine learning methods, into predicting the displacement of Miura-Ori based origami metamaterials through the use of shallow methods and neural networks.

more info on: https://www.iaacblog.com/programs/predicting-displacement-of-origami-metamaterials/

Erida Bendo
PORTFOLIO