OSGeo 한국어지부 Korean Chapter

FOSS4G Korea 2024

the use of data in design

디자인에서 데이터의 활용

V 2024 10

DESIGNER & SOFTWARE ENGINEER & EDUCATOR

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Design, Data, AI, Computation, Visualization specialist

Software engineer; ESRI, Ready.net

MDes;Harvard, MArch;UCB, B.S;SNUST, Research Fellow; MIT

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Director and founder of

NJSLabs/ https://namjulee.github.io/njs-lab-public

NJSTUDIO & NJSLAB

Since 2004

!Software Technology for Design

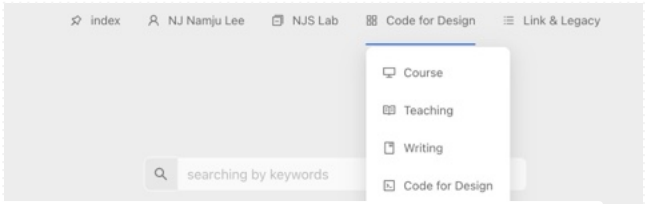
https://namjulee.github.io/njs-lab-public/

INDUSTRY & ACADEMIA

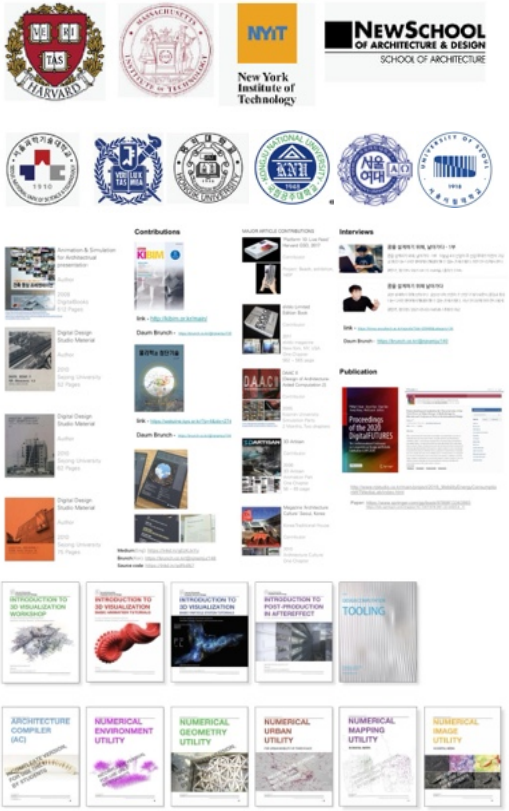
NJSTUDIO &

NJSLAB

INDUSTRY & ACADEMIA



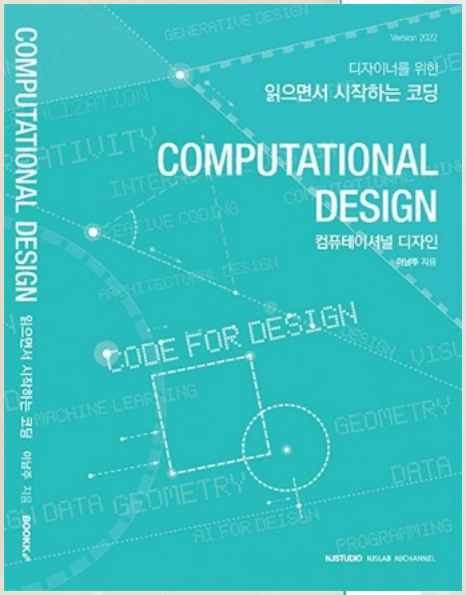
1,300 여 개의 영상 (강의 & 워크숍 & 상담 & 커리어전략), 150 여 개의 글(칼럼, 기고, 연구, 논문, 2권의 책), 140 여 개의 직/간접적은 프로젝트, 연구, 개발, 340 여 개의 워크숍 자료, 46 여 개의 수업들을 통해, 디자인과 컴퓨테이션 학습, 연구, 활용에 대한 지식과 경험을 나누고, 산업의 전문가/프런티어로서 그 역할을 충실히 해오고 있습니다. (2024년 9월 기준: 조회수 453,616명, 조회시간 25,200시간 / 1,050일)



읽으면서 시작하는

디자이너를 위한 코딩

Computational Design

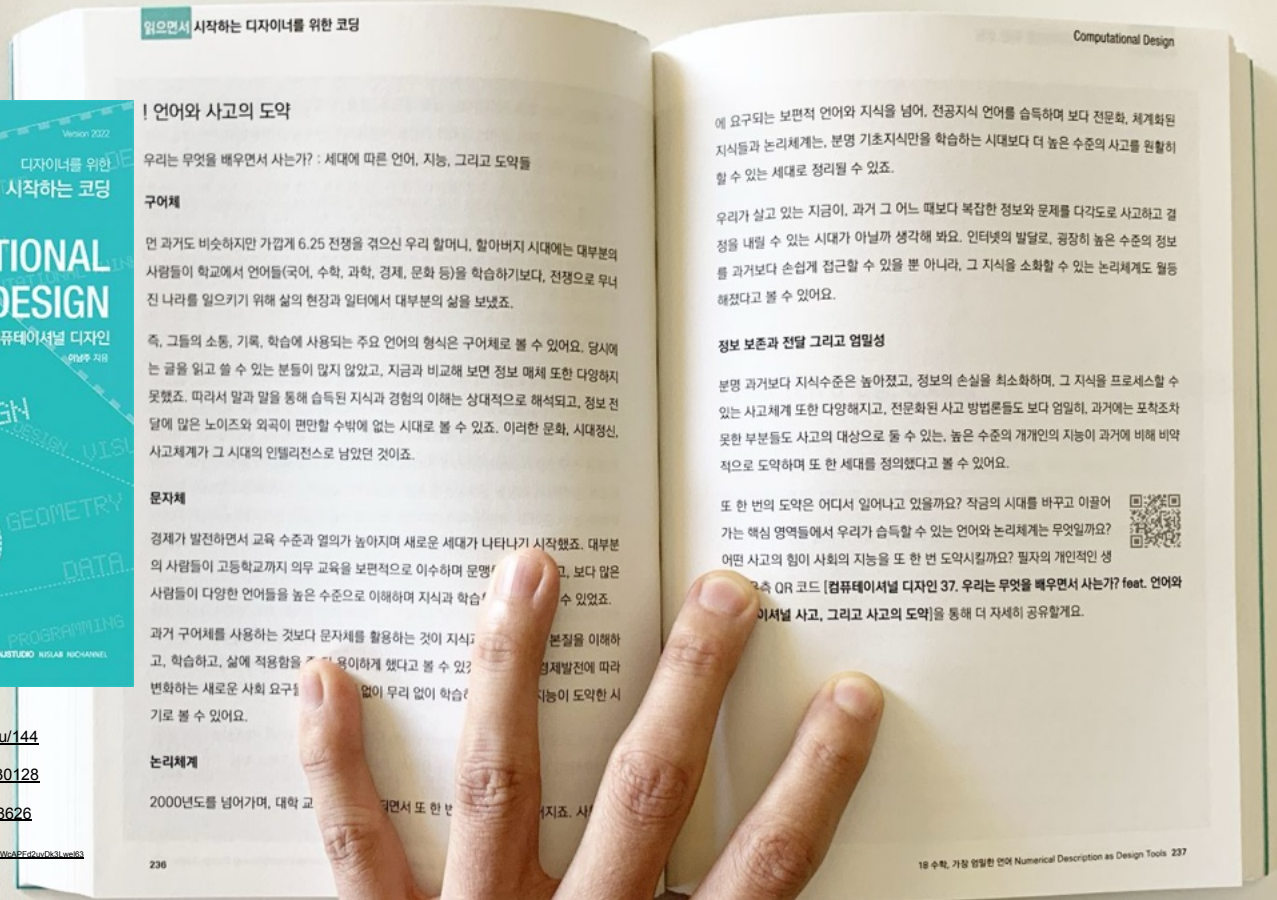


Daum Brunch - https://brunch.co.kr/@njnamju/144

Book - https://www.bookk.co.kr/book/view/130128

EBook - https://www.upaper.net/njnamju/1148626

Audio book - https://www.youtube.com/playlist?list=PLweNVwGoDkEbH7RWcAPFd2uvDk3Lwe863



[컴퓨테이셔널 디자인] 37. 우리는 무엇을 배우면서 사는가? feat. 언어와 컴퓨테이셔널 사고, 그리고 사고의 도약]

the use of data in design

디자인에서 데이터의 활용

DISCRETIZATION for SPATIAL INFORMATION & CODIFICATION of DESIGN(DECISION-MAKING PROCESS) and METHODOLOGY

공간정보의 이산화 & 디자인 프로세스의 코드화

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Architecture design, Computation, Visualization specialist

Software engineer; ESRI, Ready.net

MDes;Harvard, MArch;UCB, B.S;SNUST, Research Fellow; MIT

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Director and founder of

NJSLabs/ https://namjulee.github.io/njs-lab-public

4th industrial revolution

BIM, Smart City, Digital Twin …

AI, Machine Learning, LLM, Parallel Computing, Edge Computing ...

Drone, Autonomous Vehicle …

4th industrial revolution

BIM, Smart City, Digital Twin …

AI, Machine Learning, LLM, Parallel Computing, Edge Computing ...

Drone, Autonomous Vehicle …

Data

Materials and Tools for Design

Stone, Glass, Plastic, Iron, Concrete ...

Materials and Tools for Design

Stone, Glass, Plastic, Iron, Concret ...

Data

DATA at

geometry

architecture

urban

landscape

computation

visualization

material

GIS

Interaction

building energy

fabrication

...

DATA at

geometry

architecture

urban

landscape

computation

visualization

material

GIS

Interaction

building energy

fabrication

...

은 일과 산업을 바꾸는 차원에 국한된 것이 아닌, 사회, 문화, 경제 등 우리의 삶 전
친 근본적인 변화를 가져올 패러다임'이라 웅변하고 있어요. 즉, 데이터 기반 사회로의 도약
인 것이죠. 이러한 패러다임의 변화 앞에, 디자이너는 무엇을 해야 할까요? 그 시작은 작금
의 패러다임의 관점으로 데이터라는 재료를 다시 면밀히 살펴보고, 이해하는 것이 그 첫걸음
이 될 수 있다고 생각해요.

1.4 데이터: 현상의 압축 & 통찰의 향연

데이터Data는 현상의 표상Representation으로 볼 수 있어요. 현상을 계산 가능한 형태로 추상화Abstract
시켜 압축된 디지털 정보문서로 볼 수 있어요. 다른 말로 사실Fact, 혹은 현상의 단면을, 정성
Qualitative화 정량Quantitative화 관계성으로 통찰Insight의 형식으로 드러나게Revealing 하는 것이죠.

로우 레벨의 기술적인 설명은 뒤의 챕터에서 자세히 나누고 하이 레벨 측면에서의 데이터를
더 살펴보죠. 사회의 패러다임이 제조업에서 플랫폼과 서비스 산업으로 바뀌면서 데이터는
정보산업에 석유와 같은 존재가 되었고, 하드웨어 인프라스트럭처, 컴퓨팅 파워, 소프트웨어

“A geographic information system (GIS) is

a conceptualized framework that provides the ability

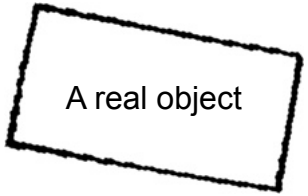
to **capture** and **analyse spatial** and **geographic data**.”

Quantitative & Qualitative

DATA

Vector & Raster

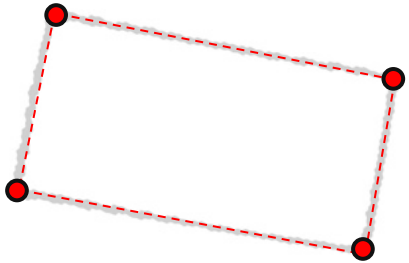
Vectorization & Rasterization



Vector

&

Raster



```
[
    [100, 50, 0],
    [50]
]
```

```
[
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    radius: 50
]
```

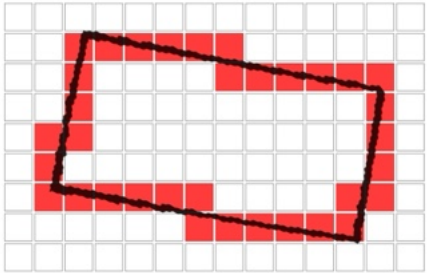

```
[
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    [ 0, 0, 1, 0, 1, 0, 0],
    [ 0, 1, 0, 0, 0, 1, 0],
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    [ 0, 1, 0, 0, 0, 1, 0],
    [ 0, 0, 1, 0, 1, 0, 0],
    [ 0, 0, 0, 1, 0, 0, 0],
]
```
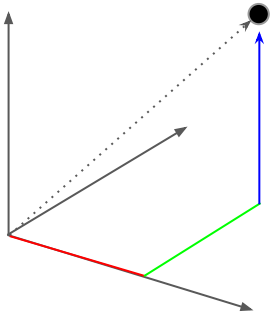
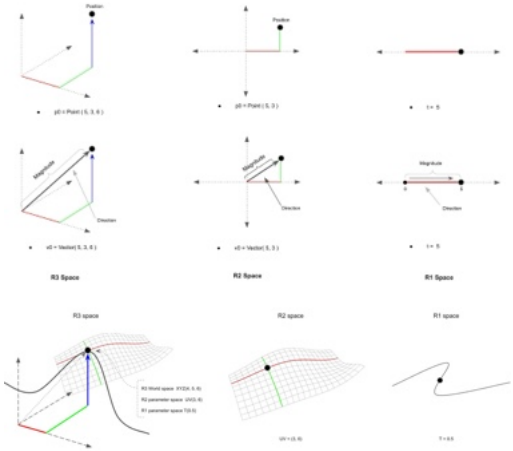
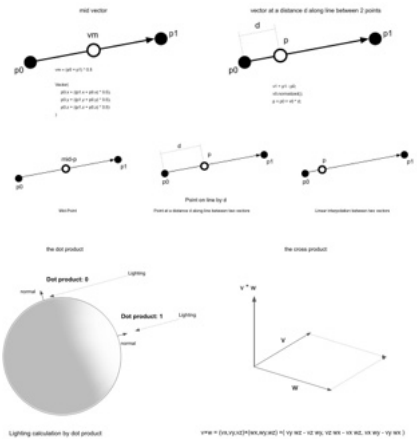

Vector

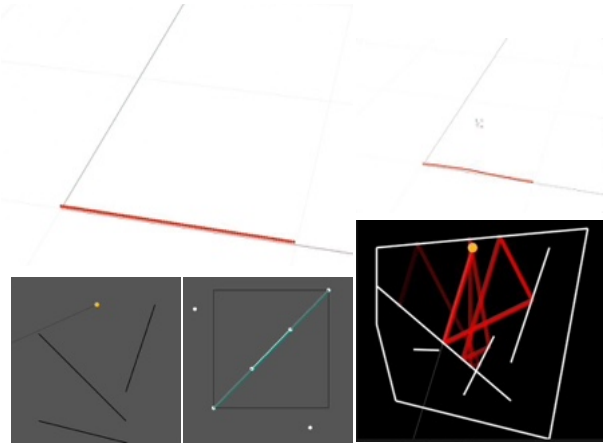
Cartesian (Euclidean) Plane R3



v0 = Vector(3, 5, 6)







https://namjulee.github.io/nis-lab-publiclab/tools/raytracer/

https://namjulee.github.io/nis-lab-publiclab/tools/bezier-interpolation/

https://namjulee.github.io/nis-lab-publiclab/tools/raytracer-scene

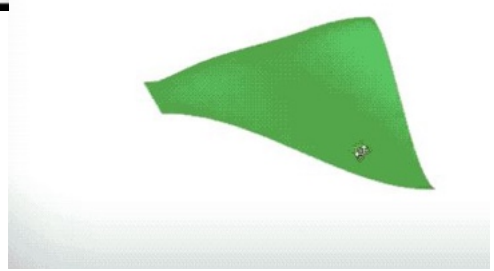
https://namjulee.github.io/njs-lab-public/work?id=2015-ngu-development

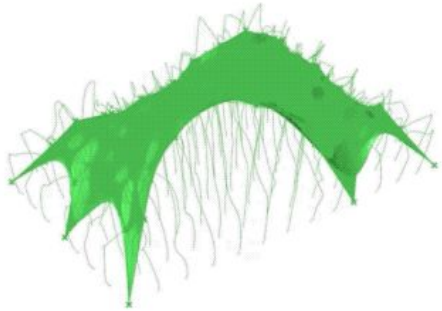
Geometry, Addon for Grasshopper
https://www.food4rhino.com/app/numerical-geometry-utility

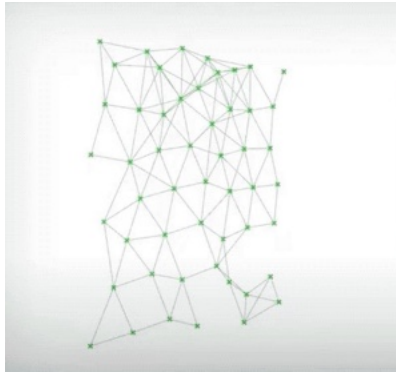
Dynamics, Addon for Grasshopper
https://www.food4rhino.com/app/numerical-mapping-utility

Geometry as Data Structure link

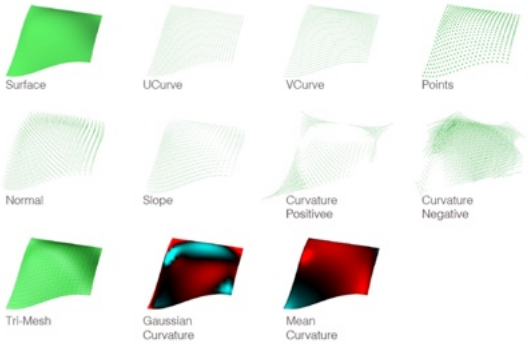
DYNAMICS

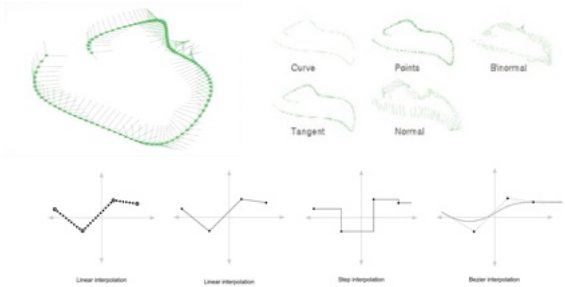




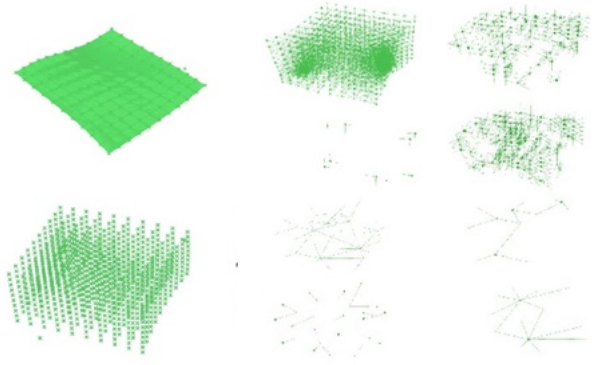


Data extractions



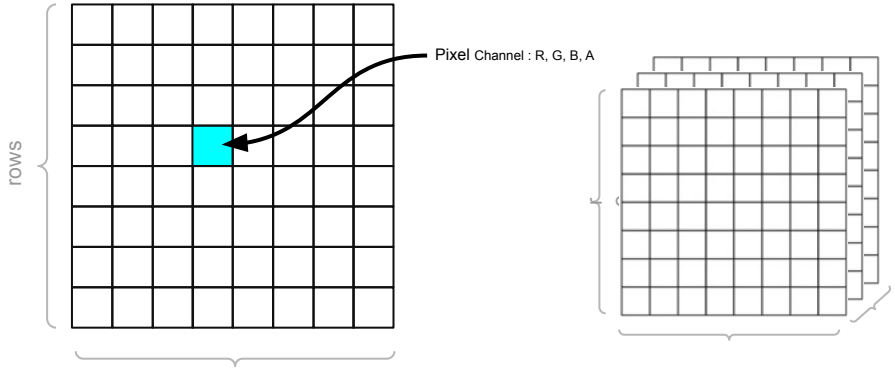


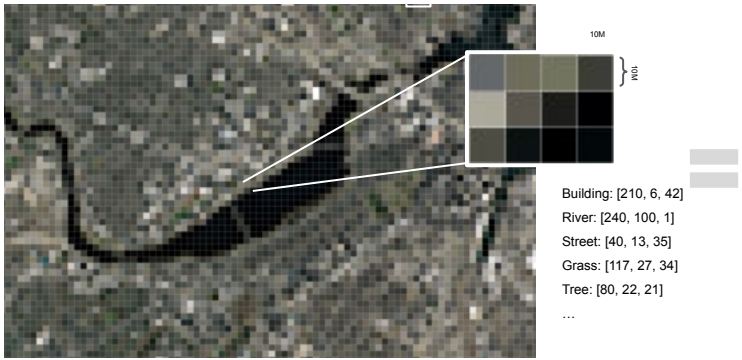
Connectivity



columns

Raster





Building: [210, 6, 42]

River: [240, 100, 1]

Street: [40, 13, 35]

Grass: [117, 27, 34]

Tree: [80, 22, 21]

…

```
[[[ 91  97  83]
  [ 82  90  69]
  [118 107  89]
  ...
  [ 98  98  96]
  [ 96  97 101]
  [101 101 101]]

 [[ 87 100  70]
  [124 122  97]
  [ 96  88  75]
  ...
  [ 85  87  74]
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  [ 99  95  92]]

 [[ 97 105  82]
  [124 122  99]
  [ 69  69  59]
  ...
  [ 65  65  55]
  [ 82  83  77]
  [ 84  89  83]]
 …
```

```
[[ 97 102  96]
  [ 64  68  54]
  [ 92  89  80]
  ...
  [ 53  51  52]
  [ 99 105 101]
  [103 104  98]]

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  [ 69  70  62]
  [ 78  82  81]
  [ 94  93  98]]]
```
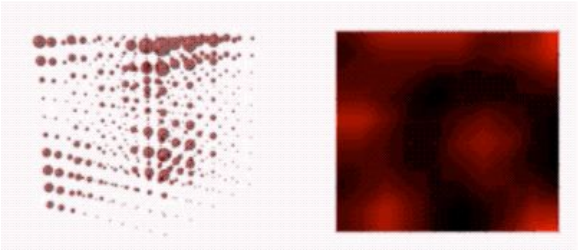
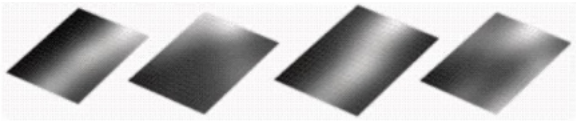

Voxel Structure



Layers



Discretizing information

Link: https://computationaldesign.tistory.com/67

numerical descriptions as design tools

data structure

graph

pixel

voxel

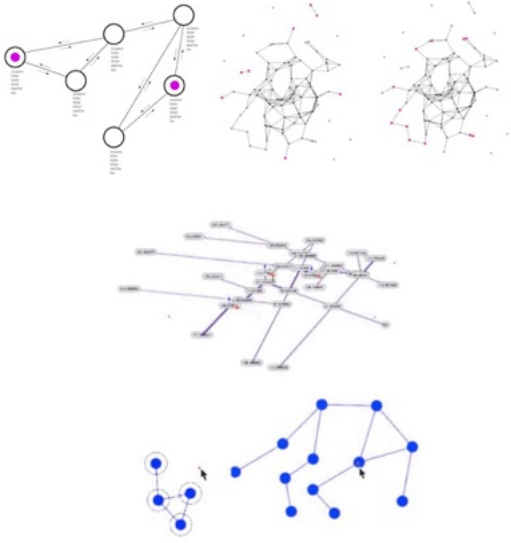
...

DATA STRUCTURE METHODOLOGY

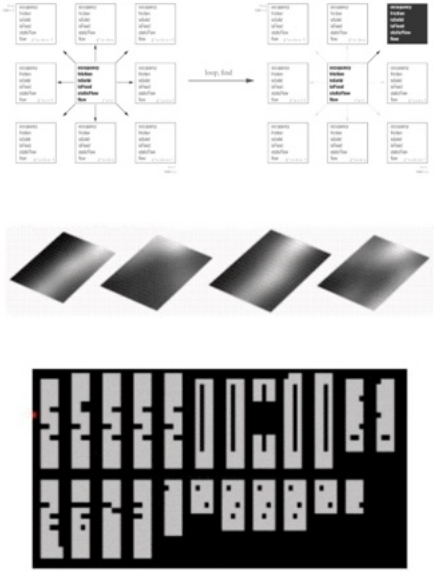
Data Structure and Algorithm for Design and Research Workshop

Type of Abstraction & Discretization & Resolution

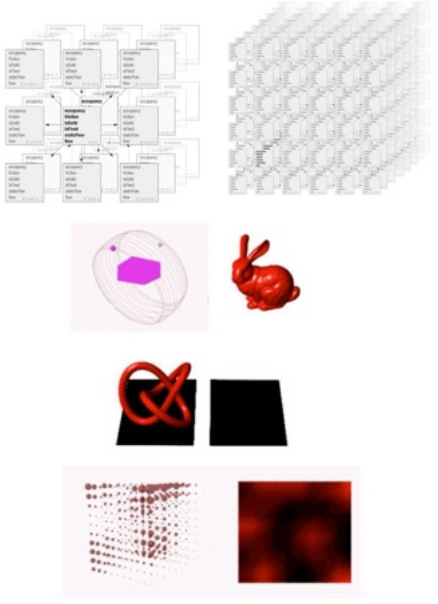
Graph link



Pixel link

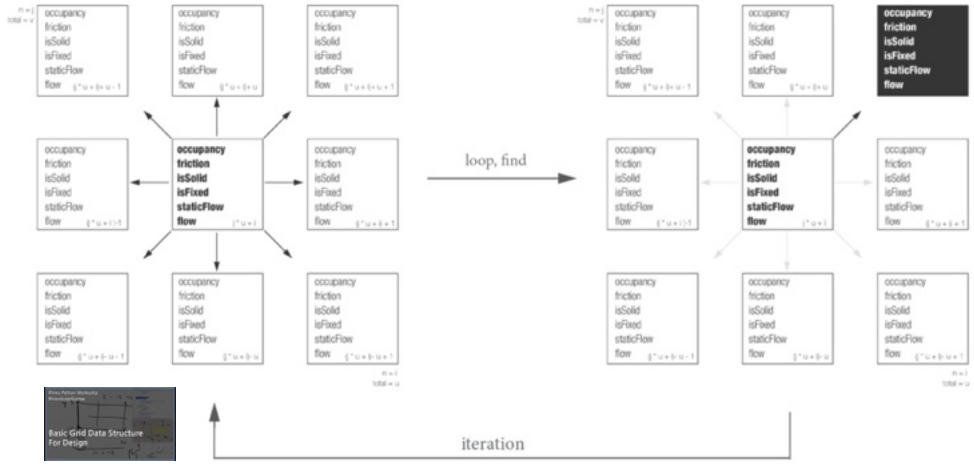


Voxel link

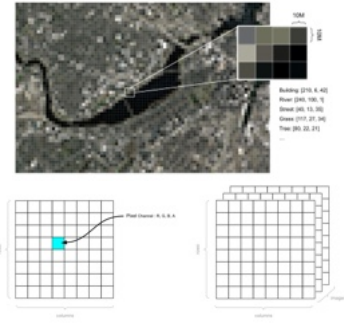


Raster Data Structure

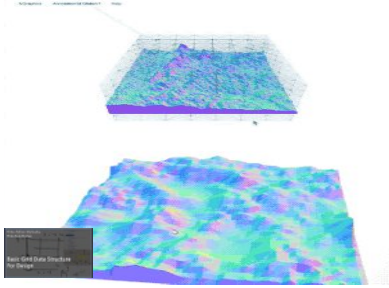
Grid System

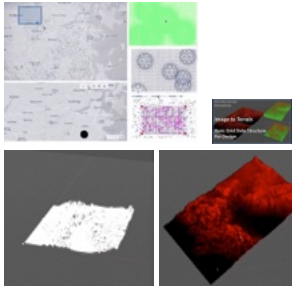


Discretization & Resolution

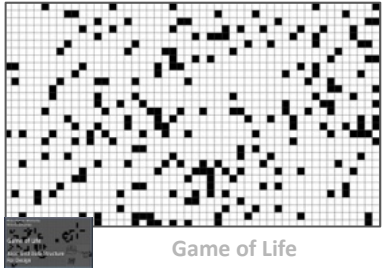


Grid Mesh

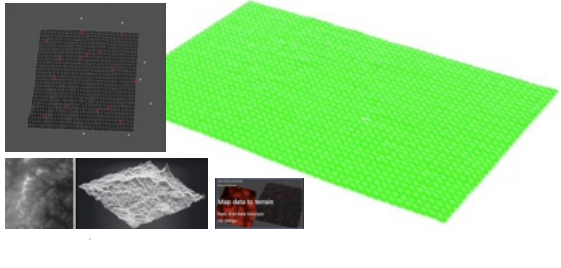




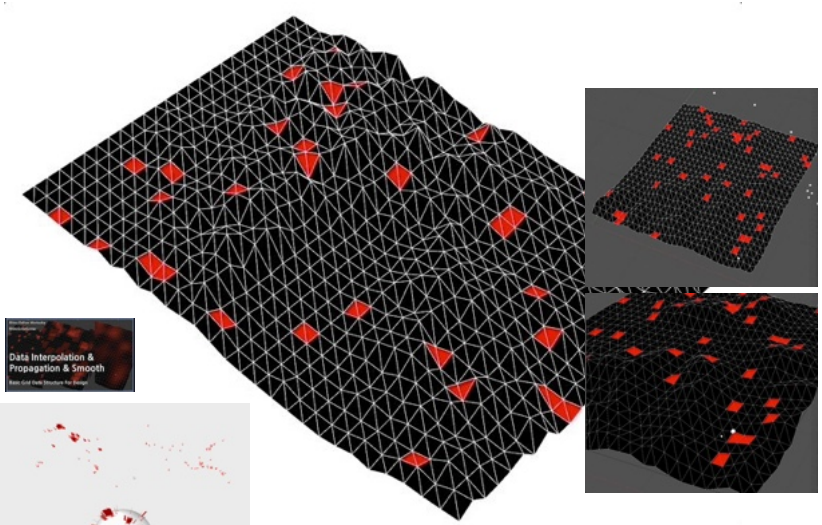
Connectivity



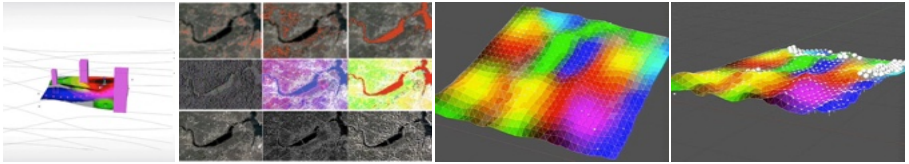
Data to Terrain



Propagation

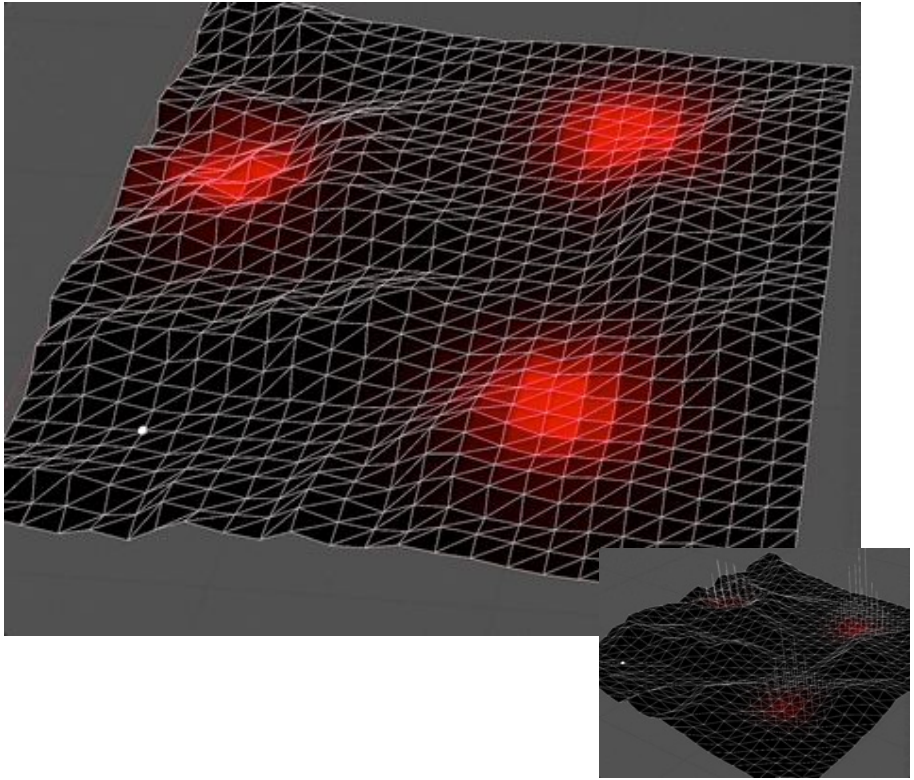


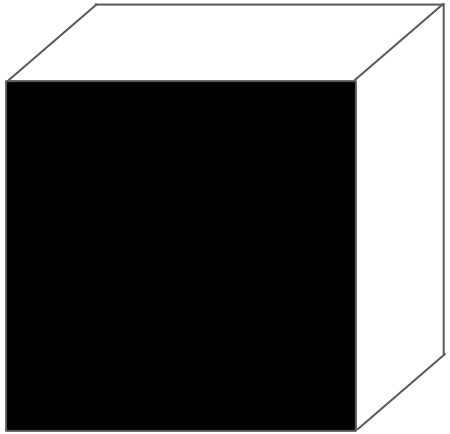
Data Channels



Numerical Descriptions as Design Tools

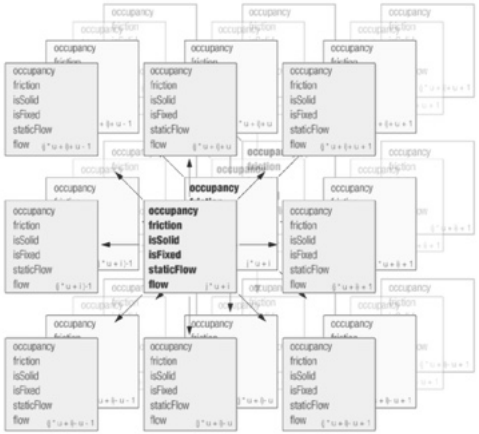
Data Falloff & Smooth

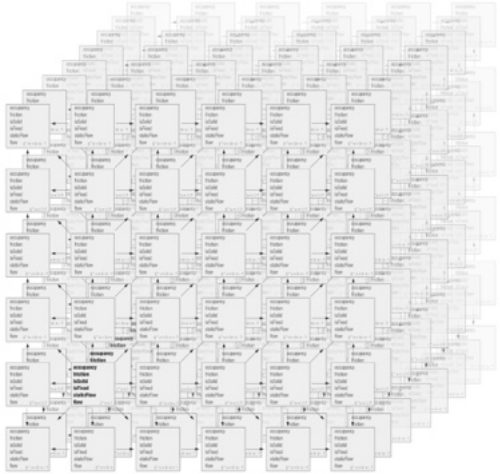




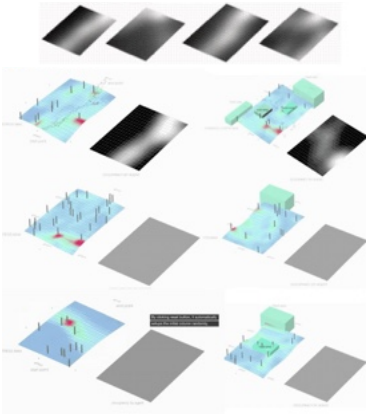
Voxel Map Data Structure

Voxel

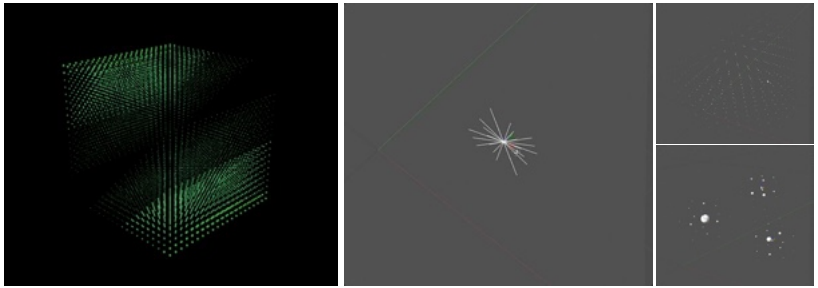


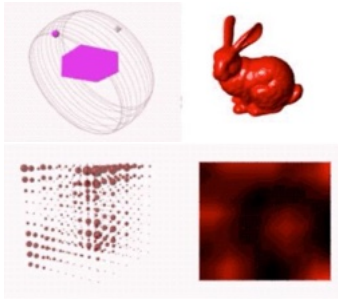


Data Interpolation

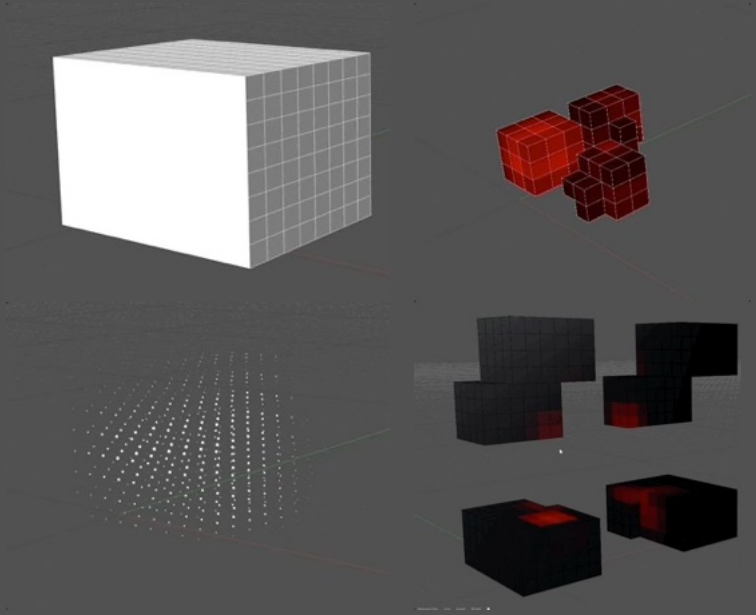


Connectivity

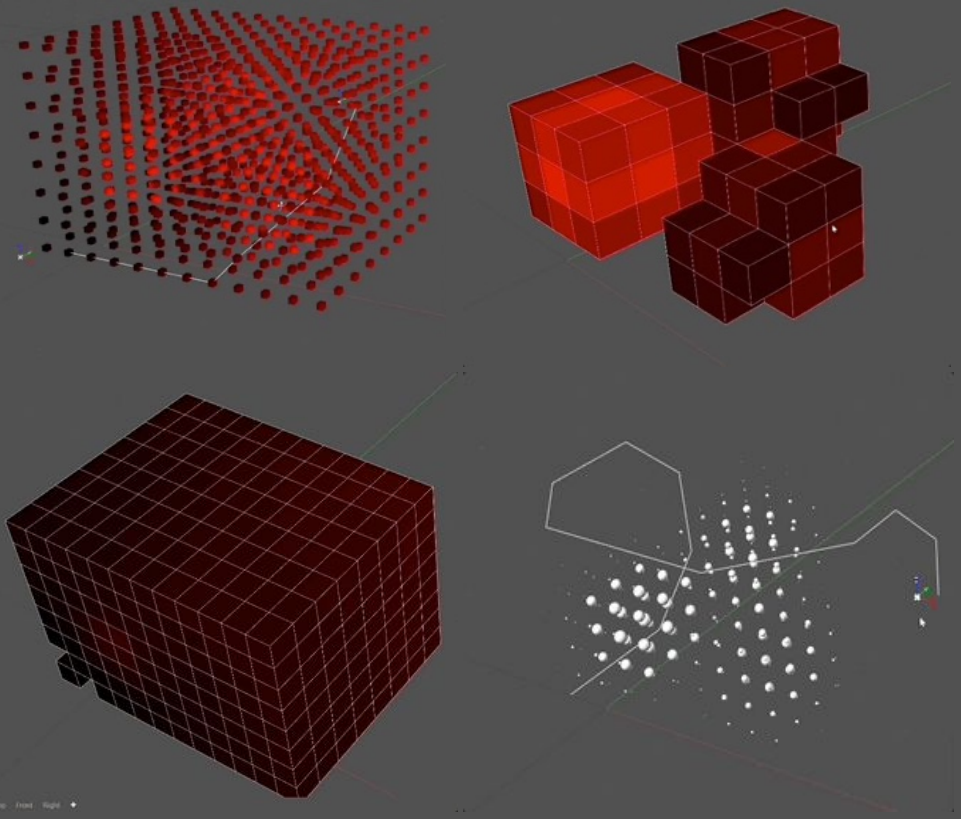




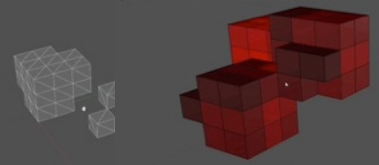
Voxel Data Visualization

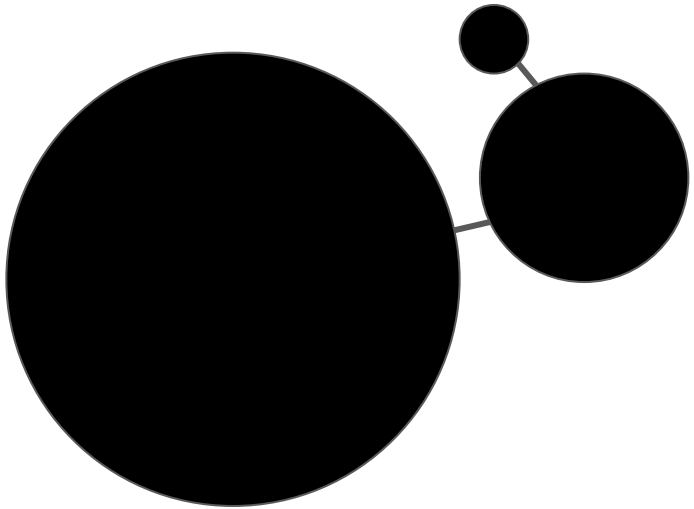


Voxel, Path Finding



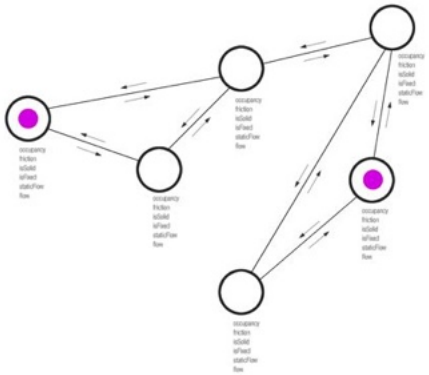
Voxel Mesh

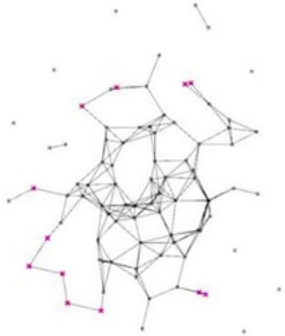




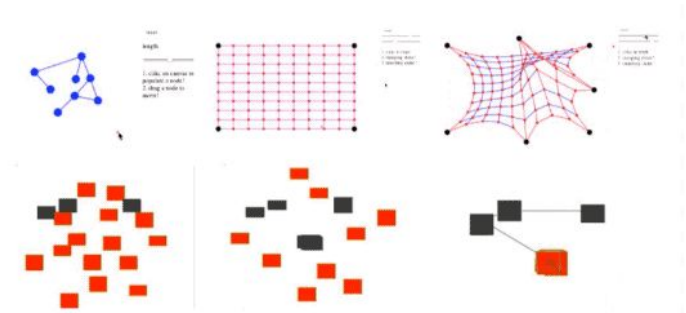
Graph Data Structure link

Graph

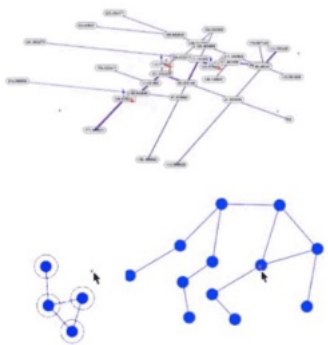


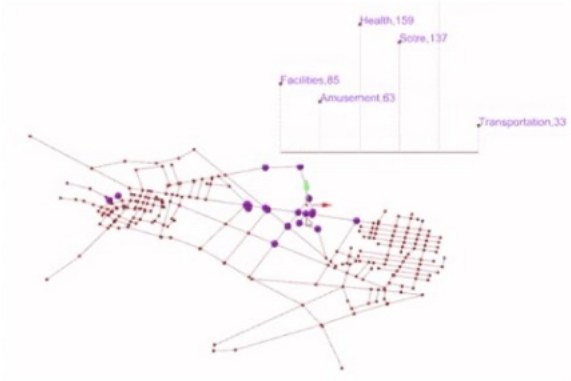


Graph Analysis
DYNAMICS



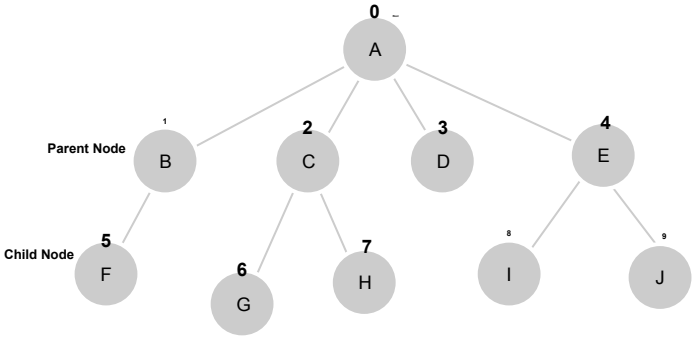
Network Analysis
DYNAMICS





Graph & Pixel & Voxel

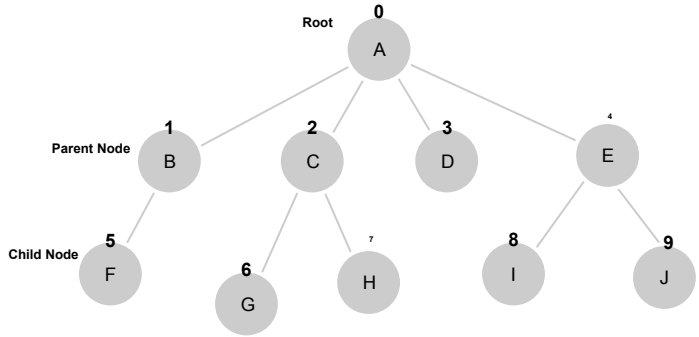
Search & traversal



DFS

Depth First Search Using a Stack

0,1,5,2,6,7,3,4,8,9



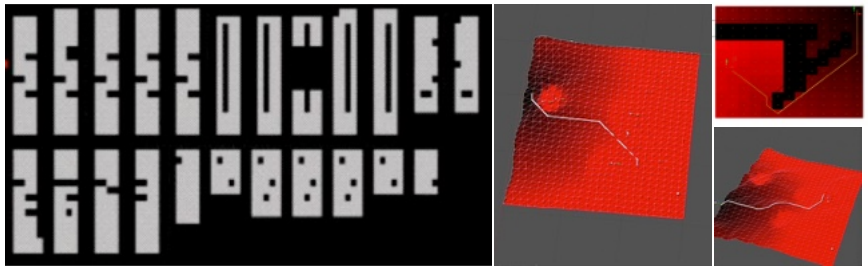
BFS

Breadth First Search Using a Stack

0,1,2,3,4,5,6,7,8,9

Reference:
https://codepen.io/NJStudio/pen/RwWxGXo?editors=1011

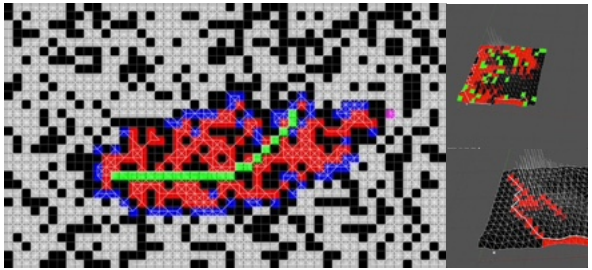
Path Finding & Dijkstra



Reference:
https://docs.google.com/presentation/d/1TJPG0EdP1JafMEbGzIYxTH8Kc9WE1PBSkH2PWxhW3Uo/edit#slide=id.g1b82a001364_0_258

https://codepen.io/NJStudio/pen/RwWxGXo?editors=1011

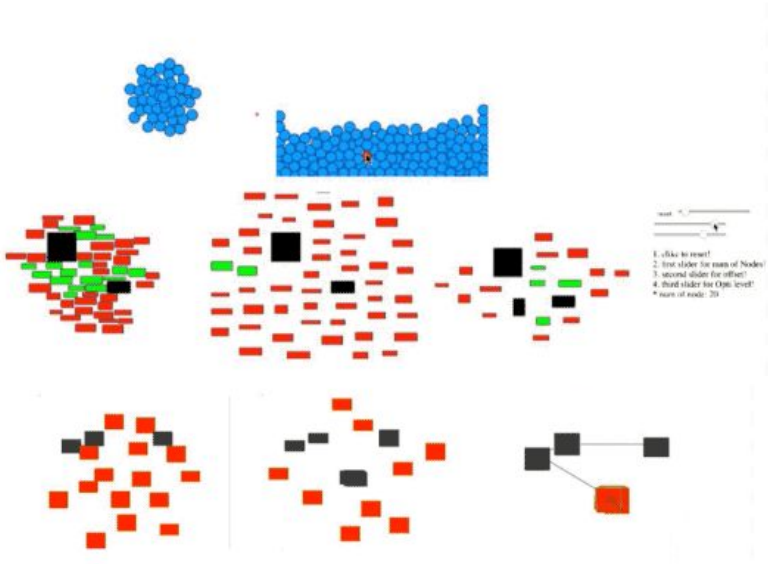
PathFinding A* concept

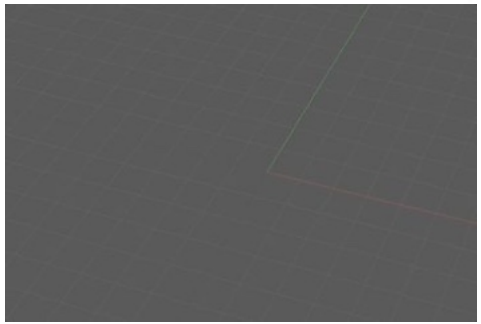


http://theory.stanford.edu/~amitp/GameProgramming/Heuristics.html

Particle

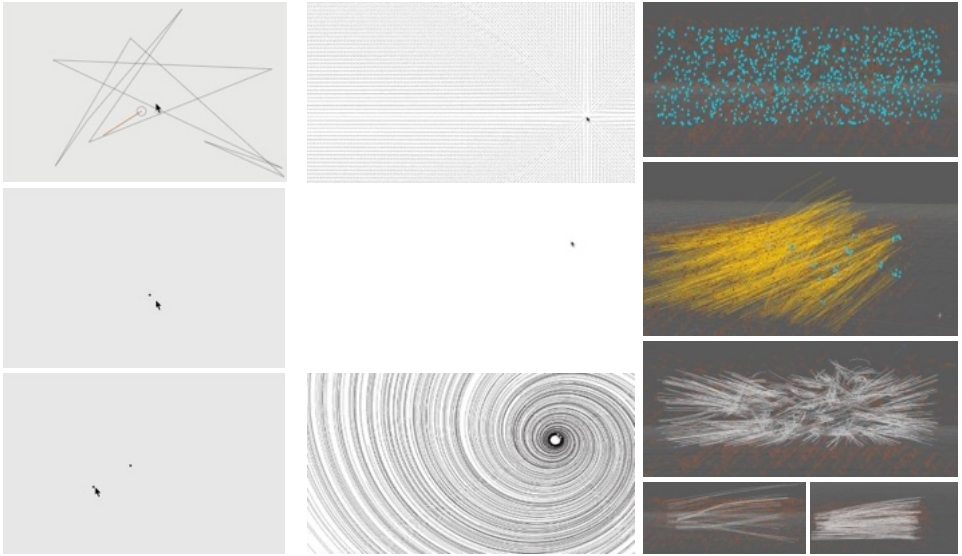
DYNAMICS

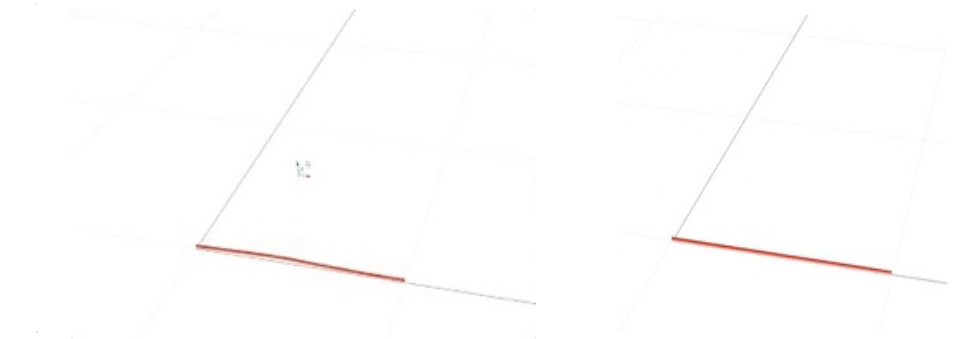




Field & Particle

DYNAMICS





SYSTEM FOR DESIGN

Translating information to insights for design decisions

Parametric, algorithmic design

Optimization & Automation

Agent-Based / multi agent based design system

Rule-Based & Generative Design System

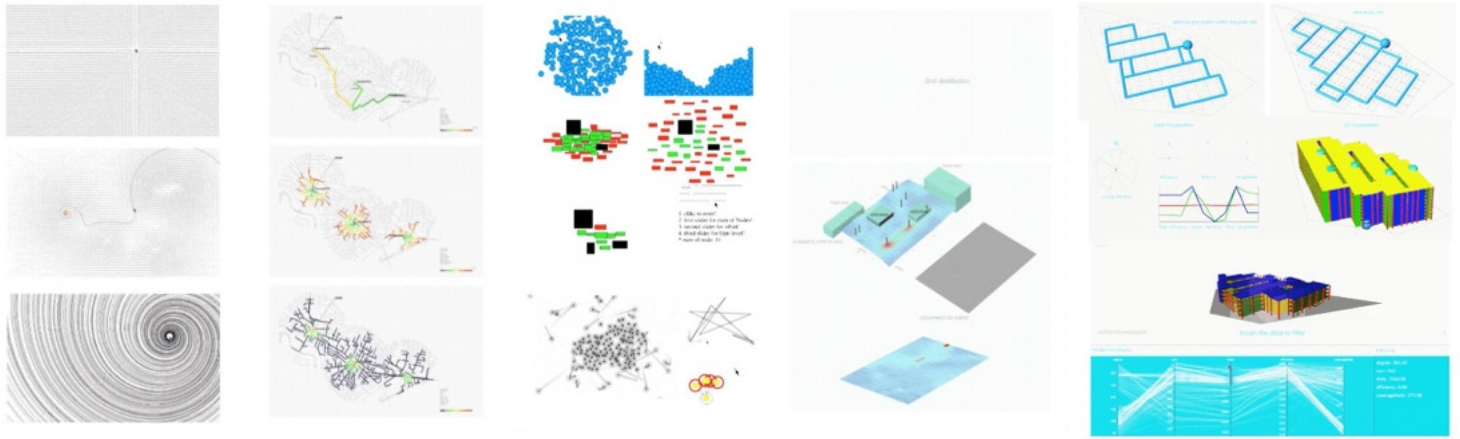
Interaction in design

Data driven decision making process

Complex system in design

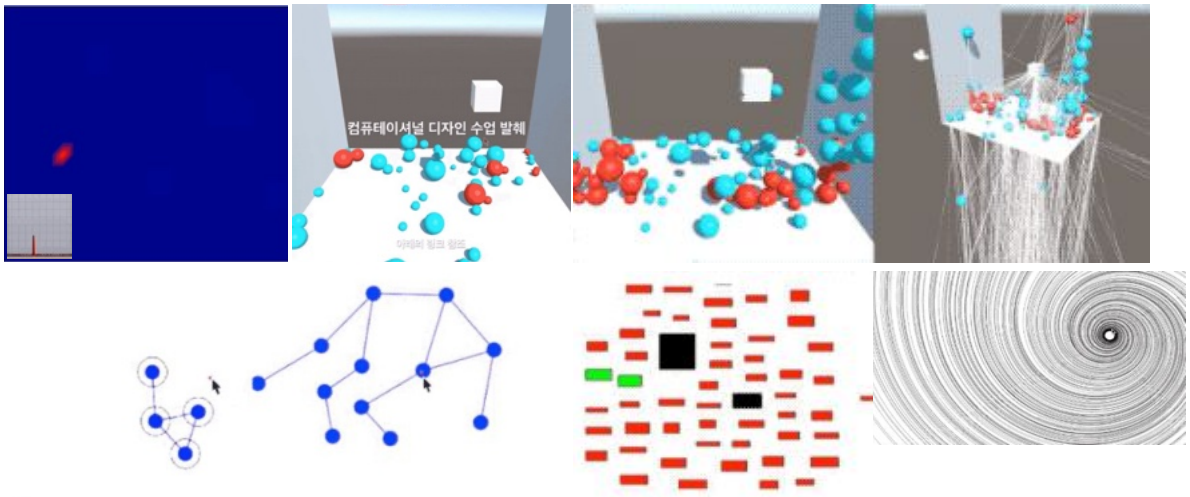
AI / ML / LLM / Generative model

BIM / BAM



Connectivity:

Dependency & Hierarchy & Relationship link



COMPUTATIONAL THINKING link

Problem solving & From implicit to explicit - 쉬운설명 https://brunch.co.kr/@ninamju/1

1.1. 암묵적(Implicit)에서 명시적(Explicit)로 – 분해(Breakdown), 추상화(Abstraction), 패턴(Pattern)

1.2. 변수(Variable) / 파라미터(Parameter)

1.3. 모듈(Module)의 재활용성(reusable)

1.4. 수 체계 –

1.5.. 프로그래밍 패러다임 (Programming paradigm)

1.6. 전공 영역(Domain)

! 컴퓨테이셔널 사고(Computational Thinking) 그리고 컴퓨테이셔널 디자인(Computational Design) - link

QnA 102 컴퓨테이셔널 디자인 프로젝트 피드백 & 컴퓨테이셔널 디자인 사고 - link

QnA 95 컴퓨테이셔널 사고 / 이분법적 접근 방지 / 문제 해결 방법 - link

QnA 94 랩버쉽오피스아워, 제품 디자인 학부생과 대화 그리고 컴퓨테이셔널 디자인 - link

QnA 93 랩버쉽오피스아워 - 데이터, 알고리즘, 학습방법, 기술과 디자인을 볼 때 - link

QnA 85. 건축학부2 컴퓨테이셔널디자인예대환3가지질문 - link

QnA 84. 건축학과2학년의질문, 컴퓨테이셔널디자인어떻게, 이해하고, 공부하고, 적용할까? - link

SA 7.0 Lecture 2. 디자이너를 위한 컴퓨테이셔널 사고 / Computational Thinking For Designer - link

[#컴퓨테이셔널디자인 38] 4/6 학습 내용과 방향 (디자이너를 위한 컴퓨테이셔널 디자인 특강 2021) - link

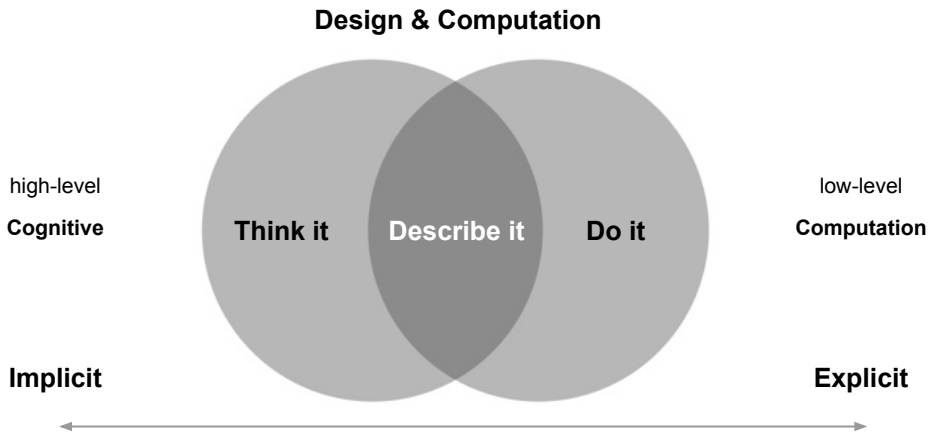
QnA 61 #컴퓨테이셔널디자인교육, 코딩 교육, 누가 가르쳐야 하나 - link

QnA 59. 가장 원반적인 오해, 컴퓨테이셔널 디자인 오해들 - link

QnA 56. 건축 컴퓨테이셔널 디자인 활용?, 응용범위?, 원론의 사고방식 ? - link

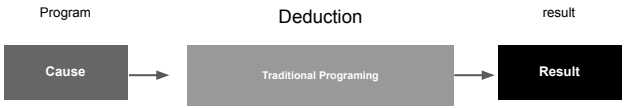
...

여기 QnA 채널에 가셔() "Ctrl + F"를 활용해서 키워드로 검색하시면 더 많은 자료를 찾을 수 있어요!



Codification of the design process link

from **function** to **result**

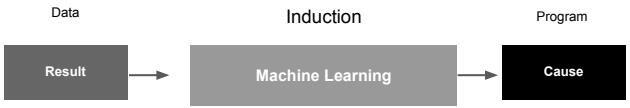


Traditional Programing, Software 1.0 link

3 + 3 = ?

VS

from **result** to **function**



Machine Learning, Software 2.0 link

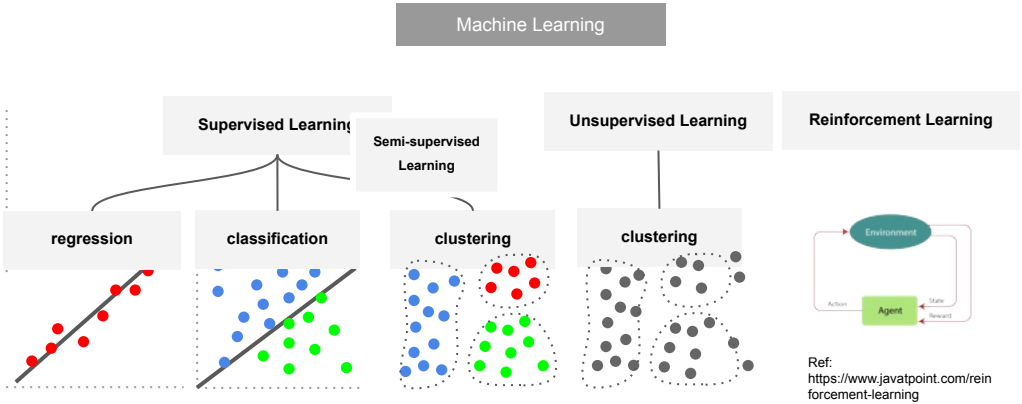
3 ? 3 = 6

Inductive learning (귀납적 학습/프로그래밍) link

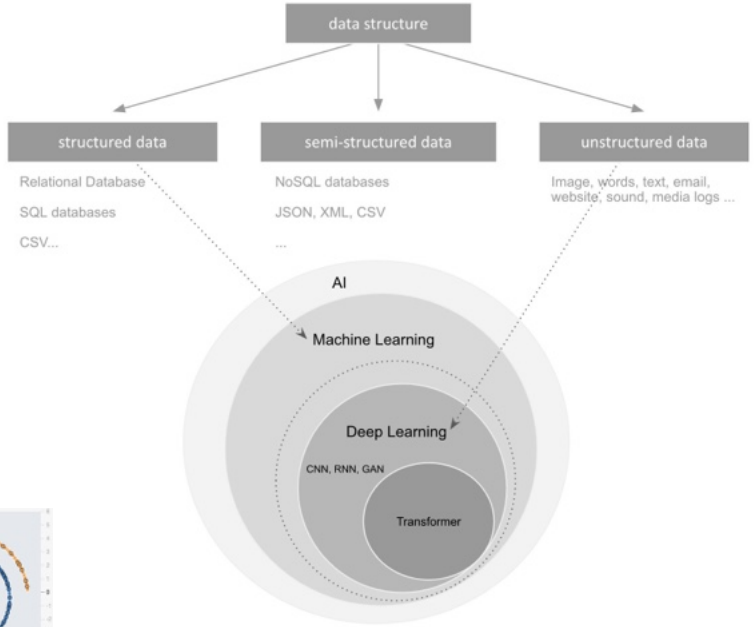
AI & Machine Learning

Machine Learning is used to transform the **structure** or **type** of data,

when we don't know to program it directly.



Ref:
https://www.javatpoint.com/reinforcement-learning



https://playground.tensorflow.org/

Issue & methodology

Analytical AI

VS

Generative AI

Analyzes data to derive insights, identify patterns, make predictions, or inform decision-making.

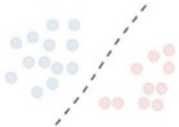
Methodology
Statistical models; Machine learning algorithms, and data analytics techniques

Creates new content; videos, images, text, or audio, by learning from existing patterns in data.

Methodology
Generative Adversarial Networks (GANs) or Transformer models (Generative Pre-trained Transformer:GPT)

Machine Learning

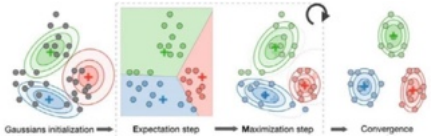
Supervised Learning



Discriminative model
Decision Boundary
Regressions, SVMs

Generative model
Probability distributions of the data
GDA(Gaussian Discriminant Analysis), Naive Bayes

Unsupervised Learning

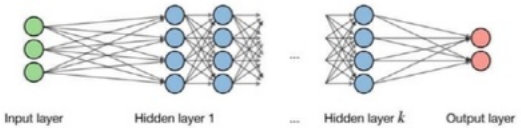


Clustering:
K-means clustering, Hierarchical clustering

Dimension reduction:
PCA (Principal Component Analysis), ICA(Independent component analysis)

Nonlinear dimensionality reduction:
t-SNE(t-distributed stochastic neighbor embedding)

Deep Learning

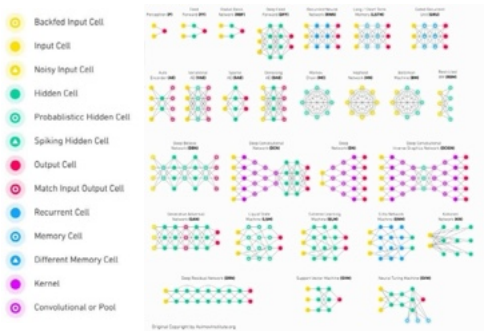


architecture

CNN (Convolutional Neural Networks)
RNN (Recurrent Neural Networks)
RL (Reinforcement Learning)

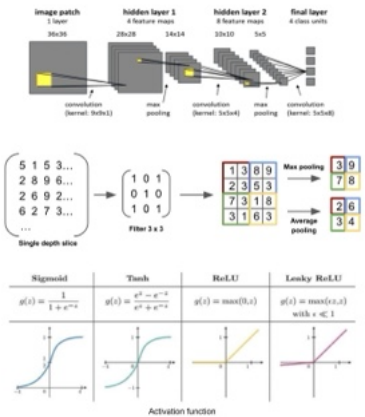
Reference: CS229 - Machine Learning, Stanford University

Neural networks basic architectures



Reference:
CS229 - Machine Learning, Stanford University
https://www.asimovinstitute.org/

Convolutional Neural Network



Codification of the design process

Computational Design Thinking

Writing, Medium - https://ni-namu.medium.com/computational-design-thinking-for-designers-68224bb07f5c

Lecture Video - https://youtu.be/ioGSrqYpEm8

1. Question
2. Methodology & Approach
3. Policy
4. Implementation : algorithm

디자이너를 위한 컴퓨테이셔널 팅킹 / Computational Thinking For Designers

01:02 - 언어를 통일 하자
01:53 - 가장 중요한 것은? Questions / Imaginations / Hypothesis
05:04 - 시작 전 우리의 자세는? Methodology / Approach
06:50 - 과정에서의 전략은? Manifesto / Policy
09:30 - 결정론? 확률론? Deterministic / Stochastic
10:00 - 확장할 것 인가? 집중할 것 인가? Converge / Diverge
13:49 - Top-down / Button-up & Holistic / Partial
14:21 - 존재하는 솔루션? 찾아 내야 하나? Existing / Emerging
15:32 - 무엇을 향해서? Oriented / Disoriented
16:49 - 무엇을 중심으로? Centralized / Decentralized
17:48 - 흐름은 어떠 한가? Procedural / Iterative
18:20 - 최고? 혹은 최적? Ultimate(Best) / Optimal

19:47 - 이행/구현의 단계에서는 / Implementation
20:09 - 무한에서 유한으로 - Infinite to Finite
21:13 - 암묵적에서 명시적으로 - Implicit to Explicit / Ambiguous to Certain
22:54 - 어떻게 나눌 것 인가 - from Entangled to Separated
24:17 - 현상에서 모델로 - Phenomenological(Observation) to Predictable(Model & System)

25:26 - 이행시 필요한 개념 / Implementation
27:30 - 클래스의 장점 그리고 추상화 - Class / Abstraction
28:51 - 요약하면

DATA & PROCESS

COMPUTATIONAL THINKING link

THE QUESTION / IMAGINATION / HYPOTHESIS

Understanding *Problem, Concern & Issue*
Declaring *Inputs & Outputs*
Writing *Instructions*

. . .

THE METHODOLOGY & APPROACH

from ***Whole*** *to* ***Parts*** *&* *from* ***Part*** *to* ***Whole***
from ***Simple*** *to* ***Complex*** *&* *from* ***Complex*** *to* ***Simple***
from ***Generic*** *to* ***Specific*** *&* *from* ***Specific*** *to* ***Generic***

. . .

THE MANIFESTO & POLICY

Deterministic *or* ***Stochastic***
Converge *or* ***Diverge*** *— Design Space, Optimization, Pareto efficiency*
Top-down *&* ***Button-up***
Holistic *or* ***Partial***
Existing *or* ***Emerging*** *(Revealing)*
Oriented *or* ***Disoriented***
Centralized *or* ***Decentralized***
Procedural *or* ***Iterative***
Ultimate(Best) *or* ***Optimal***

. . .

THE IMPLEMENTATION

from ***Infinite*** *to* ***Finite*** *— FEM, Structure Analysis*
from ***Implicit*** *to* ***Explicit***
from ***Ambiguous*** *to* ***Certain***
from ***Entangled*** *to* ***Separated*** *— Pipeline*
from ***Inactive*** *to* ***Interactive*** *— Complex system*
from ***Phenomenological****(Observation)* *to* ***Predictable****(Model & System)*
from ***Intuition****(Imagination, Hypothesis)* *to* ***Implementation***

SPATIAL DATA MANIPULATION

Dumb *or* ***Smart*** *— Component Oriented Programming, React, Unity3d*
Reciprocal *(Mutual & Dependent)or* ***Isolation****(independent)*
Public *or* ***Protected*** *or* ***Private***
Abstract *or* ***Concrete*** *— Implementation and Inherent*
Connected *or* ***Disconnected***
Static *or* ***Dynamic(Instance)***

. . .

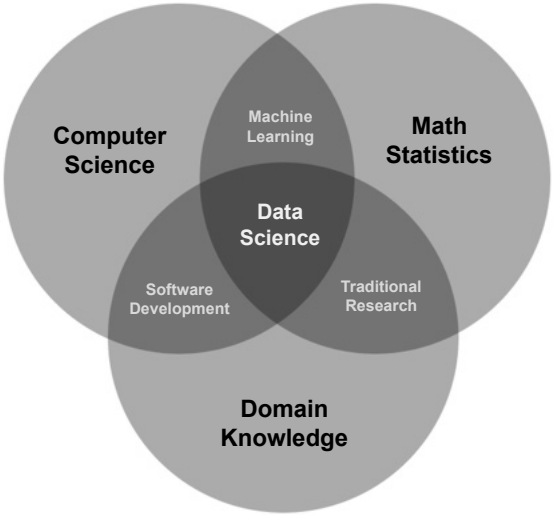
THE TOOL & THE PRINCIPAL

Analytic-Oriented & Object-Oriented & Functional & Procedural & Component...
Relational Hierarchy
Properties and Behaviors
Pure & Impure
Condition & Loop
Coordinate system, distortion, projection remap interpolation ...

. . .

1. Differentiating Issues, Problems, and Tasks
2. Developing Spatial Data Structures
3. Deploying Algorithms

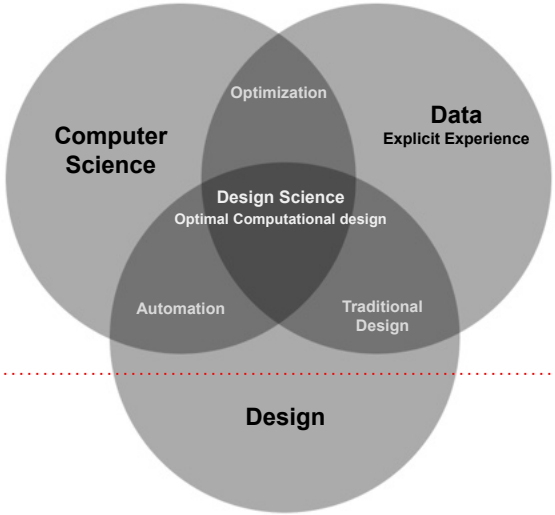
DATA SCIENCE



Computational XXX
Data Engineering
Data Science
…

DESIGN SCIENCE

Today's topic



Computational Design
Design Engineering
Design Science
…

Data & Design, Computational Design

Workshop: Introduction to Computational Design: Data, Geometry, and Visualization Using Digital Media - link

ENG: https://nj-namju.medium.com/data-design-c21457dc8dc

KOR: https://brunch.co.kr/@njnamju/88

Codification of design process (decision makings)

디자인 프로세스의 코드화

DESIGN & DATA link

selected researches and projects

URBAN ANALYSIS & AI, ML

https://namjulee.github.io/njs-lab-public/project/2016-mobility-energy-consumption-mit-media-lab/

Addon for Grasshopper
https://www.food4rhino.com/app/numerical-urban-utility

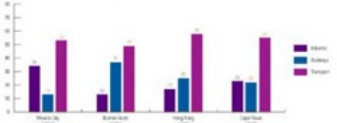
Paper: https://www.springer.com/gp/book/9789813343993
https://link.springer.com/chapter/10.1007/978-981-33-4400-6_11

01. Third Place Mobility Energy Consumption Per Person

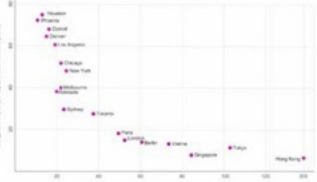
Date : 2016
Type : independent project, Changing Places Group, MIT Media Lab
Prof. Kent Larson
Role taken : **independent project (director and developer)**

Website Video Link Tool Link

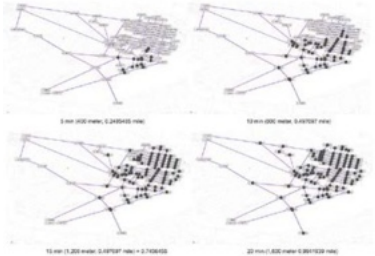
BACKGROUND
Energy is very essential resource in modern societies, Every major city in the earth consumes diverse type of energy such as fossil fuel, electrical energy, and etc at the expanse of our environment. Climate change has beome more important issu on modern society. However, everyday life , we need certin amout of energy to guarantee our live. Among the major energy consumption in cities, transform is major issue and it could be reduced.



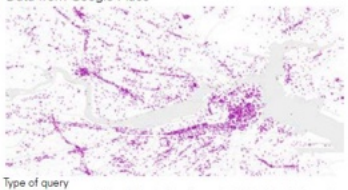
Urban population is a lager than rula areas, is concentrated on a area to deal with in term of urban mobility.



In this project, mobility energy is considered as numerical data in urban context and compute them to find better way of understading tranfortation. Based on walkerable distance, the data in the graph are computed.



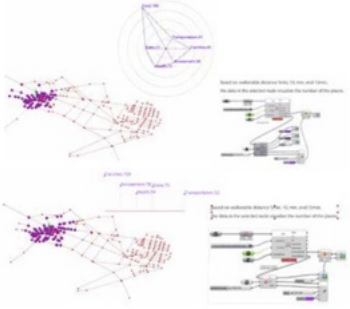
Data from Google Place



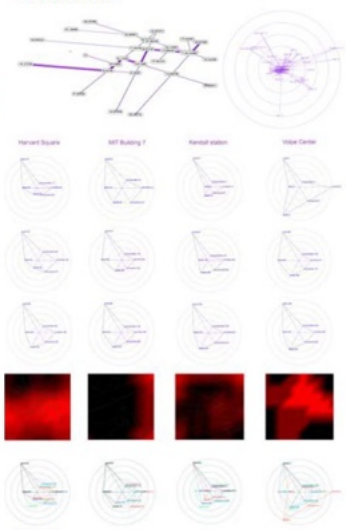
Type of query

'parking', 'veterinary_care', 'airport', 'plumber', 'roofing_contractor', 'atm', 'meal_takeaway', 'hair_care', 'insurance_agency', 'school', 'synagogue', 'stadium', 'movie_theater', 'doctor', 'zoo', 'electrician', 'establishment', 'funeral_home', 'spa', 'aquarium', 'storage', 'casino', 'park', 'courthouse', 'hospital', 'subway_station', 'painter', 'moving_company', 'movie_rental', 'embassy', 'fire_station', 'gym', 'bicycle_store', 'local_government_office', 'book_store', 'police', 'florist', 'museum', 'lawyer', 'car_rental', 'real_estate_agency', 'physiotherapist', 'electronics_store', 'hindu_temple', 'car_dealer', 'jewelry_store', 'gas_station', 'mosque', 'liquor_store', 'campground', 'library', 'university', 'accounting', 'travel_agency', 'finance', 'locksmith', 'bank', 'convenience_store', 'health', 'church', 'bakery', 'lodging', 'laundry', 'shopping_mall', 'dentist', 'store', 'cemetery

Graph data structure



Sites and results



summary
Mobility Energy Consumption
Basically, as to Mobility Energy Consumption in urban, it could be measured by computing Third place. In this research, the assumption is that 5 min, 10 min to 10 min walkable place could be considered as an identical area so that it can be characterized and visualized as a radar plot.

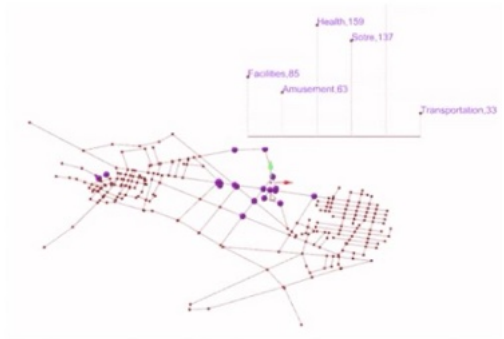
Data manipulation
Google Place is harnessed as key data for Third place in the areas, and Graph structure is utilized for data manipulation. Node in the Graph has a its own Google Place data within distance, and Edge is for computing distance in the urban network of the city.

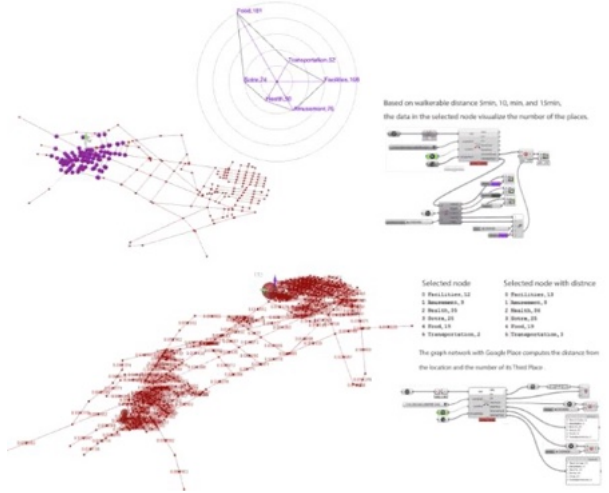
Data visualization
For Harvard Square, high density is shown compared to other places for example there are 110 food places in 5-min walkerable areas. For Volpe Center, the number of food place start from 6 places. However, it is rapidly increased due to the Cambridge Side Galleria.

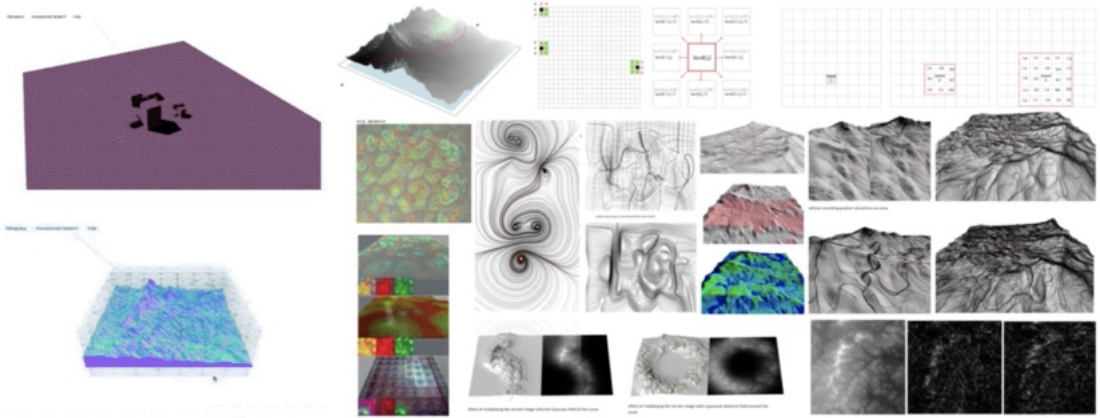
Conclusion
This research reveals the Mobility Energy Consumption for Third place. Thus, it allows designer to improve the Mobility Energy by remove or add the place catabolized into 1: Facilities, 2: Amusement, 3: Health, 4: Store, 5: Transportation.

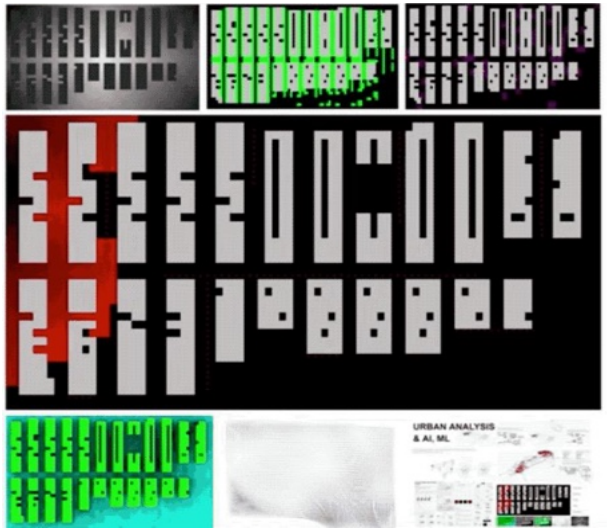
Tools

URBAN ANALYSIS & AI, ML









Properties

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Comfort

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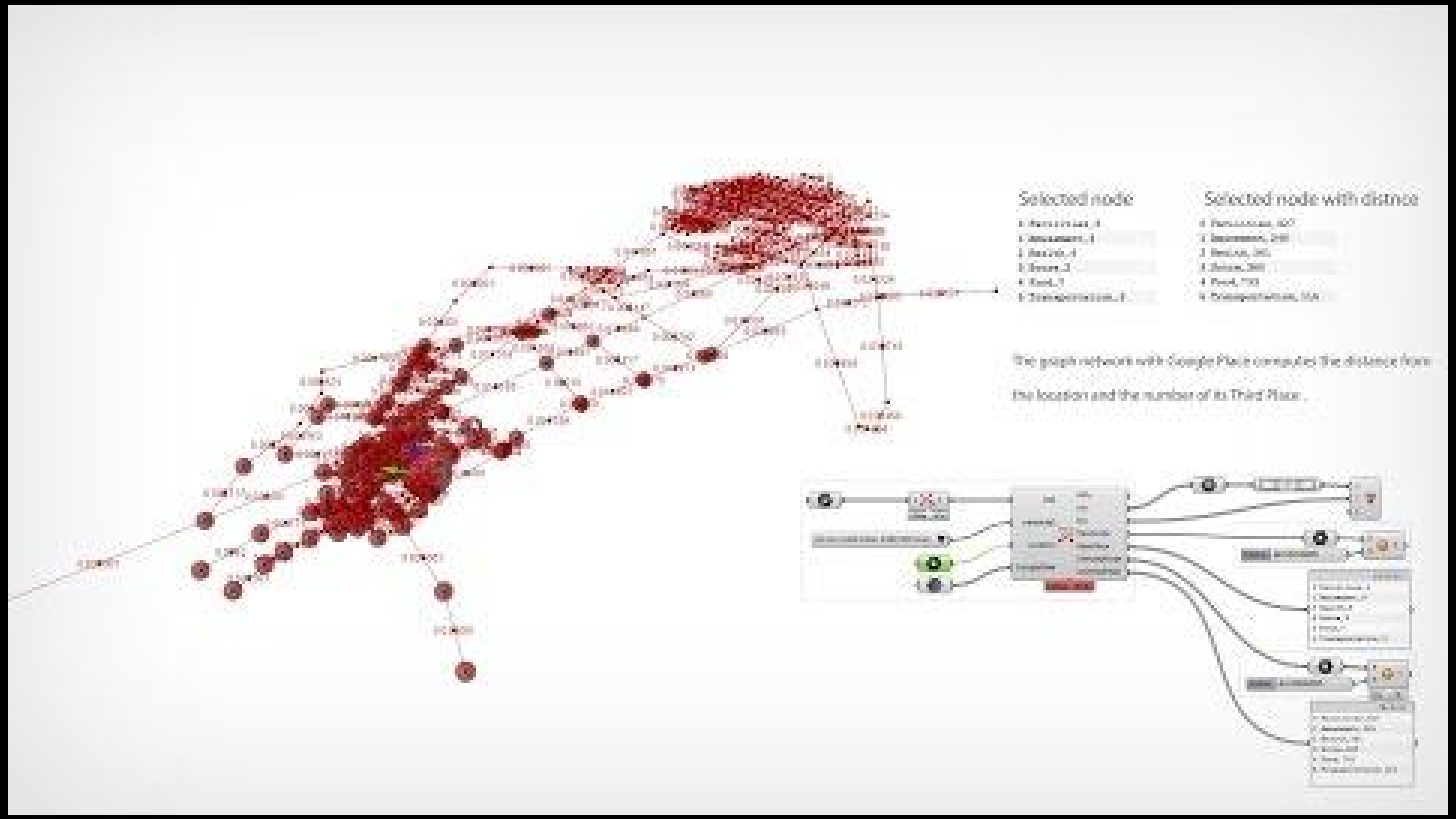


https://namjulee.github.io/njs-lab-public/work?id=2016-mobility-energy-consumption-mit-media-lab

Third Place Prediction model, Boston, LA, Redlands

Data process, Model A, Model B, Implementation

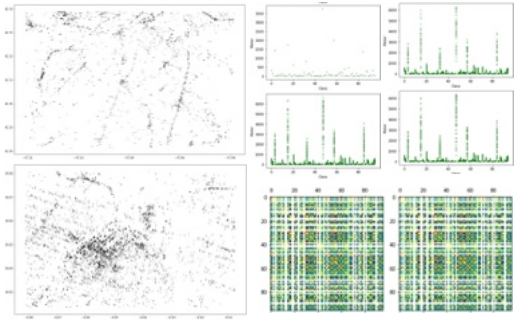
Medium(Eng): https://lnkd.in/gEzKJxYu

Brunch(Kor): https://brunch.co.kr/@njnamju/148

Source code: https://lnkd.in/gdf6d8j7

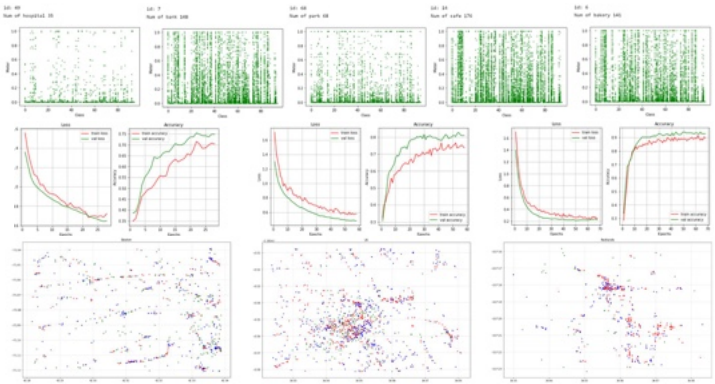
Lecture: https://namjulee.github.io/Data-Design-AI-for-Urban-Data-and-Viz-Harvard-GSD-public/

95 Class

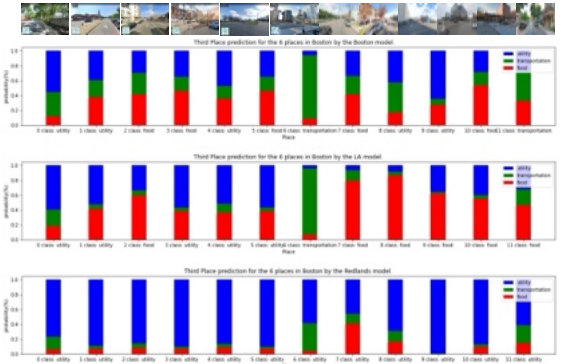


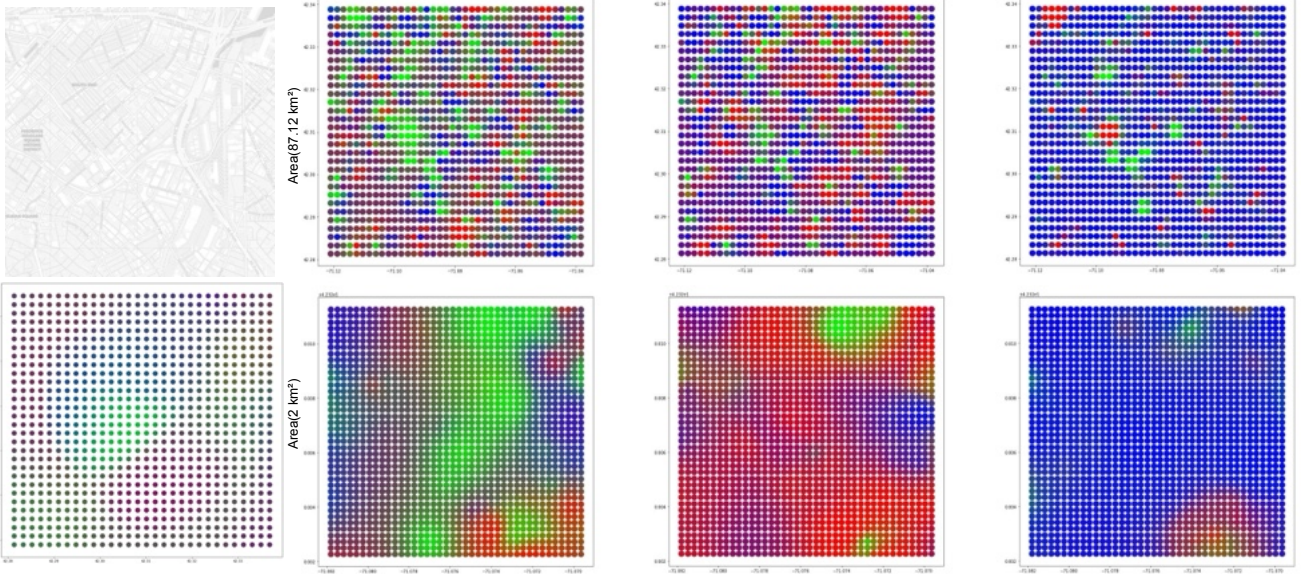
Third Place prediction results in Boston

South Station Boston, MA | 5 Southampton St, MA | 797 Columbia Rd, Boston, MA



Boston, MA | Los Angeles, CA | Readland, CA





Area(87.12 km²) | Area(2 km²)

Food | Transportation | Utility

Boston, MA | Los Angeles, CA | Readland, CA

02. Built Environment Assessment for the Housing Value Prediction

Date : 2016 Fall
Type : CS 109 Data Science, John A. Paulson School of Engineering and Applied Sciences, Harvard University
Role taken : **research, design, drawing ,modeling, visualization**
Critic : Prof. Pavlos Protopapas, Kevin Rader, Weiwei Pan
Team: Jia Gu, Eille Jungmin Han

http://www.njstudio.co.kr/main/project/2016_HarvardCS109_DataScience/index.html

Is there any relationship between Built environment and housing and rent prices?
This question motivates us to investigate to emerge the relationship between social economic aspect (housing and rent price data) and urban spatial data (Built environment data) in City of Boston.

Methodology.
We define city infrastructural data such as the current housing price, energy consumption of the area, income of neighborhoods, transportation accessibility, green space in the neighborhoods, specific housing features, and crime rates as "top-down data". We also define informal crowd-sourcing data such as, twitter texts, Instagram tags, or yelp reviews as "bottom up data" . There is a third category of data that has not been widely deployed yet which we define as the "holistic visual data". It is the general impression to your visual surroundings when you at a specific spot that we believe can be captured by google street views.

By testing on the data of visual surroundings as dependant variables, we hope to capture missing information from the top down data and therefore tell if the visual environment is a significant feature in a housing prediction analytical model. We use machine learning methodology to pre process Google street views to give certain attributes. To combine different data sets (from top-down to bottom-up) into one file for machine learning, we use graph data structure. Basically, we collect information on different locations and merge them together in specific pixelized grid based data points utilizing graph structure.

Step 1 :Data Parsing
Parsing, clearing, and data structure

Step 2 :Data Exploration
Data Visualization and Exploration

Step 3 :Leraning Housing Price
Lasso, ridge, RandomForest Regression, and ETC

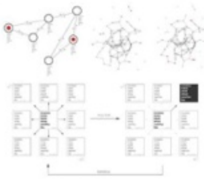
Step 4 :Leraning Renting Price
KNN, Lasso, ridge, RandomForest Regressor, PCA for Logistic Regression, Decision Tree, Random Forest Classifier, and ETC

Step 5 :Conclusion
the conclusion of the research

1. Data Parsing

There are two different data sets: 1) social economic data representing city of boston as a social aspect such as land price, crime, energy usage, and so on, 2) Urban spatial data representing city of boston as a urban.

Data Structure : Graph and Pixel Data



SOCIAL ECONOMIC DATA
Renting Prices Data From Trulia
data type : numeric and category
featrues: umber of room and bathroom, zip, address, date, rent price, SQFT(Square Foot/Feet)

Housing Prices Data From Zillow
data type : numeric and category
featrues: geographic coordinate, last_sold_price, number of bathrooms and bedrooms, zestimate amount, prices, property size, zip, tax year, status, address, last sold date, tax value, year built, home_size, home_type, property

Energy data in Boston from Boston Data
data type: numeric and category
featrues: Site EUI, geographic coordinate, Tax Parcel, Years Repo, Site Energ, ZIP, ShapeSTLen, Energy Star, Pct Gas, Reported, Pct_Elect, Address, GHG Intens, Year Built, Property T, Water Inte

Crime data in Boston from Boston Data
data type: numeric, string, and category
featrues: year, type of crime, geographic coordinate

Poperties Assessment in Boston from Boston Craigslist
data type: numeric, string, and category
featrues: average land values, geographic coordinate

House and Room post data in Boston from Boston Craigslist
data type: numeric, string, and category
featrues: date, title of post, content of post, geographic coordinate

URBAN SPATIAL DATA
google place from Google place API
data type: numeric, string, and category
featrues: geographic coordinate, type of places(school, food, MBTA, etc...)

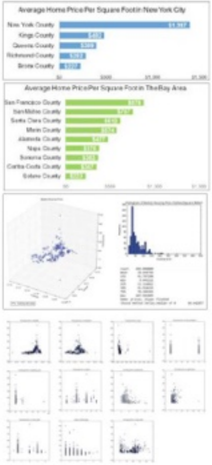
google street view from Google street API
data type: image
featrues: RGB values and mathematical numerical features

2. Data Exploration

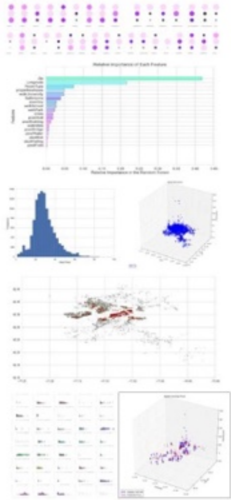
On top of the top down data (generated by the local government), the bottom-up data (post processing of Google Street Views, Google Places, and Craigslist Boston), and the top-down data(Crime data from Data Boston and hosing price data from Zillow) can be mapped and deployed for train and contrive the analytical model of predicting housing price. To process the google street view data, there are two data structures (pixel and graph data structure) where individual data are populated and calculated. Pixel data structure is a matrix, discretizing an urban or district into a finite setting for analysis, in which each pixel has the relationship with its neighbors, and each one computes its own data on the basis of neighbors' settings, so that urban data can be naturally addressed and computed in spatial context.

3. Learning Housing Price

We explored housing prices statistics and the relationshpi between Boston housing price and our dataset features. Boston's average housing price is around $58/m2 and the median is about $60/m2 while it has a range from $9.4/m2 to $447/m2, which ranks quite high nationally.According to Zillow home values report , the national average housin gprice is $13.2/m2.(http://www.zillow.com/home-values/)

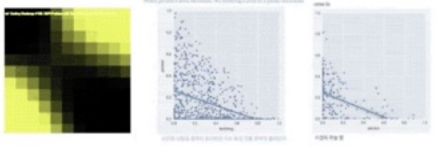


4. Learning Renting Price

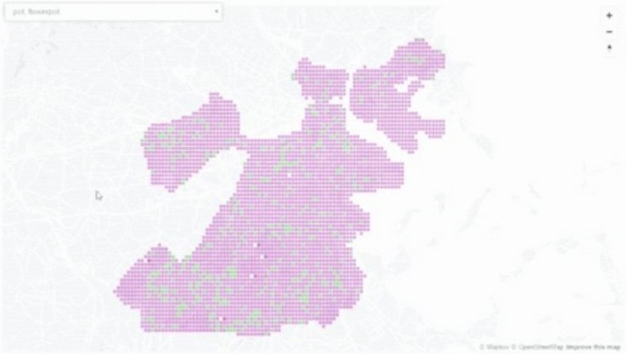


5. Conclusion

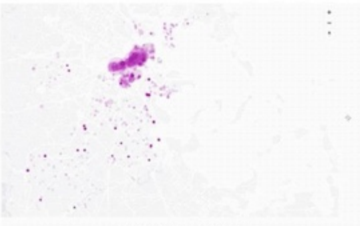
Intricated urban matrix needs to be organized such an order, but there are multiple factors effecting urban issues including land values and housing prices. From our project, it can be said that decision



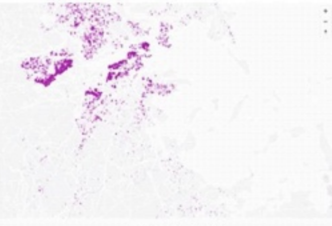
Crime Data from Boston Data
number of data used: 5,001 crimes



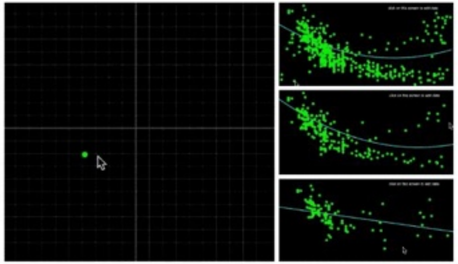
Data from Google street view + Deep Learning for semantic segmentation
Image data used: 18,588 images

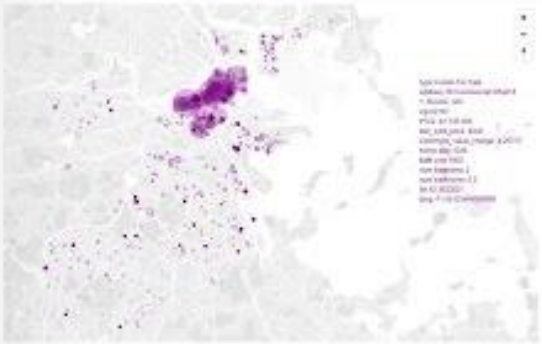


Housing Price data from Zillow
number of data used: 988 houses



Rent Price data from Trulia
number of data used: 13049 rents





Housing Price data from Zillow

number of data used: 988 houses

Rent Price data from Trulia

number of data used: 13049 rents

https://namjulee.github.io/njs-lab-public/work?id=2016-harvard-cs109-data-science-research

"Politics of Space and its Shadows" in the Seoul Biennale International Studios (SBIS):

Date : 2017
Type : architectural urban research exhibition
Role taken : **Research and Visualization**

Link

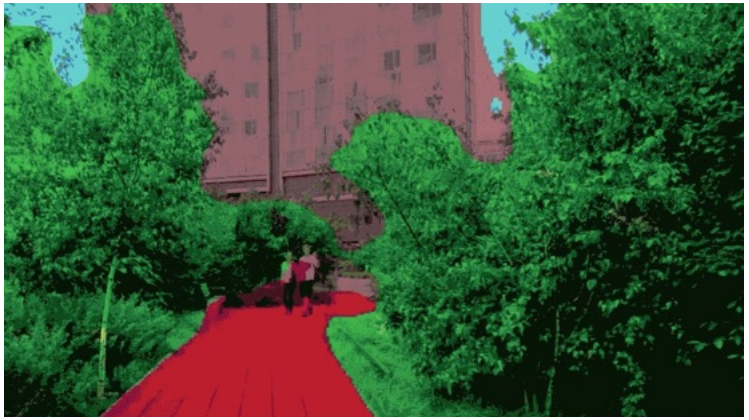
Overview of Project

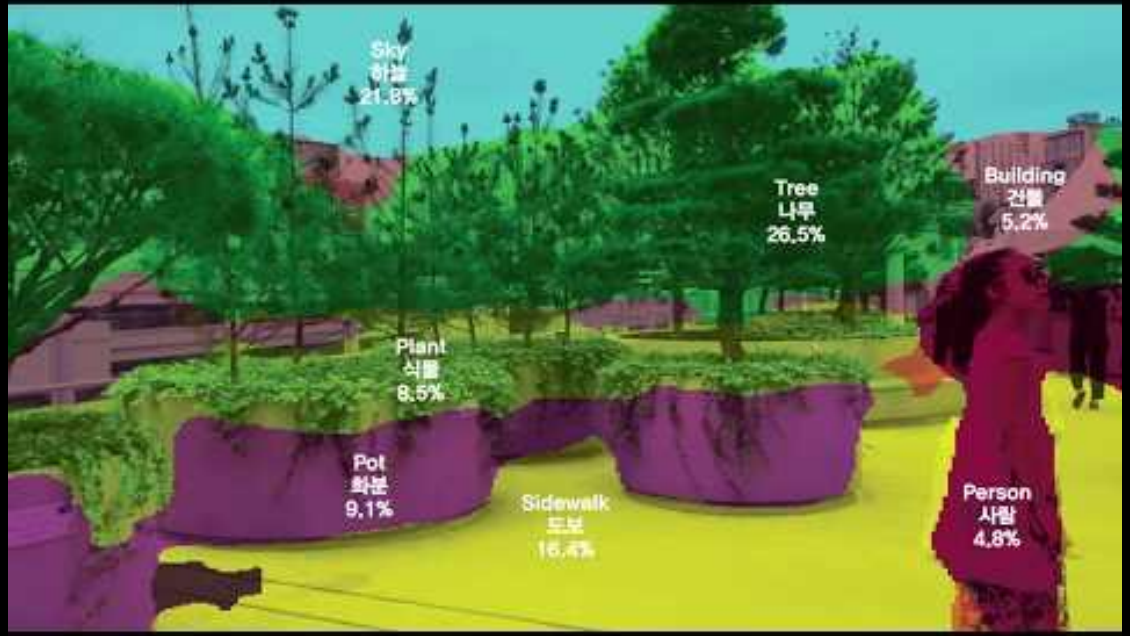
This project examines how the changing urban environment is perceived by the public and how they are represented through new emerging technologies. I developed a design pipeline for the project that enabled analyzing and visualizing big-data available to the public.

There are an enormous amount of big data being produced by the public, images posted on Instagram is such example. In parallel, there are emerging computational algorithms that process such big-data. However, the urban design discipline has not been able to meaningfully bridge the gap between these emerging technologies and the accumulating big-data. This project attempts to bridge this gap by examining new methods to use big data to better understand public spaces.

The technical workflow is as follows: 1) parse data 2) process data 3) analyze emerging result from the raw data. In the first step, I developed a program to download all images that people upload on the web in the site. By using Deep Learning, I analyzed the image data and converted them into numerical data for processing. As the last step, I classified the results using important keywords associated with the images. The result of this research was invited and exhibited at the Seoul Biennale International Studios (SBIS) exhibition curated by John Hong (SNU) at the inaugural Seoul Biennale of Architecture and Urbanism directed by Hyungmin Pai and Alejandro Zaera-Polo.

Link:
https://namjulee.github.io/nis-lab-public/work?id=2017-politics-of-space-shadows



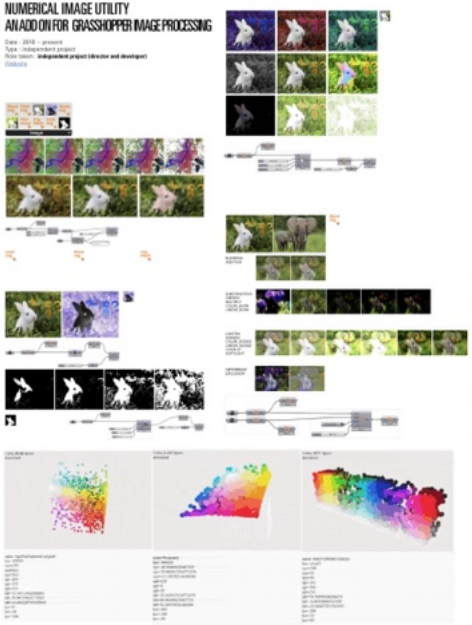


Link: https://namjulee.github.io/njs-lab-public/work?id=2017-politics-of-space-shadows

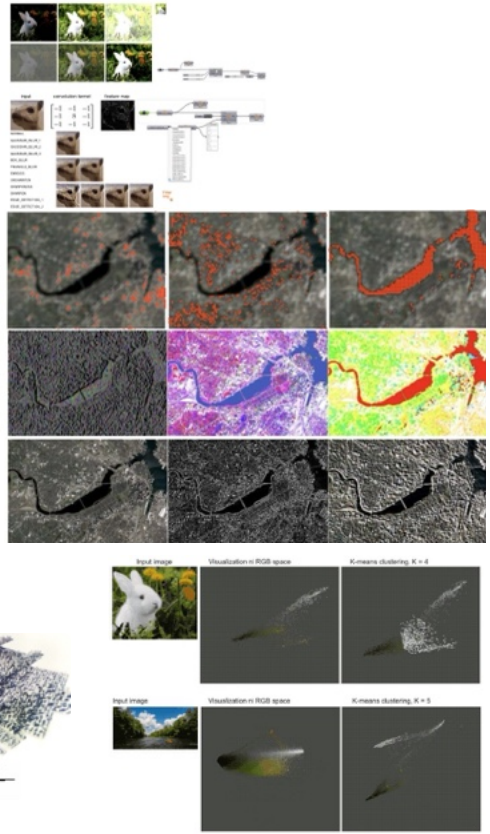
IMAGE PROCESSING

remote sensing / color processing

https://namjulee.github.io/njs-lab-public/work?id=2018-niu-development



Addon for Grasshopper
https://www.food4rhino.com/app/numerical-image-utility



AERIAL SEMANTIC SEGMENTATION

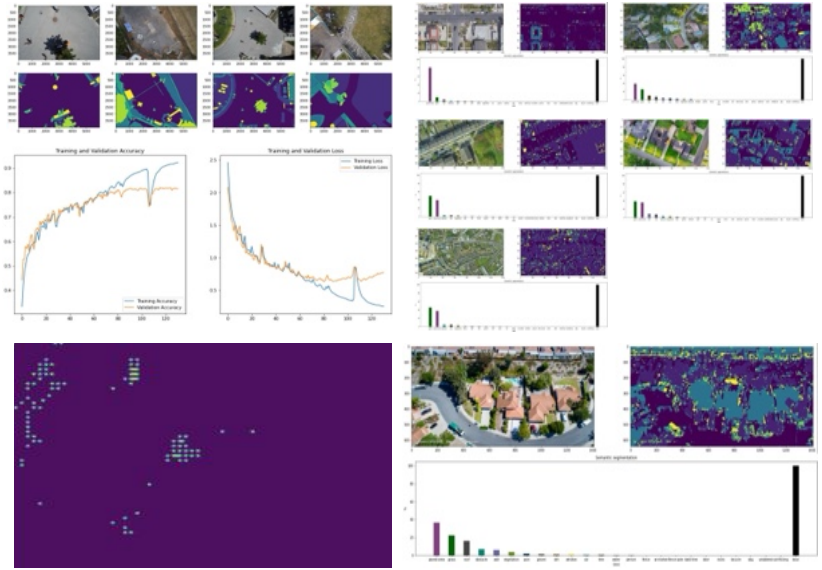
Machine Learning & Implementation

Link: https://computationaldesign.tistory.com/29

Reference: https://www.kaggle.com/datasets/bulentsiyah/semantic-drone-dataset

Classes

[unlabeled, paved-area, dirt, grass, gravel, water, rocks, pool, vegetation, roof, wall, window, door, fence, fence-pole, person, dog, car, bicycle, tree, bald-tree, ar-marker, obstacle, conflicting]



SMTracer

Sketch to Map Translator

ESRI Storymaps Hackathon
Link: https://computationaldesign.tistory.com/29

LANGUAGE
Python
Typescript

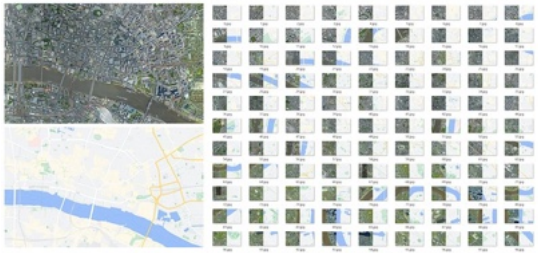
LIBRARY
Tensorflow, 2.5.0
CV2, numpy, PIL, ...
HTML Canvas, NJSCoreLib

PROCESS
1. Data Collections and Preprocessing:
2. Trains and Validations for each model:
3. Design, Visualization and Video:
4. Development for Sketch App:

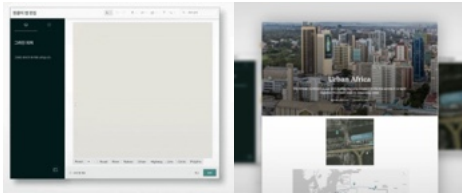
MODEL(NETWORK)
pix2pix: Image-to-image translation with a conditional GAN (a modified U-Net)

Sketch-to-Map Translator

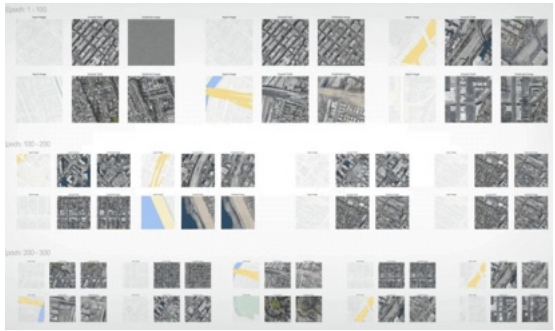
Data collection and preprocessing



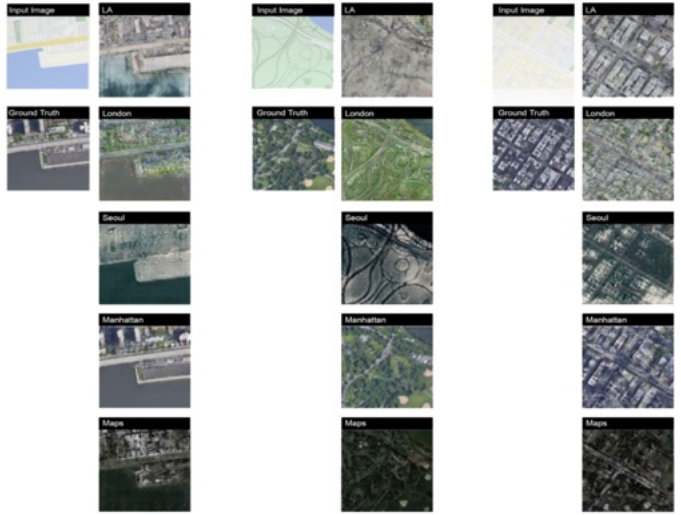
Sketch App



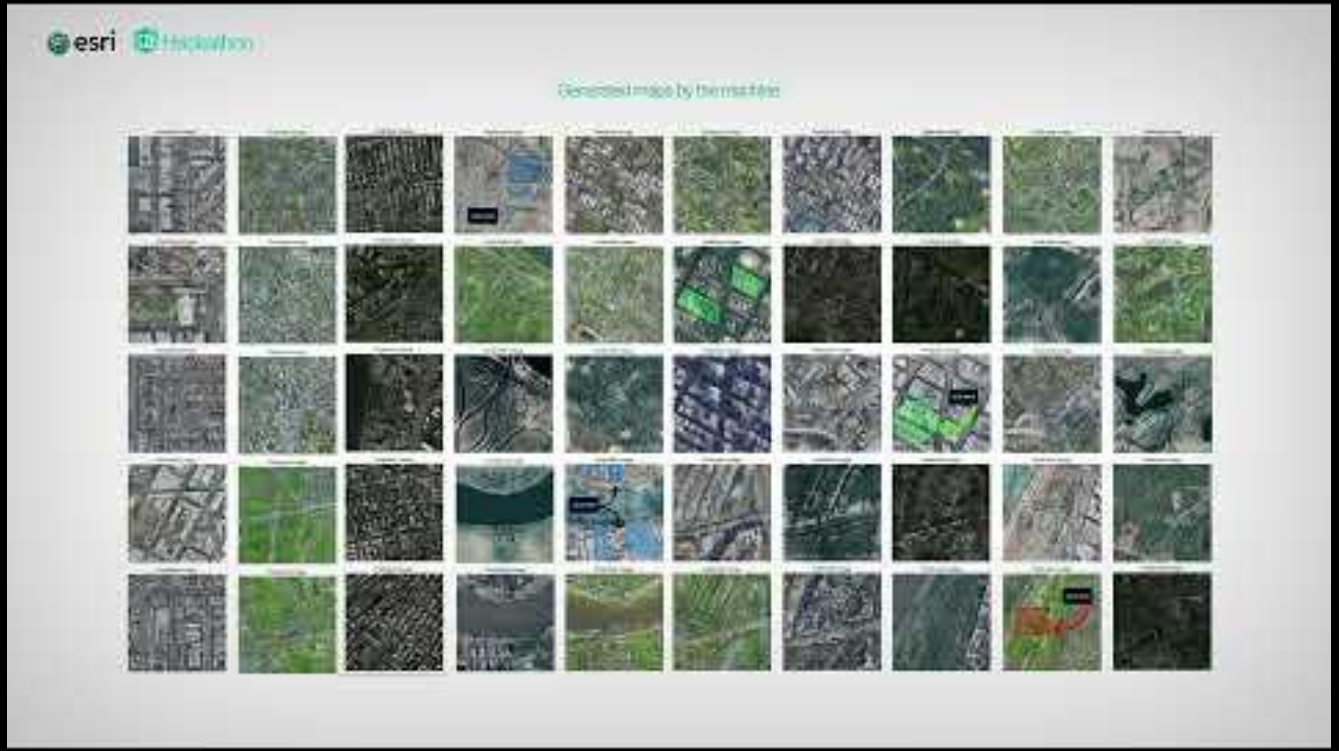
Training and Predictions



Generated maps by different city looks(Seoul, London, Manhattan, LA ...)



Generated maps by the machine



https://namjulee.github.io/njs-lab-public/work?id=2021-smart-map-tracer

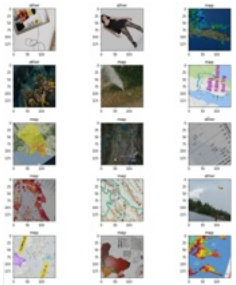
Map Classifier

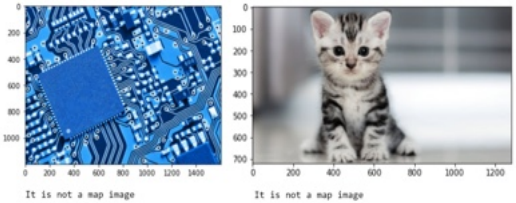
Machine Learning & Implementation

Link: https://computationaldesign.tistory.com/29

Classes

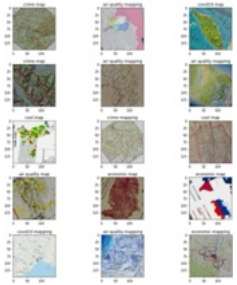
2 : [map, other]

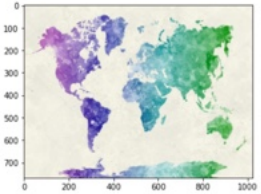




Classes

22: [air quality map, air quality mapping, cool map, cool mapping, covid19 map, covid19 mapping, crime map, crime mapping, economic map, economic mapping, fire map, fire mapping, forest map, forest mapping, national park map, national park mapping, population map, population mapping, traffic map, traffic mapping, weather map, weather mapping]





weather map

	air quality map	cool map	covid19 map	crime map	economic map	fire map
0	0.000885	0.000079	0.000001	0.005158	0.00055	0.000002

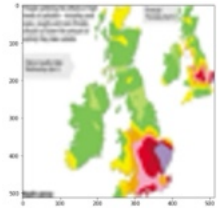
	forest map	national park map	population map	traffic map	weather map
0	0.000012	0.000017	0.00068	0.000472	0.992143

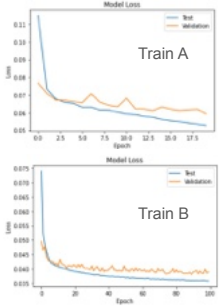
Map Super Sampling

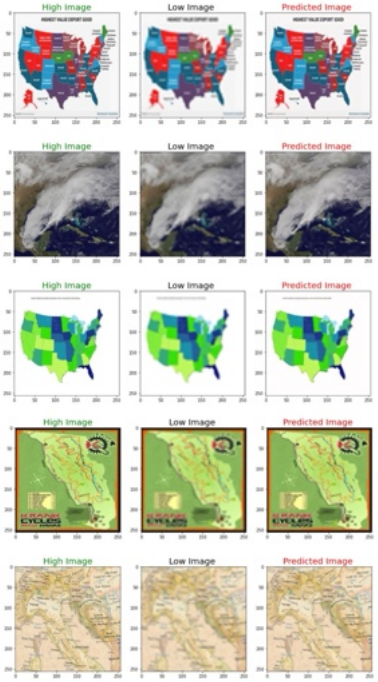
Machine Learning & Implementation

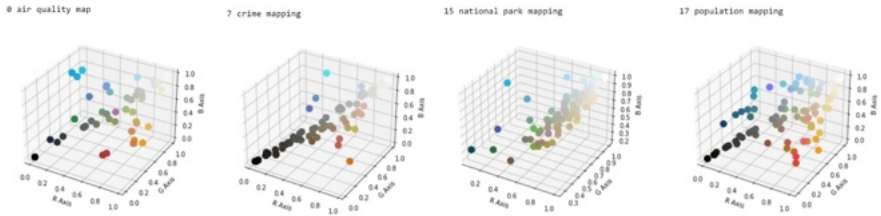
Link: https://computationaldesign.tistory.com/29

Train data : 3,000 (maps)







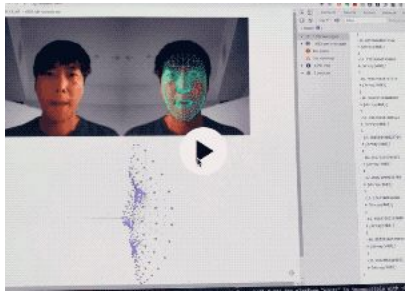


THE COLOR AI

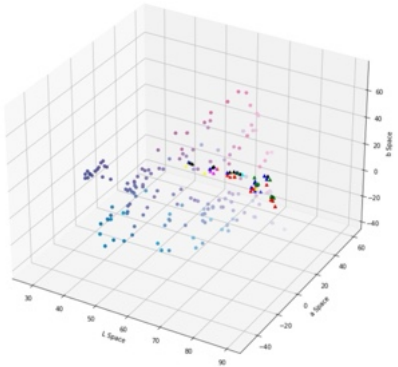
Machine Learning & Implementation

Link: https://computationaldesign.tistory.com/29

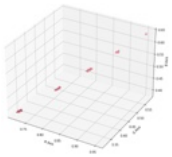
Personal Color & prediction and implementation

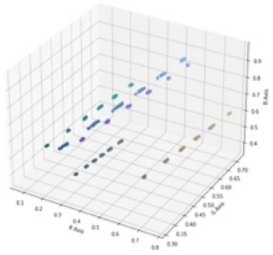


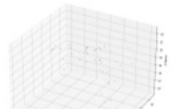
Demo

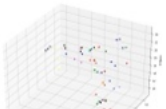


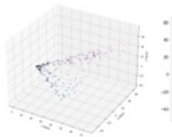
Texture detection

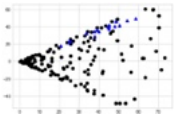










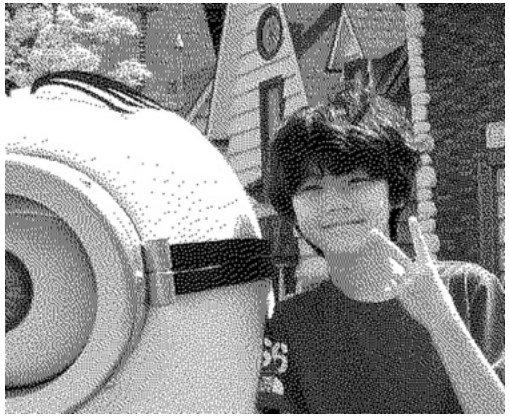


REST API and Image Processing

Machine Learning & Implementation

Link: https://computationaldesign.tistory.com/29

Demo

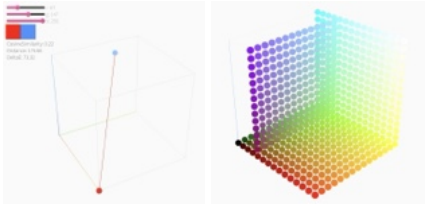


Demo

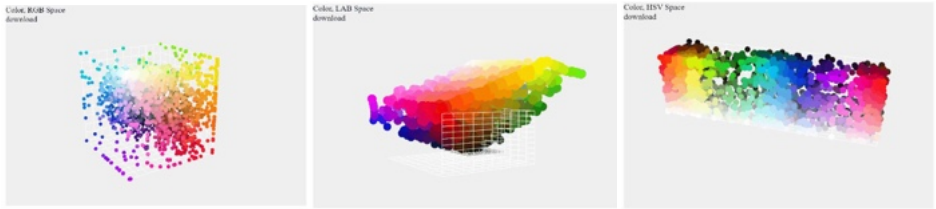
Demo

COLOR DATA

colors spaces

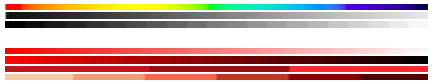


Color Difference



Color Space

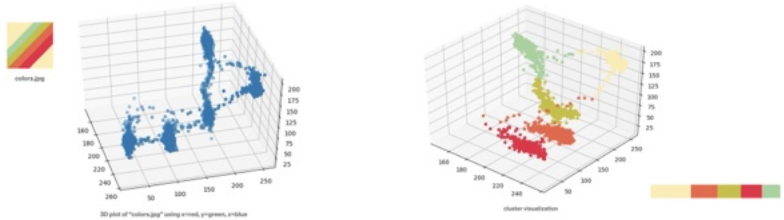
color as scales



https://namjulee.github.io/nis-lab-public/lab/color/color%20space?ui=0

Dominant colors

in an image using k-means clustering



Ref.: https://buzzrobot.com/dominant-colors-in-an-image-using-k-means-clustering-3c7af4622036

NNA, NUMERIC NETWORK ANALYSIS TOOLBOX

Lecture:
https://namjulee.github.io/njs-lab-public/work?id=2020-discrete-urban-space-connectivity

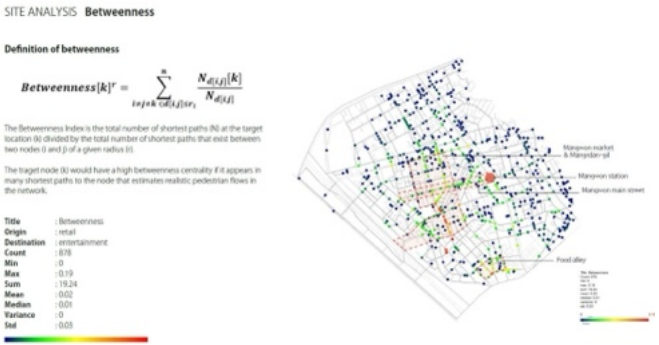
Medium:
https://nj-namju.medium.com/numeric-network-analysis-post-covid-19-urbanism-6-ft-rule-de267886b028

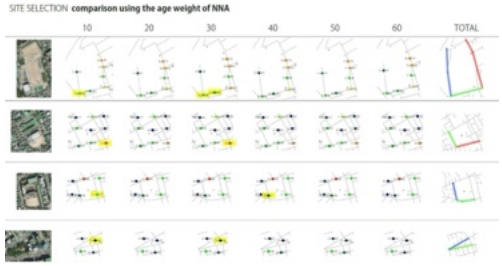
Addon For Grasshopper
https://www.food4rhino.com/app/numeric-network-analysis-nna

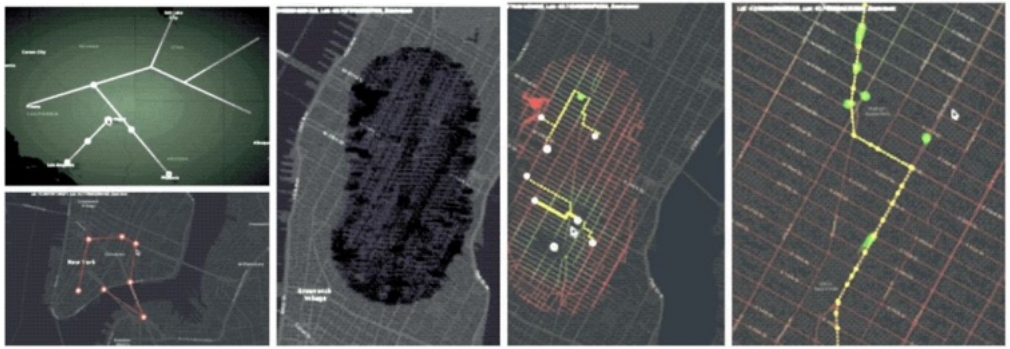
Lecture, NYIT
https://youtu.be/_9l7dp5q6A0

Accessibility Analysis
Reach, Gravity, Huff-model

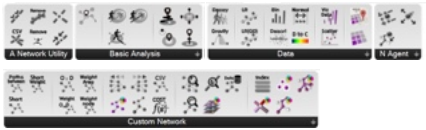
Centrality Analysis
Betweenness, Closeness, Straightness, Degree

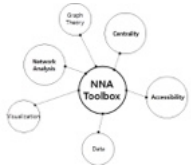






Graphic User Interface for the GH implementation

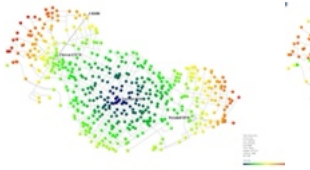




Degree
(No. connectivity at each node)

In graph theory, **Centrality** estimates to determine the **hierarchy of nodes or edge within a network**. The centrality analysis uses for diverse urban scales for local and global. A local centrality defines the distance between nodes within a given radius and a global centrality calculates the distance between nodes in a whole system. The Centrality Index is useful to understand the operational analysis of network flow tendency in transportation geographies, such as airline networks, road networks, and canal networks. As well as it measures to understand a node (location) importance in space.

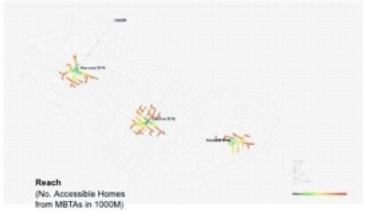
Betweenness
(Home to MBTAs)



Closeness
(Home to MBTAs)

Straightness
(Home to MBTAs)

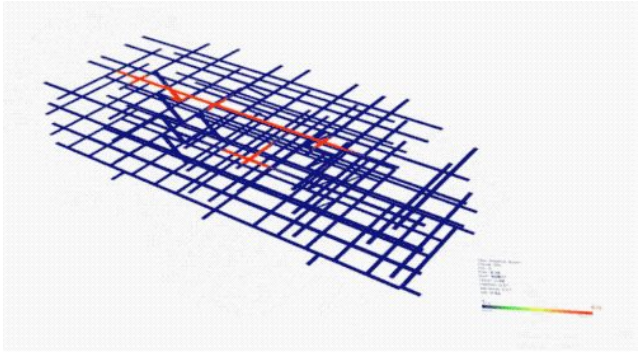
Huff
(Probability to visit locations)

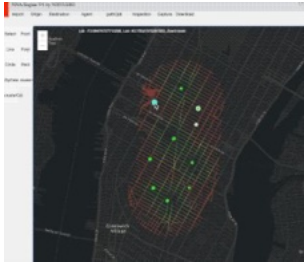


Reach
(No. Accessible Homes from MBTAs in 1000M)

Gravity
(Discounted No.accessible Homes from MBTAs in 1000M)

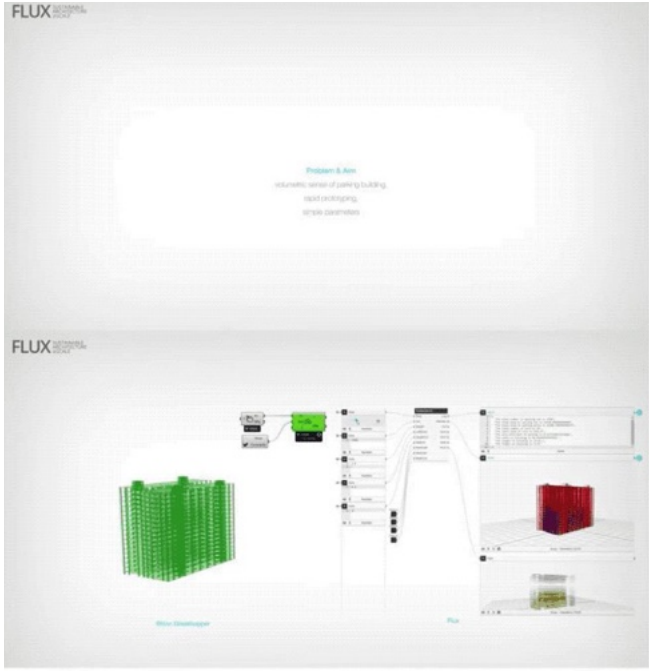
Accessibility analysis has been researched in the field of physical planning and spatial modeling for over 50 years. The concept of accessibility explains both **activity patterns in space** and the **connections between activities** linked to Newton's law of gravity. Hansen's "How Accessibility Shapes Land Use" (1959) was the first defined paper about accessibility as a potential of using urban planning.

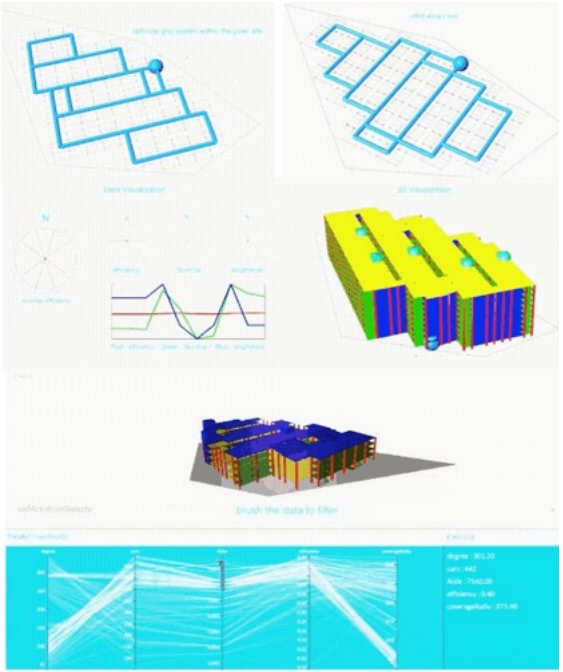


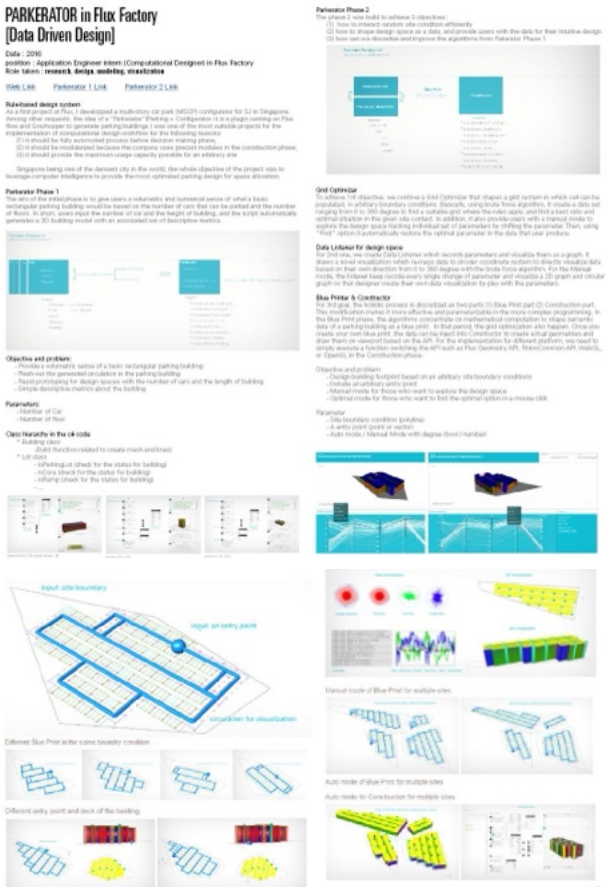


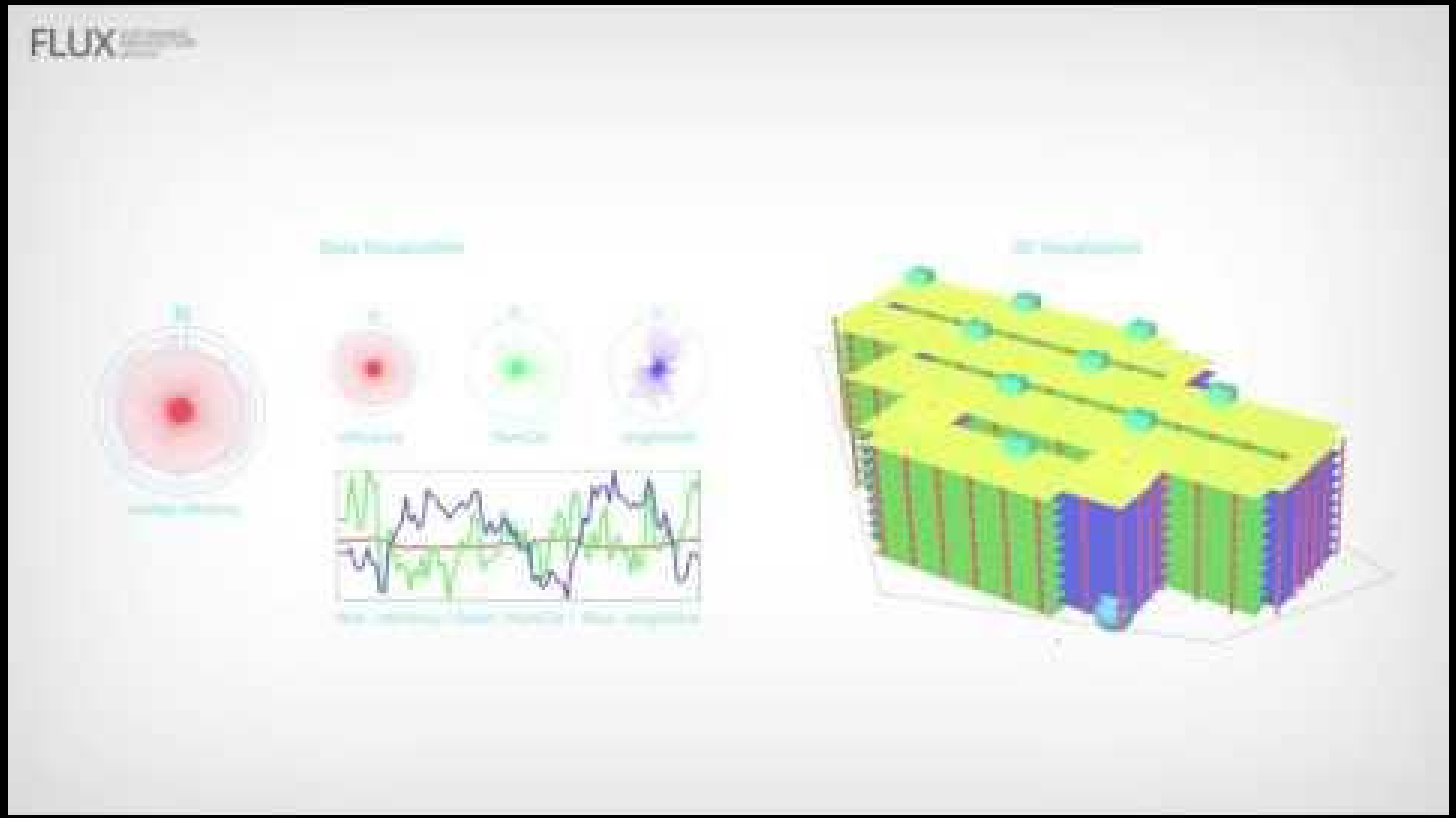
PARAMETRIC & OPTIMIZATION 2016

https://namjulee.github.io/njs-lab-public/work?id=2016-parkerator-flux-factory





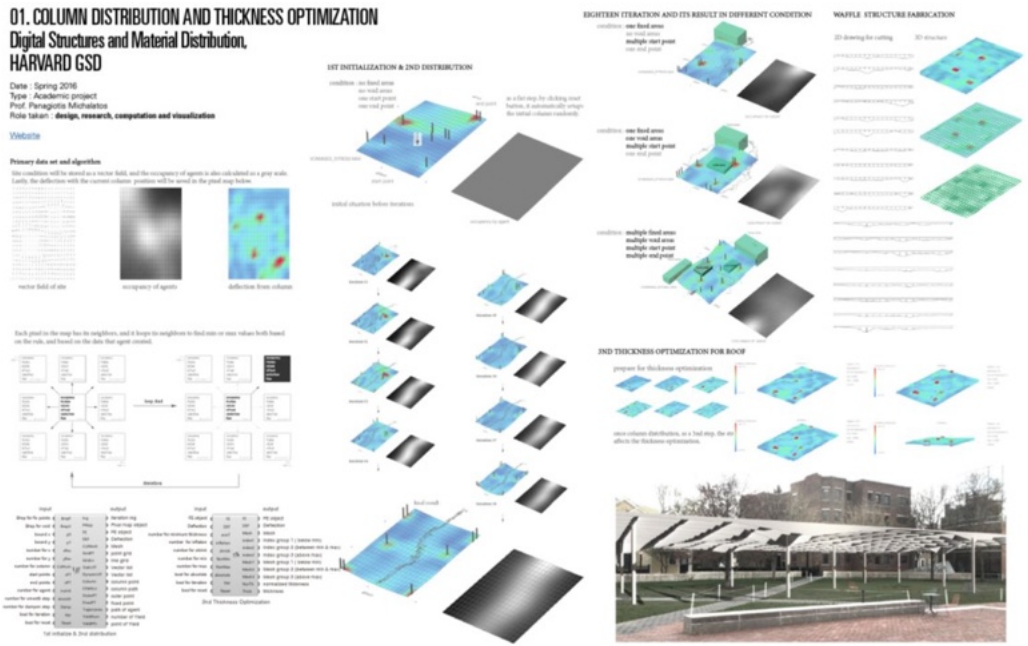


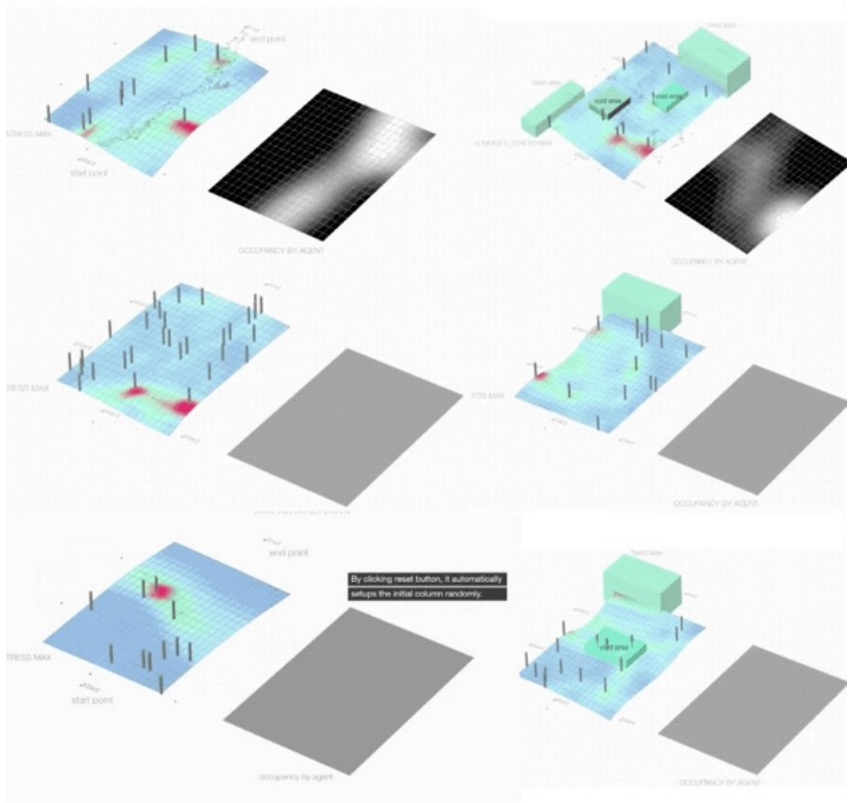


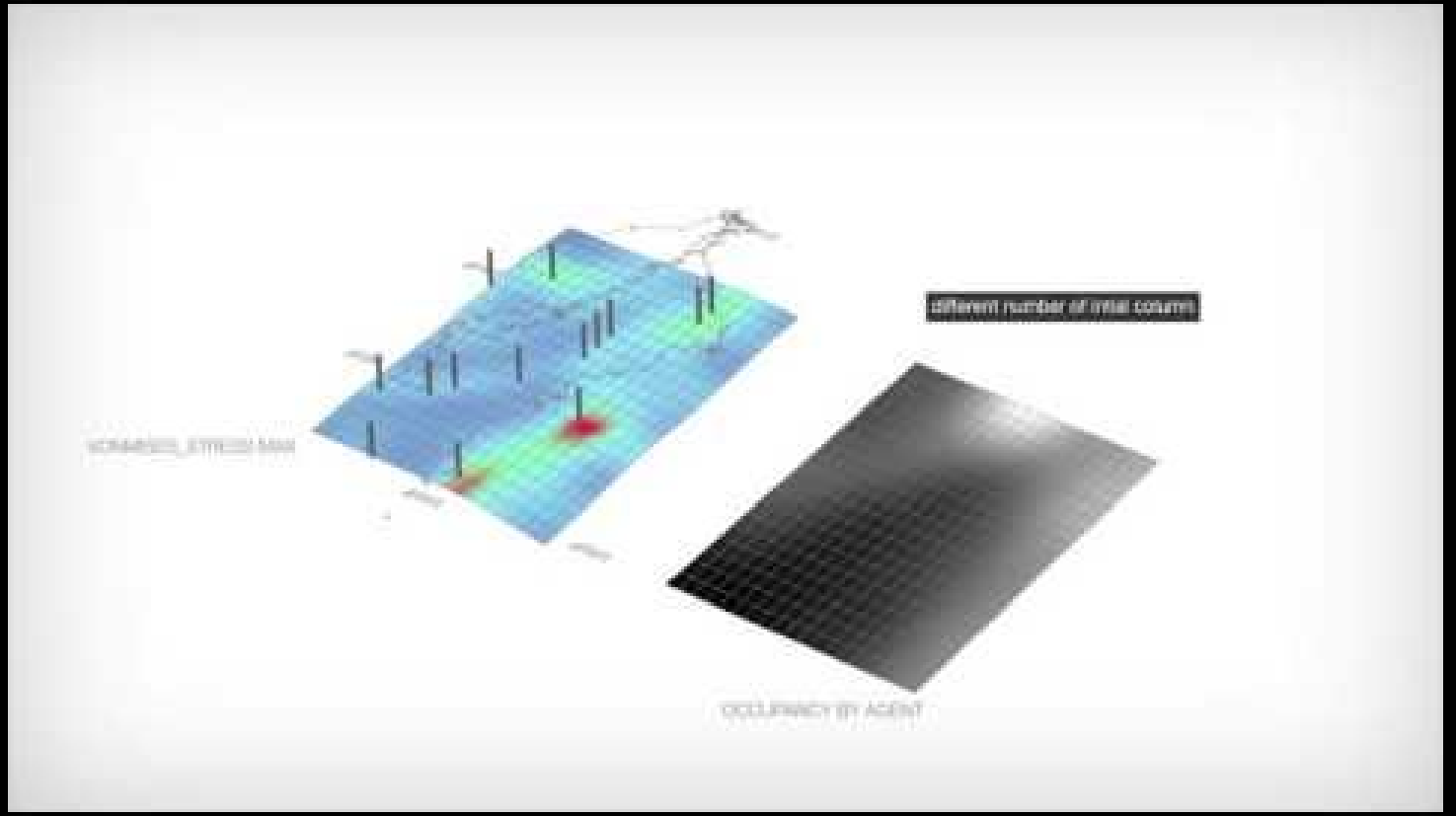
https://namjulee.github.io/njs-lab-public/work?id=2016-parkerator-flux-factory

STRUCTURE & OPTIMIZATION

https://namiulee.github.io/njs-lab-public/work?id=2015-column-distribution





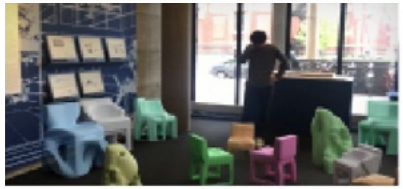


https://namjulee.github.io/njs-lab-public/work?id=2015-column-distribution

DESIGN SYSTEM & AI, ML
VOXEL REPRESENTATION

Long:https://namjulee.github.io/njs-lab-public/project/2017-thesis-voxel-harvard-gsd/public/

Short: https://namjulee.github.io/njs-lab-public/work?id=2017-thesis-voxel-harvard-gsd



REMIXING & RESAMPLING THREE DIMENSIONAL OBJECTS
Use of Volumetric Representations and Machine Learning in design

Date : 2016 – 2017
Type : thesis project at Harvard GSD
Role taken : **independent project**
Website

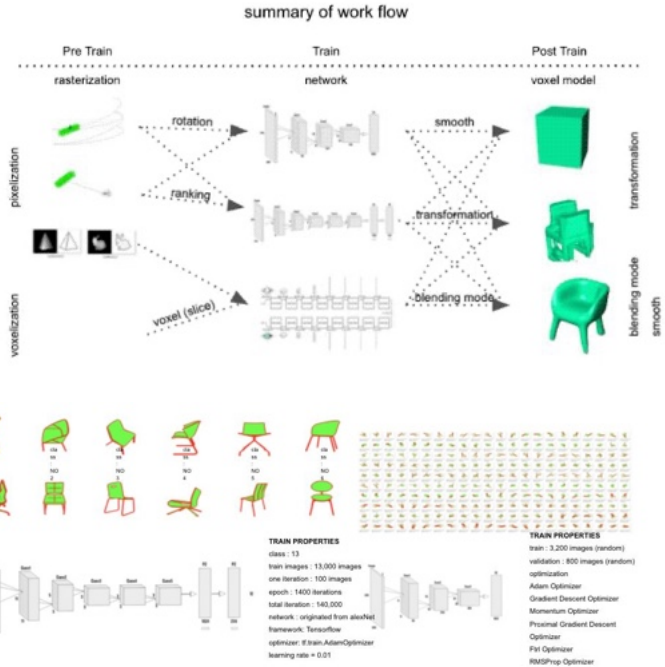
Digital Design Prize, class of 2017 Harvard GSD

ABSTRACT

This thesis aims to explore the opportunities of remixing and resampling three-dimensional geometry data with the use of volumetric representations and machine learning in design. A voxel is a volumetric element representing a fragment of space. There are various types of implementations of voxel representations in different fields such as game design, simulations, architecture, fabrication, medical or computational design.

This thesis consists of the following parts: First, It introduces what voxel modeling is, compared to traditional modeling techniques. It looks at the advantages and disadvantages of a voxel representation compared to conventional digital modeling techniques such as Mesh or NURBS modelling paradigms. It also describes characteristics of voxel space covering as pixelated and voxelated space, as a dense representation (implicit relations) compared to sparse representation (explicit relations), and its data manipulation in relation to voxel space.
Similarities of voxel representations and two-dimensional images, enable us to leverage the developments of the past few years in the field of image analysis and machine learning and extend them into the third dimension. Therefore, the second part of the thesis investigates the use of machine learning techniques with the opportunities for pixelated and voxelated representation of 3D geometry by analytical inference, numerical modification, and blending multiple volumetric geometries.

The thesis examines several prototypical implementations of proposed design systems or workflows, as a series of experiments based on the process from rasterization, (1) pixelated, (2) voxelated (3) depth, of 3D geometry with machine learning, (1) convolutional neural network(CNN) and Generative Adversarial Networks(GAN), In order to show new types of geometries by voxel blending.



voxel by slicing

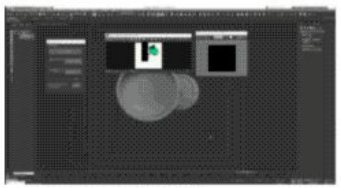
voxelated geometry

blend modes

blend A to B

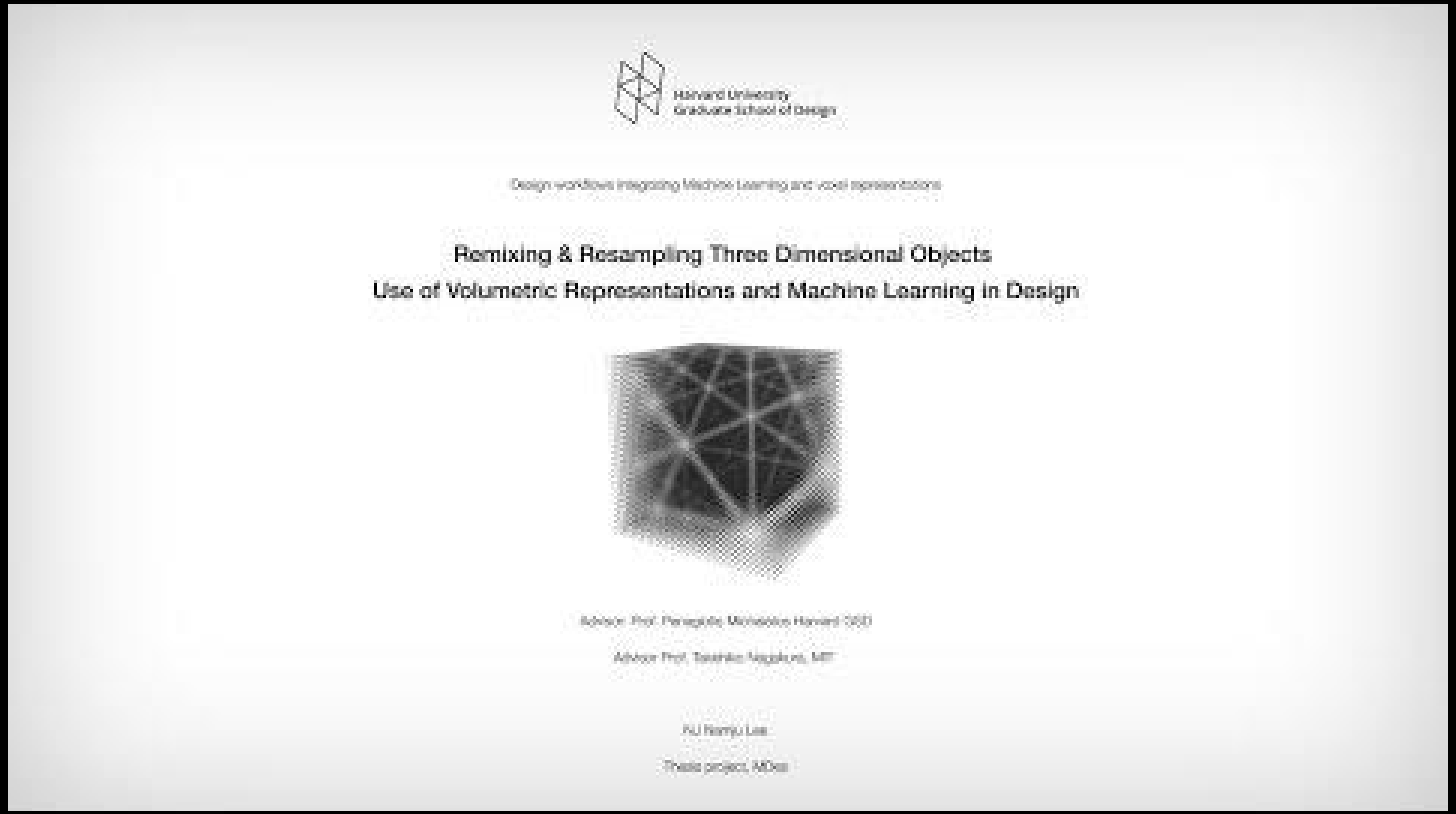
smooth

smooth



rendering

slice mesh with Monolith

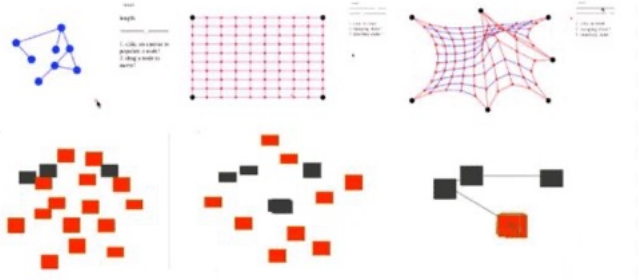


https://namjulee.github.io/njs-lab-public/work?id=2017-thesis-voxel-harvard-gsd

Geometry and Position Optimization

based on graph and spring model physics

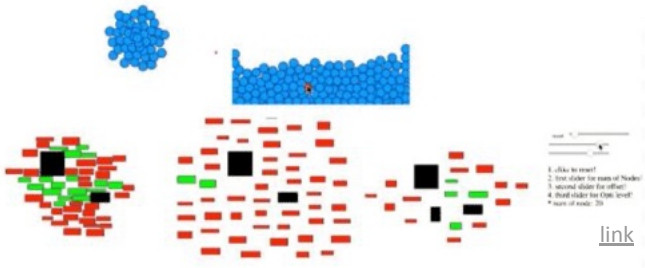
Position Optimization
based on graph and spring model physics
Experimentation for overlapping text boxes
with constraints



link

link

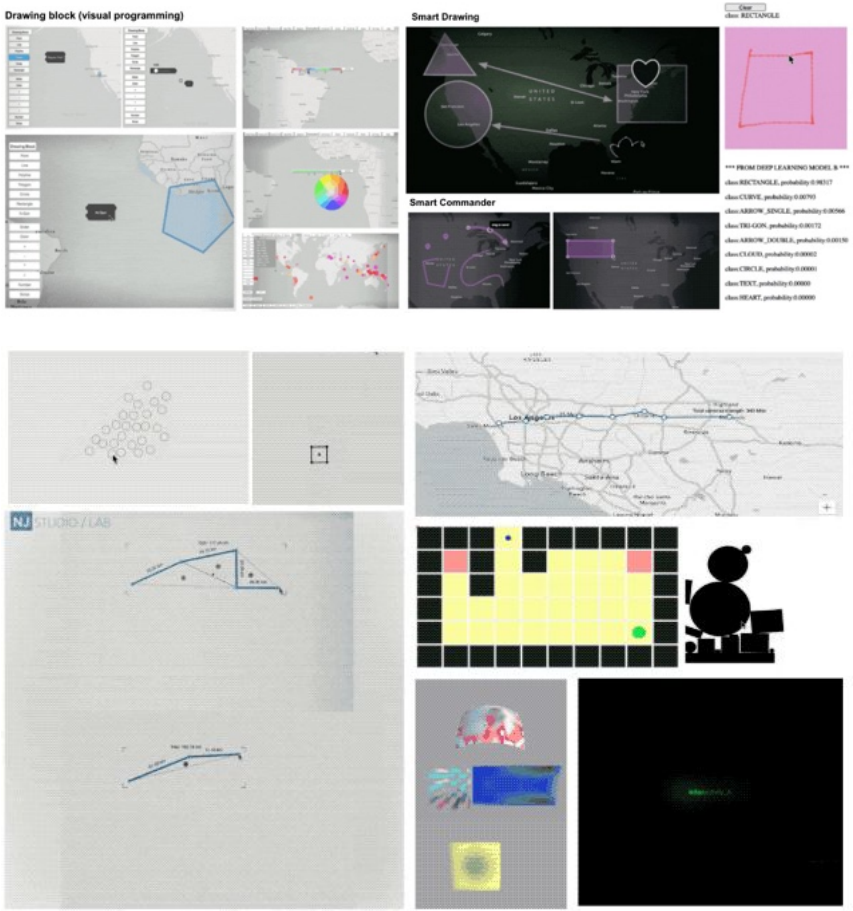
Position Optimization, Second
agent-based optimization
and physics engine
with different level of optimization and offset



link

Advanced Geometry manipulations

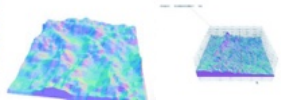
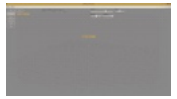
Dynamics, Spring, Voxel, Shader ...

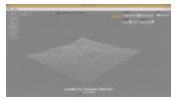


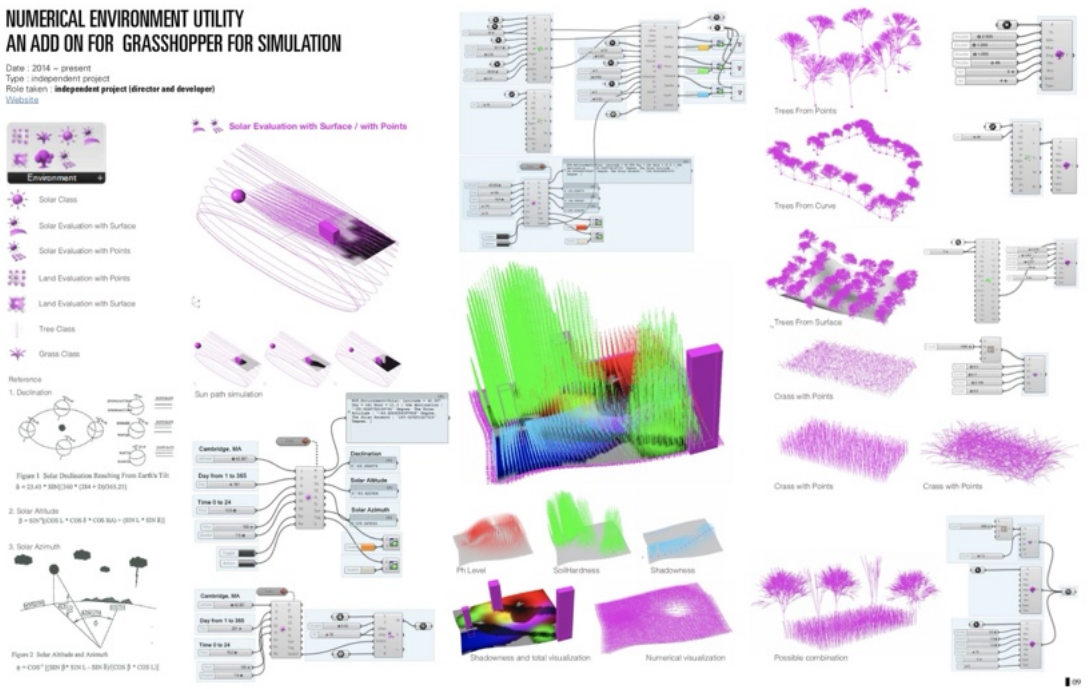
LANDSCAPE & ENVIRONMENT

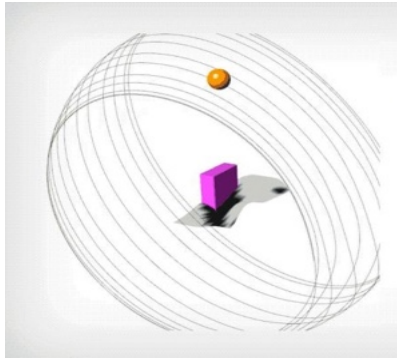
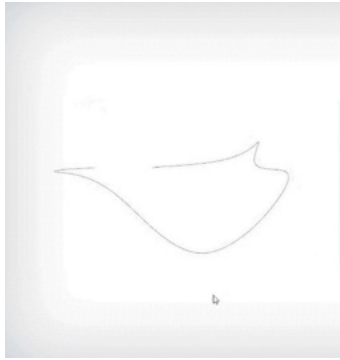
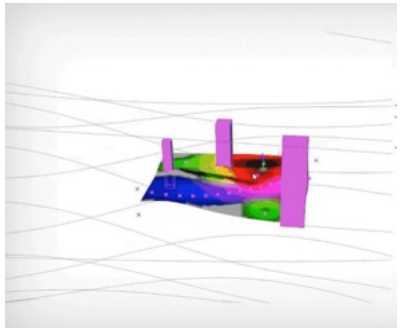
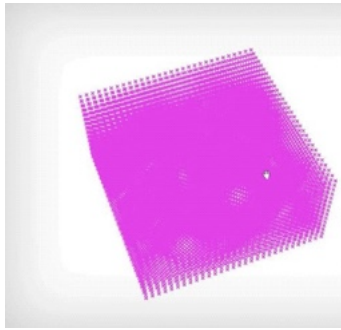
https://namjulee.github.io/njs-lab-public/work?id=2015-neu-development

Addon for GH
https://www.food4rhino.com/app/numerical-landscape-utility





Numerical Environment Utility

data in pixel and voxel, Version 2015

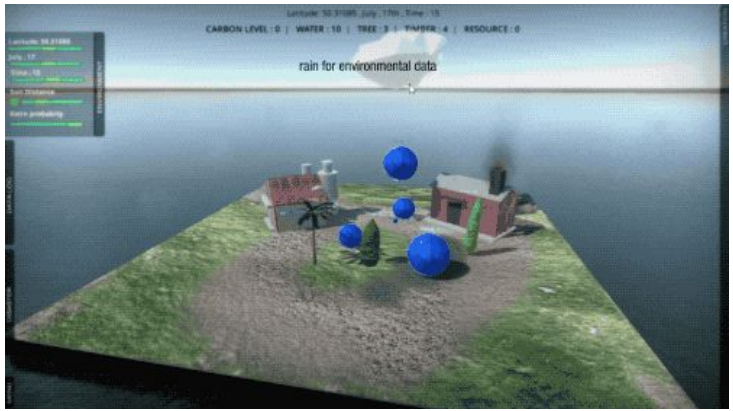
www.njstudio.co.kr

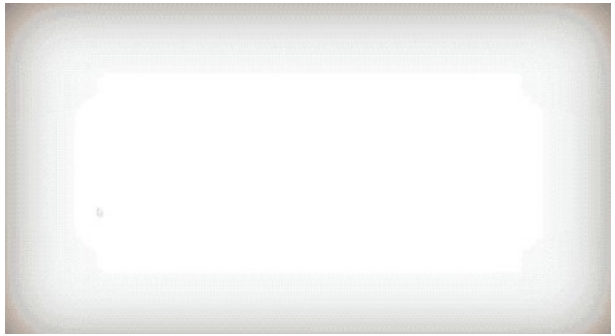
https://namjulee.github.io/njs-lab-public/work?id=2015-neu-development

https://namjulee.github.io/njs-lab-public/work?id=2015-landbox-for-ar-development

DESIGN SYSTEM & COMPLEX SYSTEM

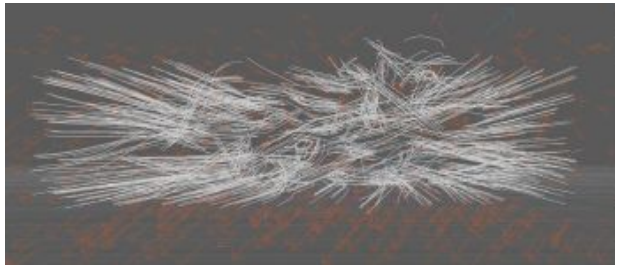
http://www.nistudio.co.kr/main/project/2016_SmallEnvironments/2016_SmallEnvironments.html

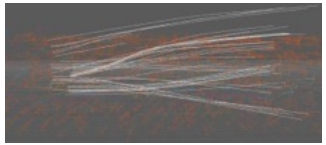


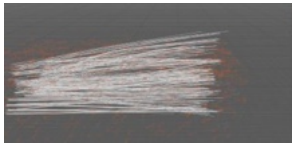


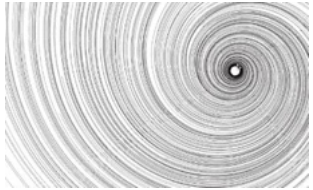
Field & Particle

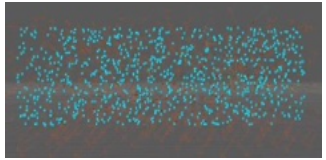
DYNAMICS

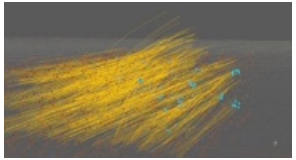


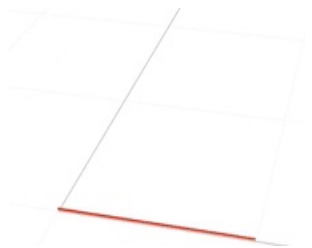


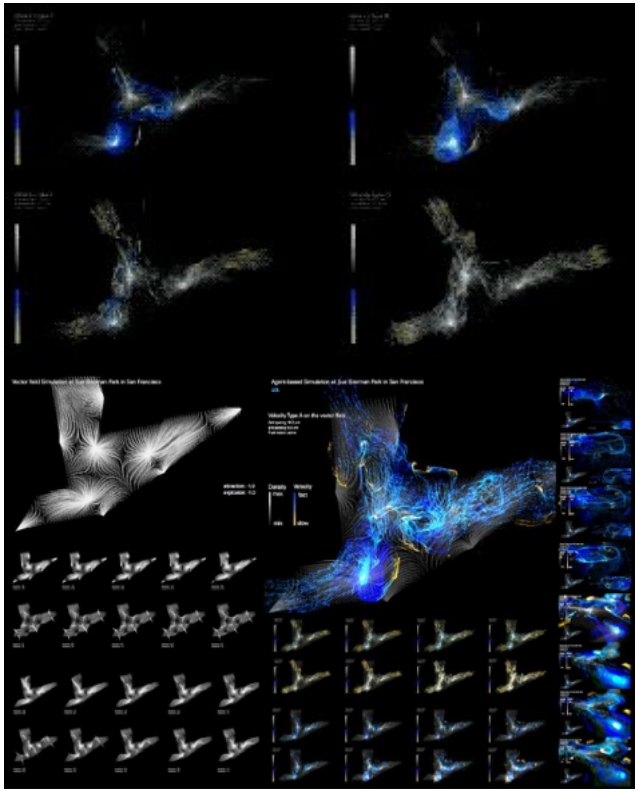








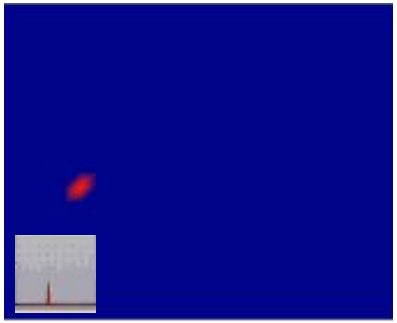


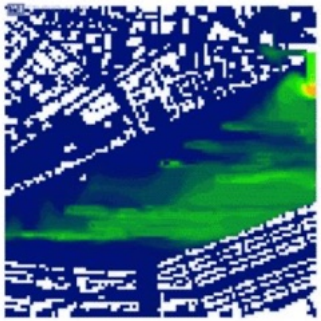


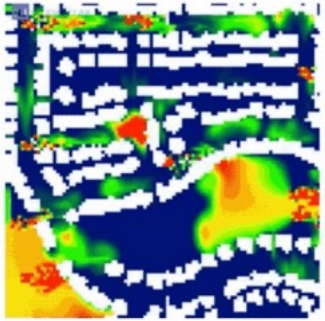
Field & Particle

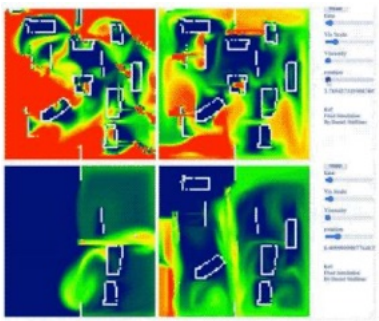
DYNAMICS

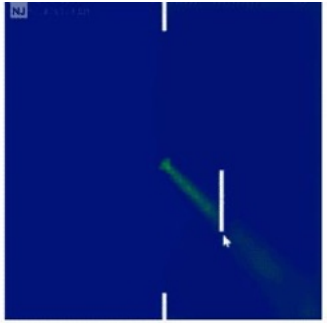
Fluid dynamics simulation- Lab link

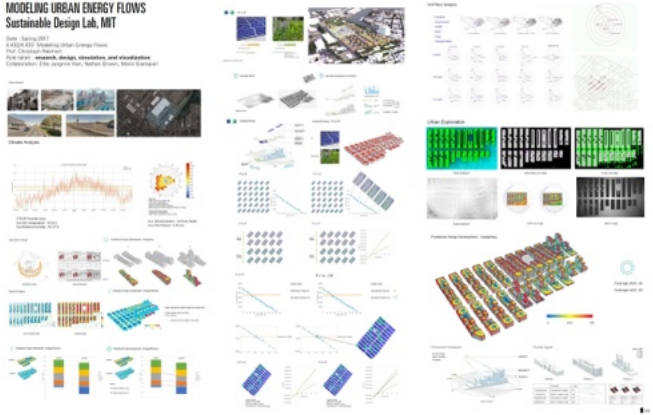


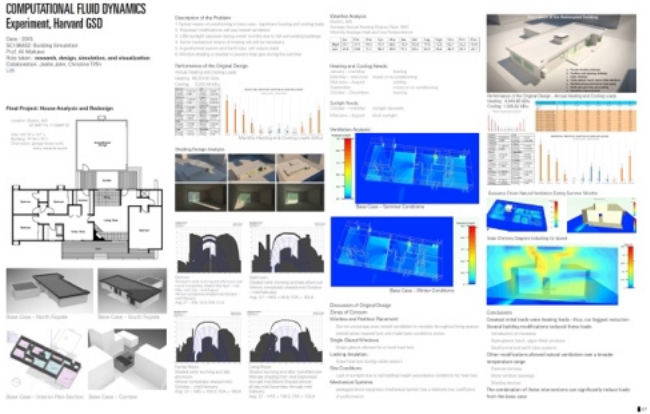










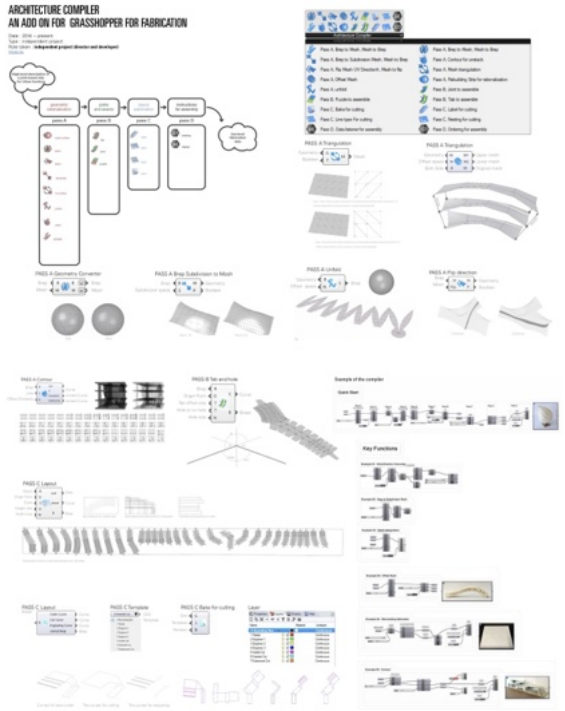


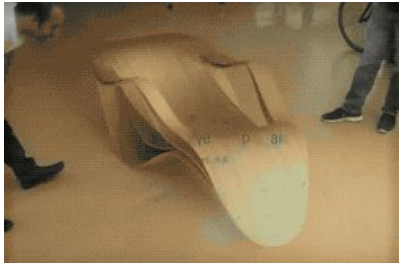
FABRICATION & DIGITAL MOCKUP

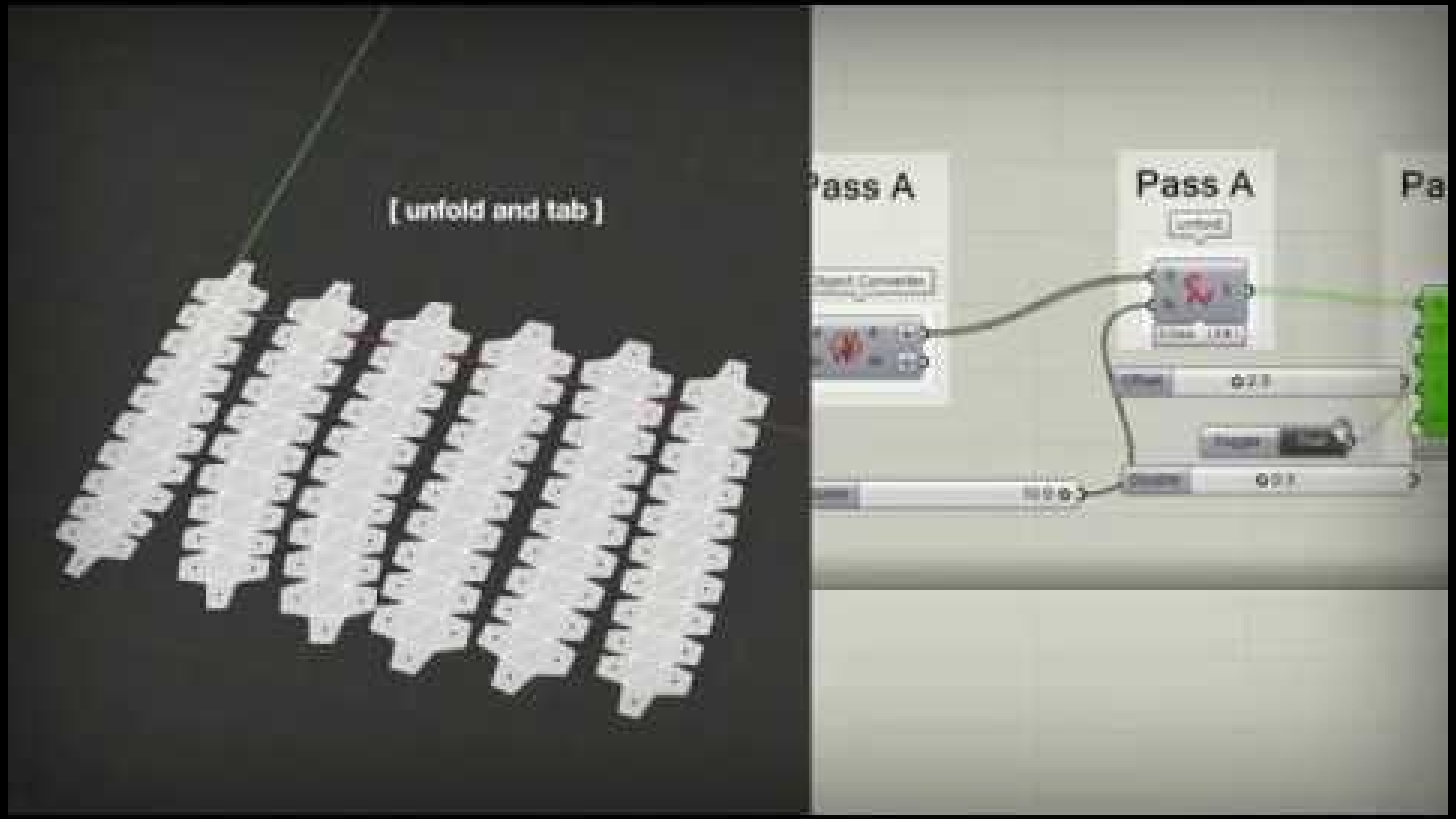
https://namjulee.github.io/njs-lab-public/work?id=2015-ac-development

https://namjulee.github.io/njs-lab-public/work?id=2015-bending-scape

Addon for GH
https://www.food4rhino.com/app/architectural-compiler-digital-fabrication





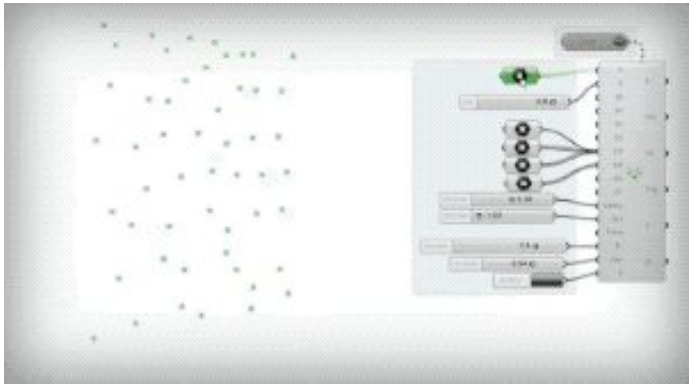


https://namjulee.github.io/njs-lab-public/work?id=2015-ac-development

https://namjulee.github.io/njs-lab-public/work?id=2015-demo-digital-mockup

MATERIAL & COMPUTATION

https://namjulee.github.io/njs-lab-public/work?id=2015-nano-micro-macro

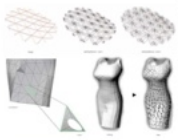


TRMORESPONSIVE FABRIC AND BLIND

Nano Micro Macro: Adaptive Material Laboratory, HARVARD GSD

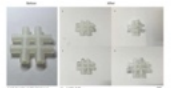
Date : Fall 2015
Type : Academic project
Prof. Martin Bechthold, James Weaver
Role taken : **design, research, computation and visualization**
Collaboration : Ji Hyuk Choi, Taehyun Jeon

Website Link

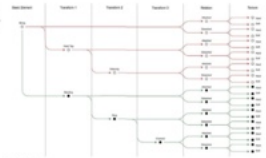


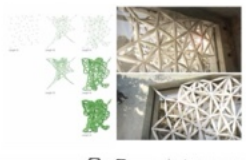
Concept
This design responds to thermal changes by varying the scale of porosities. The system consists of two separate membranes: one is rigid and the other is swelling. Basically, as the second membrane swells, cavities within the surface gets smaller to respond to outside thermal conditions.

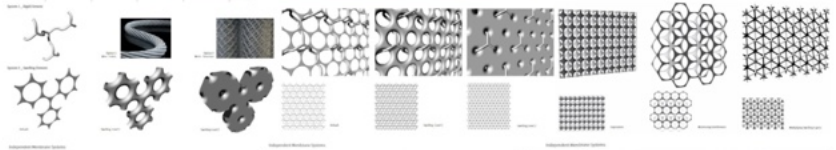
Core Technology
Thermo-responsive Swelling

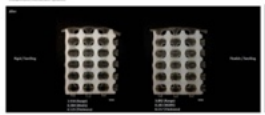


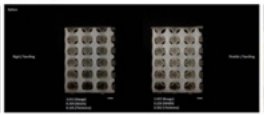
Material & Process
This experimentation is mainly done by 3d printing with the swelling materials. It was started from a basic shape for measuring the capacity of swelling toward more complex structures to maximize transformation by catalysis. Then, the computational model was created based on the measured data, and it was simulated in the digital setting.

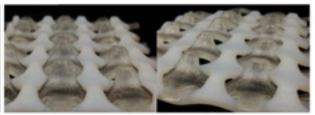


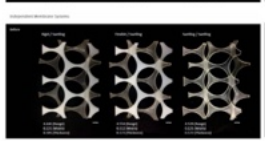


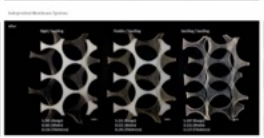


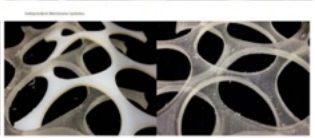


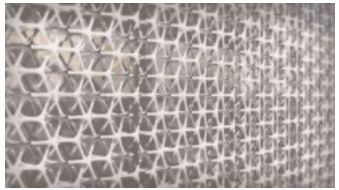


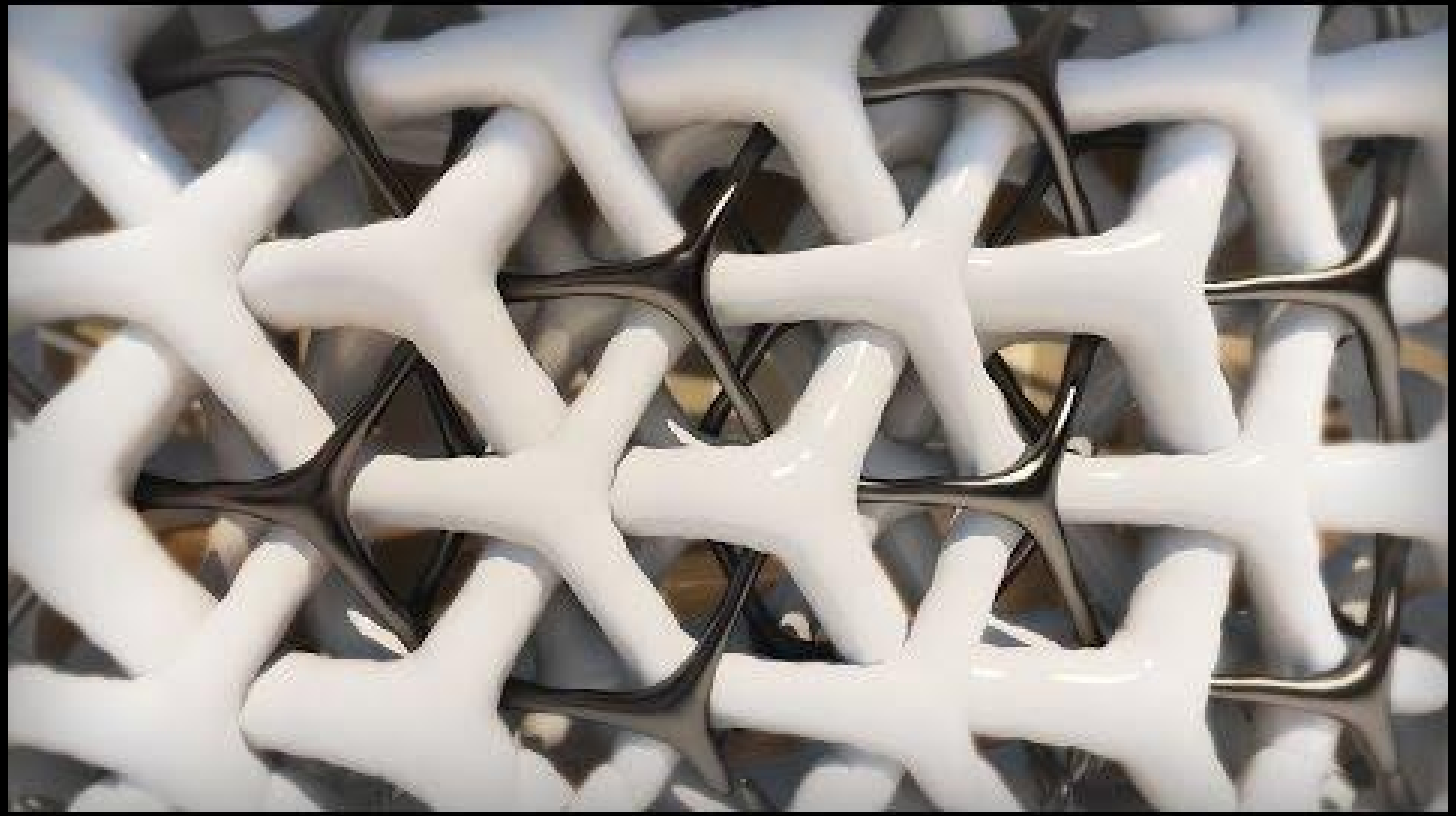












https://namjulee.github.io/njs-lab-public/work?id=2015-nano-micro-macro

FABRICATION & COMPUTATION

https://research.gsd.harvard.edu/maps/portfolio/cevisama-2017/

https://namjulee.github.io/njs-lab-public/work?id=2017-cevisama

CERAMIC MORPHOLOGIES
Cevisama Installation 2017
HARVARD GSD

Project Team: Professor Martin Bechthold, Director; Salmaan Craig, Lecturer in Environmental Technology; Nono Martínez Alonso; Jose Luis García Del Castillo; Tiffany Cheng; Kevin Hinz; Namju Lee, Zhiwei Liao; Matan Mayer; Saurabh Mhatre; Zach Seibold; Santiago Serna González; Juan Pablo Ugarte.

Role taken : **computation design and visualization**

Sponsor: ASCER Tile of Spain & Cevisama

Coordinator: ITC, Javier Mira Peidro

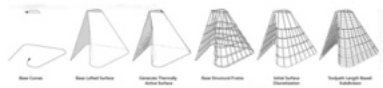
Production: Instituto de Tecnología Cerámica, Pilar Gómez Tena, Carmen Segarra Ferrando, Aroa García Cobos

Installation: Grupo on Market

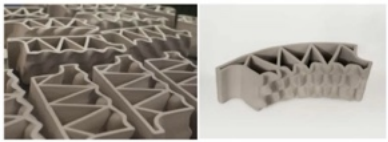
Documentation: Fernando García del Castillo López

Link

Ceramic Morphologies explores the design opportunities of a novel ceramic 3d printing strategy. The project was developed by researchers and students from the Material Processes and Systems (MaP+S) Group at the Harvard University Graduate School of Design. Supplemented with production and material research by the Instituto de Tecnología Cerámica in Castellón, Spain, the project is a prototype for the additive manufacturing of ceramic building components at the industrial scale

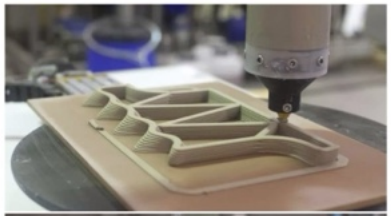


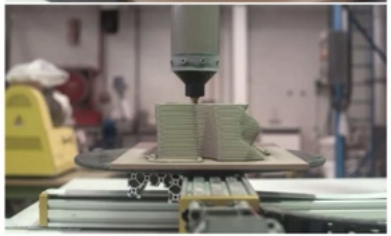
The pavilion is meant to showcase the expressive potential of ceramic 3d printing, and test the adaptation of principles of thermodynamic heat transfer to 3d printed geometry. The shape and design are products of current research related to the thermal performance of naturally ventilated spaces – the result of our collaboration with our colleagues Salman Craig and Matan Mayer from the Harvard Center for Green Buildings and Cities. While the exterior surface of the pavilion is smooth and uniform, the interior surface is heavily contoured and 3d textured. In addition to creating a unique relationship between interior and exterior space, the geometry of this undulating surface relates to research on the optimal dimensions for thermodynamic heat transfer.



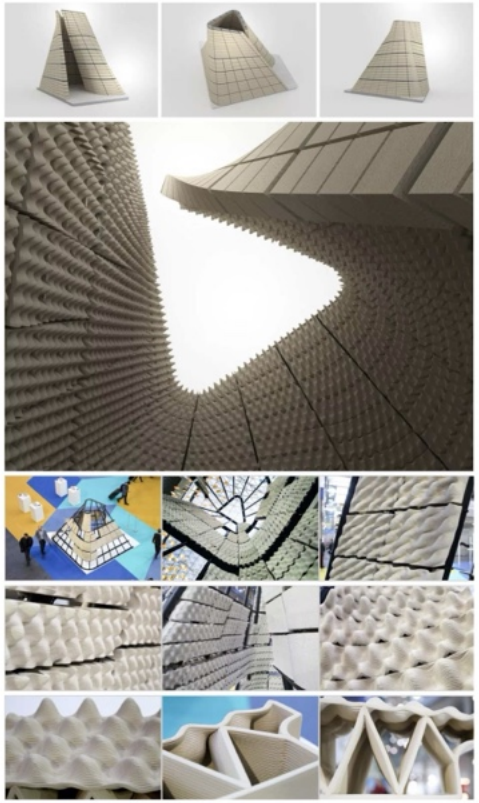
The thermal agenda is embedded in the logic of both the pavilion's interior surface geometry and the configuration of its overall form. Its pyramidal shape facilitates upward air movement, and the interior geometry impacts the thermal exchange between ambient air and the interior mass/surface. The contoured, sinusoidal texture of the interior surface is designed to optimize the ratio of surface area to thermal mass, and maximize the potential for cooling through natural ventilation and buoyancy effects. The project team has created mathematical models to predict the thermal behavior of the system.

The project utilizes a proprietary clay extrusion system and 3-axis armature to produce each of the pavilion's 552 unique ceramic elements. Each element is sized according to its position within the structure, the dimensional constraints of the printing bed, and a maximum allowable toolpath length. The team developed a novel computational approach to generate the surface geometry of the pavilion, discretize the form into individual bricks, and accommodate for the structural metal frame. Toolpath geometry and machine code is also generated directly within the parametric model. The digital workflow enabled the research team to account for shrinkage during the drying and firing process, reduce overall printing time and material consumption, and tune the stability of individual bricks.



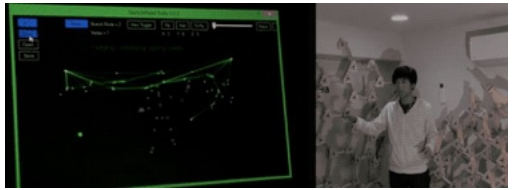


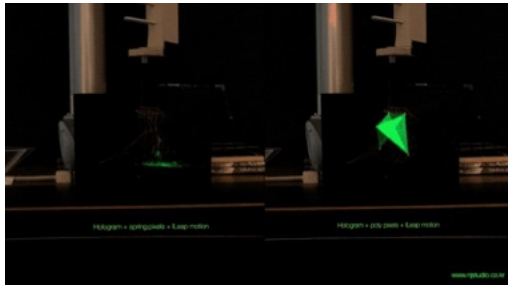
Measuring 3 m tall, with a footprint of 3.2m x 3.6m, the pavilion consists of 552 unique elements ranging from 260-545 mm in length, and 70-150 mm in height. 184 elements, representing 1/3 of the entire structure, are displayed in the current configuration shown at the 2017 Cevisama Fair in Valencia, Spain. Gaps between pieces allow for tolerances in the production. The modules can be bonded with mortar for permanent installations or, for temporary applications such as Cevisama 2017, can be dry-stacked and secured to a support frame. In total, the 184 printed elements displayed required 358 hours of printing time, and include 19.84km (12.33 miles) of extruded clay bead.

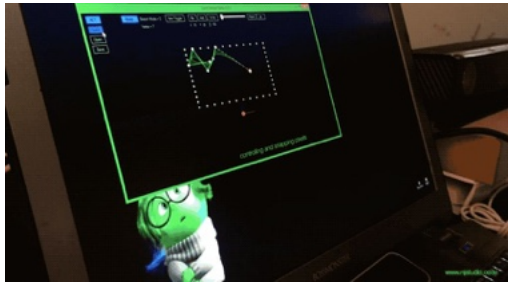


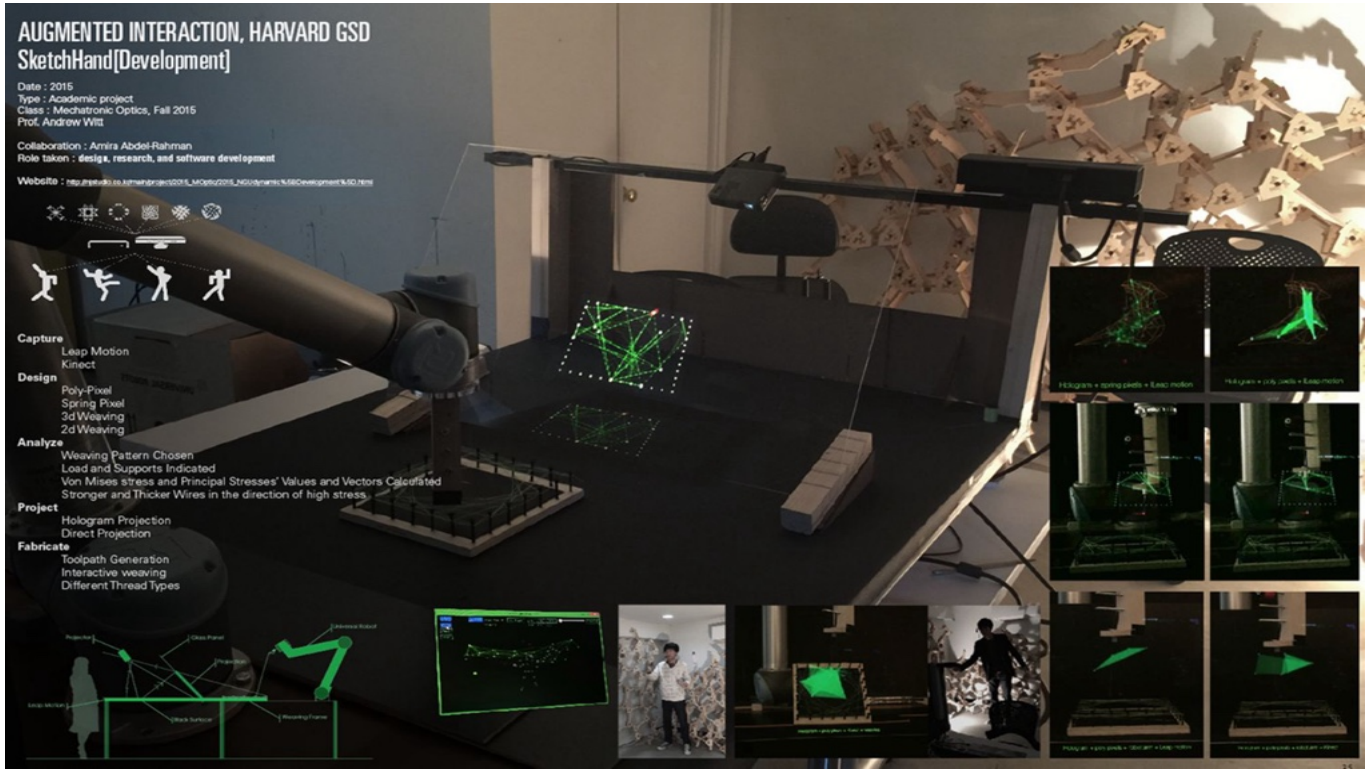
INTERACTION & ROBOTICS

https://namjulee.github.io/njs-lab-public/work?id=2015-sketch-hand-mechatronic-optic









https://namjulee.github.io/njs-lab-public/work?id=2015-sketch-hand-mechatronic-optic

NJCHANNEL PROJECT

Education

APPENDIX

EDUCATION

https://namjulee.github.io/njs-lab-public/teaching

Youtube English
https://www.youtube.com/channel/UCP4q3a4ogJN1-SbJcIJR3Ww

Youtube Korean
https://www.youtube.com/channel/UC3Z42uoe9C7Et39h5cLK1dw

Medium
https://nj-namju.medium.com/

https://medium.com/me/stories/public

Codepen:
https://codepen.io/NJStudio/collections/

Daum Brunch (Korean)
https://brunch.co.kr/@njnamju

Tistory (Korean)
https://computationaldesign.tistory.com/

Daum Brunch - link

NJ's Computational Design Series

초급: 읽으면서 입문하는, 모두의 디자인 코딩

중급: 따라 하며 입문하는, 모두의 디자인 코딩

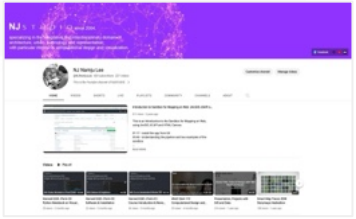
고급: 데이터 & 디자인 컴퓨테이셔널 디자인

처음 코딩을 접하는 디자이너에게 - link

NJ Channel Project, 콘텐츠 & 학습 자료 인덱스 - link

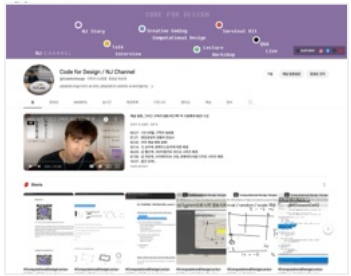
NJSTUDIO project and portfolio channel

Date : 2011 ~ present
Type : independent project
Role taken : **director**
link



Education Channel

Date : 2011 ~ present
Type : independent project
Role taken : **director**



Tistory - link

Data & Design

Computational Design, NJSTUDIO

https://nj-namju.medium.com/data-design-c1457dc8dc

Computational Design Thinking for Designers

Computational Design

The keywords could help designers to start thinking like a computational design specialist. Computational thinking in design asks you holistic approaches to resolve a small design problem while also asking you an extremely isolated process to fix a comprehensive design concern. These different levels of the approach become baddles to understand computational design processes for designers.

The keywords could guide you, who have no computer science backgrounds, to deal with the dilemma, and you would be able to get a sense of understanding of developing computational design process in manifold circumstances in your design practices.

THE QUESTION / IMAGINATION / HYPOTHESIS

Understanding *Problem, Concern & Issue*
Declaring *Issues & Claims*
Writing *Instructions*

THE METHODOLOGY & APPROACH

from ***Whole*** *to* ***Parts*** *&* *from* ***Part*** *to* ***Whole***
from ***Simple*** *to* ***Complex*** *&* *from* ***Complex*** *to* ***Simple***

https://nj-namju.medium.com/computational-design-thinking-for-designers-f8f24b90f9c

6 Digital Mapping using ArcGIS JSAPI

DigitalFUTURES WORLD : ARCHITECTS UNITE Workshops

Day 6: Digital Mapping using ArcGIS JSAPI
Introduction to JSAPI and the Development of a Mapping App

Keyword
Projection, Remap, Interpolation, Generalization, ArcGIS JSAPI, Gestalt Principles, Principles of Graphical Integrity, Bertin's Visualization design space

Research Overview:
* *Third Place Mobility Energy Consumption*

Lecture:
1) Projection, remap, interpolation
2) Generalization
3) Understand modify Object-oriented programming(OOP) pattern

Workshop: *Codepen, Github*
1) develop a mapping app with JSAPI based on the boilerplate code

Additional note:
1) data visualization using d3
2) data visualization using Amcharts

https://nj-namju.medium.com/6-digital-mapping-using-arcgis-jsapi-626e108d624b

Introduction to Computational Design: Data, Geometry, and Visualization Using Digital Media

DigitalFUTURES WORLD : ARCHITECTS UNITE Workshops

Subtitle: Introduction to Computational Design for Geometry Visualization and Data Visualization for Digital Mapping on Web

Short Description:
This is a hands-on workshop and lecture series about the Introduction to Computational Design for Data and Geometry Visualization for Digital Mapping on Web. For those who are interested in developing both the ideas and skills of data and geometry visualization to understand the data in architectural or urban contexts, this workshop is yours. The workshop consists of three key parts: (1) processing and visualizing data (2) constructing geometries (3) developing a pipeline for an interactive

https://nj-namju.medium.com/introduction-to-computational-design-data-geometry-and-visualization-using-digital-media-141616f9f22f

Geometry as Data Structure and Visualization

Introduction to Geometry as Data Structure and Visualization

Keyword
Class, Computational Geometry, Data Structure, Projection, Remap, Interpolation, Generalization, Gestalk Principles, Principles of Graphical Integrity, Bertin's Visualization design space

Lecture:
1) File format(CSV , JSON, GeoJSON, Image)
2) Geometry as Data Structure
2) Remap, Interpolation, Generalization
3) Object-oriented programming(OOP) pattern
4) Visualization

DATA STRUCTURE

Structured data- CSV
Semi-structured data- JSON, GeoJSON — link
Image- Remote Sensing, DEM — link

Programming Paradigm / Typescript Classes
Software design pattern: link, (GoF) Design Patterns
Inheritance (object-oriented programming): link

https://nj-namju.medium.com/geometry-as-data-structure-and-visualization-48bcfdea3851

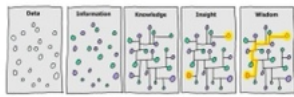
Discrete Urban Space and Connectivity

SA(Social Algorithms) 2020, Computational Design

Subtitle: Partition & Relationship

Keyword
Data Structure, Graph, Matrix, Pixel, Voxel, Discretization, Partition, Connection, Search

Workshop Reference
1. *Computational Design Thinking for Designers — link(Eng)*
2. *Data & Design — link(Eng) — link(KR)*



Data to Wisdom, The Information Factory (U.K.

IWe are able to answer these questions below.

how to capture and process spatial data in design

https://nj-namju.medium.com/discrete-urban-space-and-connectivity-492b3dbd0a81

Introduction to Computational Design

Digital FUTURES World Workshop 2020

Tistory Search: https://computationaldesign.tistory.com/16?category=937139

Video Playlist - https://www.youtube.com/playlist?list=PLweNVwGaDKEZZvedJi632ULMJ6allmz2s

DigitalFUTURES Word link https://www.digitalfutures.world/workshops-asia-pacific-blog/nilee-kr

Medium link

1 Python Basic

2. Data Visualization, RhinoGH Python

3. Typescript & HTML Canvas Visualization

4. Computational Geometry & Geometry Class & Visualization

5. Pipeline for Interaction, Data, and Geometry Visualization

6. Digital Mapping using ArcGIS JSAPI

Introduction to Design Visualization

Harvard GSD, MIT SA+P

Link - https://namjulee.github.io/3d-visualization-harvard-gsd.github.com/
Video - https://youtu.be/3VeLfmt2N-0
Git - https://github.com/NamjuLee/Harvard-GSD-Workshop

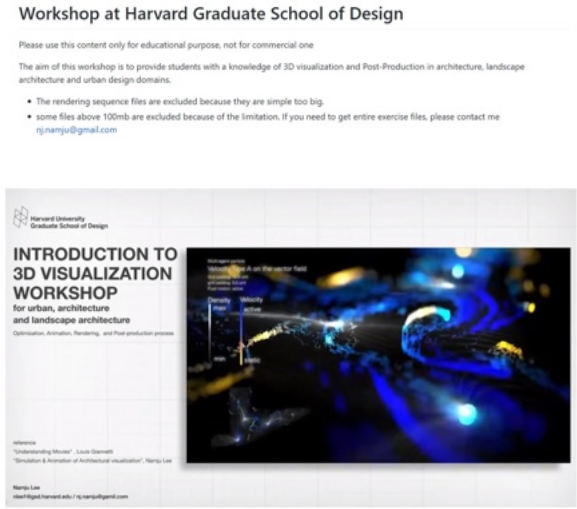
Download:

Content(pdf)

Example files

BasicAnimation.pdf

BasicParticleSystem.pdf



DATA & DESIGN, JTem at Harvard GSD

NJSTUDIO & NJSLab

https://namjulee.github.io/njs-lab-public/data-for-design

https://namjulee.github.io/njs-lab-public/teaching

Index

Computational Design Lecture Series:

Tistory Search - https://computationaldesign.tistory.com/3?category=937138

NJ's Computational Design Lecture series - http://bit.ly/2SqBRq0

37. 우리는 무엇을 배우면서 사는가 feat. 언어와 컴퓨테이셔널 사고, 그리고 사고의 도약 - link
36. 코딩공부와 수학 그리고 공부할것 Feat. 4차 산업혁명 그리고 디자인 - link
35. 함수호출 By Reference, By Value - link
34. 소프트웨어 어떻게 공부할까? 변할것 변하지 않을것, Feat VR AR AI - link
33. 디자인 엔지니어링 / Design Engineering - link
32. 궁극의 테크트리! 컴퓨테이셔널디자이너로 살아 남기!! - link
31. SA 7.0 Lecture 5. 데이터 구조로서의 지오메트리 그리고 시각화 - link
30. SA 7.0 Lecture 4. 이산 도시공간과 연결성 (그래프)/Discrete Urban Space and Connectivity (Graph) - link
29. SA 7.0 Lecture 3. 캐드, 데이트의 흐름 / CAD data pipeline - link
28. SA 7.0 Lecture 2. 디자이너를 위한 컴퓨테이셔널 팅킹 / Computational Thinking For Designer - link
27. SA 7.0 Lecture 1. 데이터 & 디자인 / Data & Design - link
26. 곱하기 어떻게 볼까? 추상을 통한 상상? 컴퓨테이션/크리에이티브 코딩 - link
25. 힙합문화로 보는 새로운 패러다임 그리고 컴퓨테이셔널 디자인의 운명 - link
24. 정규화 & 보간 & 이상치 / normalization & interpolation & outlier - link
23. 프로젝션 & 리맵 / Projection & Remap - link
서바이벌키트 11. 디자이너에게 코딩이란 / 나에게 코딩이란 / 코딩을 하는 이유 - link
22. 코딩공부 어떻게? (잔소리포함) / 제발 타이핑해보자!! - link
21. 내가 생각하는 컴퓨테이셔널 디자인 / 워크숍 강좌를 만드는 배경 / 디자인 데이터 / Design & Data - link
20. 컴퓨테이셔널디자인을 바라보는 시각과 오해 - link
19. 건축 3D 랜더링에 관한, 어느 건축가의 질문들.../ 건축 시각화 - link
18. 매핑 (건축, 도시) / Mapping for Urban and Architecture - link
17. 도시, 건축 랜더링 팁 / Architectural & Urban Rendering tips / 건축 시각화 - link
16. Mouse Event / 마우스 이벤트, CAD System - 캐드시스템 - link
15. Active Command - 엑티브 커멘드, CAD System - 캐드시스템 - link
14. Harvard GSD Technology 그리고 MIT Computation 지원준비, 프로그램 비교 , 및 컴퓨테이션 공부 준비 방법 - link
13. 자료구조, 픽셀, 복셀 / Data Structure for design , pixel and voxel data structure 2/2 - link
13. 자료구조, 그래프 / Data Structure for design , Graph 1/2 - link
12. 라이노 파이썬 / Rhino Python, 공부법 - link
11. HTML Canvas, 데이터 시각화, 크리에이티브 코딩 - link
10. 건축 시각화 / Architectural Visualization - link
09. 데이터 시각화 / Data Visualization - link
08. 디자이너를 위한 프로그래밍 언어 2/2 - Typescript(Javascript) - link
08. 디자이너를 위한 프로그래밍 언어 1/2 - C# - link
07. 파이썬 (Python) 배워야 할까? 장단점을 알아보자! - link
06. 쉽게 이해하는 클래스(Class) - link
05. VR / AR 꼭 해야 할까? 2019 버젼 - link
04. 건축 도시 디자이너를 위한 프로그래밍 테크트리 - link
03. 컴퓨테이셔널 사고 (띵킹) / Computational Thinking - link
02. 파라메트릭 디자인? / Parametric Design - link
01. 컴퓨테이셔널 디자인? / Computational Design - link

QnA

Tistory Search - https://computationaldesign.tistory.com/2

Video Playlist - https://www.youtube.com/playlist?list=PLweNVwGqDKEYzuT2sezSsQCP-me-1Tb7e

3.1 디자인 그리고 컴퓨테이션

QnA 01, 어느 고등학생의 질문 / 건축 파라메트릭 디자인 예제
QnA 02, 건축가의 일반적인 질문 2차 (건축컴퓨팅실무)
QnA 04, 건축컴퓨팅을 공부하고 싶으신 건축가형님과의 대화
QnA 05, 코딩과 건축컴퓨팅에 관심이 많으신 건축가형님과의 대화
QnA 06, 건축가의 일반적인 질문 (건축컴퓨팅실무응용)
QnA 11, 어떤 젊은 건축 디자이너의 질문
QnA 15, 복셀(Voxel)과 컴퓨테이셔널 디자인 그리고 건축 디자인
QnA 16, 파라메트릭(Parametric Design)과 미적분
QnA 17, 내가 생각하는 그라스하퍼(Grasshopper)의 단점과 개인적인 생각
QnA 19, 파라메트릭 디자인 배우려면 어디서부터 어떻게 시작해야하나요?
QnA 21, 5G기술과 건축산업(설계 협업 및 시각화 VR), 정말 유용 하나?
QnA 22, 내가 생각하는 그라스하퍼(Rhino Grasshopper)의 장점
QnA 23, 디자인 소프트웨어 어떻게 공부할까? / 그 많은 것 언제 다 해요?
QnA 24, 디자인 소프트웨어 어떻게 공부할까? 두 번째, NURBS , Mesh(Polygon)
QnA 25, 디자인 소프트웨어 어떻게 공부할까? - 알고리즘 공부 방법 / 그리고 브런치!
QnA 31. 대학생의 질문, 대학교, 대학원, 파라메트릭 디자인 스튜디오 어떻게 접근 할까?
QnA 36, 파이썬 그리고 그래픽 툴(맥스, 마야, 라이노...)
QnA 37, 프로덕트디자인 위한 코딩 그리고 3D 소프트웨어 공부 질문, 그리고 개인적인 생각
QnA 43, SA 7.0 Unit 2 관련 질문 / 스스로 공부하는 방법

3.2 코딩

QnA 33, 코딩 시작 시에, 필요한 수학? 과연 뭐가 필요할까?
QnA 38, 너는 어떤 프로그래밍 언어를 쓰니?
QnA 39, 데크니컬 아티스트 공부 방법? 책? 학원?
QnA 44, 네이버 카페, 그래서호퍼 챌린지 질문 / 코딩을 공부하는 자세

3.3 인공지능, 데이터 그리고 시각화

QnA 07, 데이터 시각화 도구(tools) 그리고 개인적인 생각
QnA 12, 데이터시각화가 꿈인 카이스트 학생의 질문
QnA 14, 디자인(건축), 빅 데이터, 그리고 인공지능(머신러닝)에 대한 질문
QnA 42 시각디자인 전공, 학생의 질문, 데이터 시각화 어떻게 공부할 것인가?
QnA 46 지도위에 데이터 시각화, 어떤 제품으로 개발을 하면 좋을까?
QnA 47, AI, ML(머신러닝), GL(그래픽), CV(비전), 컴퓨테이셔널 전공을 시작하는 학생 질문

3.4 취직 / 진학 / 유학

QnA 08, 컴퓨테이션 직업군 및 준비 자세
QnA 09, 직장상사가 내 미래에 도움이 안될 때, 회사를 떠나야하나? 존윅에서 배울점
QnA 13, 미국, 호주, 유학준비와 그에 따른 생각들...
QnA 20, SOP 작성 유의사항 (취직 커버레터 / 자기소개서)
QnA 26, 대학원 진학, 유학에 대한 질문, 그리고 개인적인 생각, feat MIT Media Lab
QnA 28, 건축과 학생의 질문, 건축, 디자인 유학 준비 그리고 주관적 생각
QnA 29, 건축 & 디자인, 포트폴리오 그리고 취직, 유학
QnA 30. 건축 유학 & 학비 그리고 개인적인 생각
QnA 32, 건축/컴퓨테이션/뉴미디어/디자인 직업군, 어떻게 준비하면 좋을까요?
QnA 34, 유학 고민 많을 때, 실내건축학과 전공자의 M.Arch 유학에 대한 고민
QnA 35, 컴퓨테이셔널 디자인 유학을 준비하는 학생의 질문
QnA 40, 건축 컴퓨테이셔널 유학 그리고 파이썬 코딩 공부
QnA 41, 데이터를 활용한 도시 설계? 공부 전략? 그리고 (MIT SENSEable City Lab 연구소
QnA 45, 컴퓨테이셔널 직장 구하기? 마음가짐?
QnA 48, 유학? 얻는 이익이 있나?
QnA 49, 스페셜리스트가 되기 위한 어느 학부생의 전공고민

Numeric Network Analysis

SA 7.0 Unit 2

Daum Brunch : https://brunch.co.kr/@njnamju/91

Video Playlist - https://www.youtube.com/playlist?list=PLwsNVwGqDKEbGYBBPoKxHdMohJW245o38

Medium : https://nj-namju.medium.com/numeric-network-analysis-post-covid-19-urbanism-6-ft-rule-de267886b028

유튜브 한국어 전체강좌(수업, 워크숍, 미팅, 프레젠테이션) – 플레이 리스트
유튜브 영어 전체강좌(수업, 워크숍, 미팅, 프레젠테이션) – 플레이 리스트

원문 링크 Numeric Network Analysis: Post-COVID-19 Urbanism, 6 ft rule – link
선수 공부 자료 – link

이남주 / NJ Namju Lee / nj.namju@gmail.com
우정현 박사 / Junghyun Woo / axuplatform@gmail.com

SA 7.0 Unit 2 한국어 강좌

0. Introduction Unit 2 – Medium link
유닛 2수업 소개 – 전체 버전 (Eng)

1. Lecture, Data and Design – Medium link
데이터 그리고 디자인 – 전체버전 – 편집버전

2. Lecture, Computational Design Thinking for Designers – Medium link
디자이너를 위한 컴퓨테이셔널 사고 – 전체버전 – 편집버전

3. Lecture, Pipeline for Interaction, Data, and Geometry Visualization – Medium link
CAD 소프트웨어의 구조 그리고 데이터의 흐름과 시각화 – 전체버전 – 편집버전

4. Lecture, Urban Design Quality and Walkability – Medium link
도시디자인과 보행환경 – 전체버전

5. Lecture, Spatial Network Analysis in Transportation Geography – Medium link
교통계획 분야에서의 공간 네트워크 분석의 활용 – 전체버전

6. Lecture, Examples of Numeric Network Analysis using the NNA Toolbox – Medium link
NNA toolbox를 활용한 도시 공간정보 분석 예시 – 전체버전

7. Lecture, Discrete Urban Space and Connectivity – Medium link
이산 도시 공간과 연결성 – 전체버전 – 편집버전

8. Lecture, Geometry as Data Structure and Visualization – Medium link
데이터 구조로서의 지오메트리 그리고 시각화 – 전체버전 – 편집버전

9. Workshop, Pedestrian Volume Studies– Medium link / Post-COVID-19 Urbanism –Medium link
보행자 이동성 정보 수집 방법 / 포스트 COVID-19을 대비한 도시 환경 계획 및 아이디어 – 전체버전

10. Workshop, Data Visualization, Numerical Image Utility
데이터 시각화 / 이미지 툴 – 전체버전

Discrete Urban Space and Connectivity

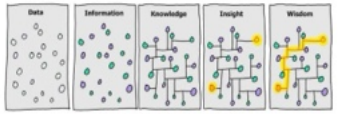
NJ Namju Lee Jul 10, 2020 · 3 min read

SA(Social Algorithms) 2020, Computational Design

Subtitle: Partition & Relationship

Keyword
Data Structure, Graph, Matrix, Pixel, Voxel, Discretization, Partition, Connection, Search

Workshop Reference
1. *Computational Design Thinking for Designers — link(Eng)*
2. *Data & Design — link(Eng) — link(KR)*



Data to Wisdom, The Information Factory S.A.

!We are able to answer these questions below.

how to capture and process spatial data in design

Relationship among data in a space

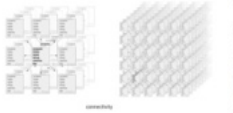
Discrete a space into parts

1. Graph

Graph is a mathematical object that consists of set of points and edges, dealing with discrete information.

Graph is widely used for computation, discrete mathematics or representing relational data structures, and It has explicit relationship among vertices by edges visualizing the topological aspect such as street network of urban, highway or the subway map, whose graphs closely resemble their physical form due to its characteristics.

2. Pixel / Voxel (Volumetric Element)



- Voxel could be considered as a set of image(pixel)

Voxel is a 3 dimensional grid containing pixels can have rich data set including R, G, B, A values. It is frequently utilized for visualization of scientific or medical data which is needed for volumetric representation.

Voxel for geometry in space is a discretized space of geometry where it has a beam or node are connecting but as a continuous map in space. This is basically an idea that an object become a 3 dimensional map.

3. Partition

Linear regression, KNN , Support vector machine, Random Forest, CNN, Tensorflow Playground

Delaunay triangulation / Voronoi diagram

Discrete space — Space Partitioning

Quad Tree / Octree / Bin System

Axis(AABB) / Distance

Clustering Points: Collision-Based Dynamic Graph method — link

4. Connectivity

GRAPH — link
Graph Data Structure for Spatial data — link(KR)

Social network as Graph — link
Transportation as Graph (Street, freeway(highway), subway, sky way,...)
Folder structure as Graph — link
Programming executions as Graph — link
Zoning as Graph — link
Associative geometry — link
Interface — link / link
Network for ML — link

Structure — link, link
Mesh(Polygon) as Graph — link
Mesh from Rhino3d: link

NJSTUDIO Presentation slide

Data structure as Graph
JSON /GeoJSON as Graph
Matrix (link) Pixel(link) and Voxel(link) as Graph

AI & Data for Design

Link: https://computationaldesign.tistory.com/29

AI and Data for design / 데이터 그리고 디자인 / 디자이너를 위한 인공지능

J-Term 2017, Harvard GSD :

Title: Introduction to Data Science for Building Simulation

1 Python Basic
2 Data process & Visualization
3 Train modes & Predict missing values

Data Process

Numpy, Pandas, CV

Workshop

Temperature Conversion
Multiplication Table 1. regression model 2. cnn model
Smart Drawing 1. Data process 2. Model A 3. Model B
Smart Commander
Semantic Segmentation
Third Place Prediction
Map Classifier
Super Resolution
Smart Map Tracer
Texture Prediction
Color Prediction
3D Volumetric Representation and Machine Learning in Design

Python Basic

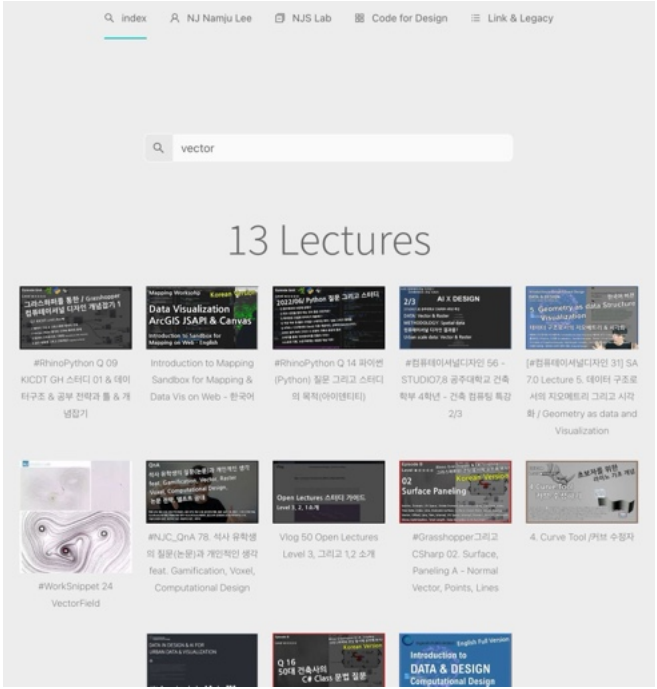
Typescript Basic, Tensorflow JS

Project

Project, **Smart Map Tracer, ESRI Storymaps Hackathon** - video
Project, **Smart Drawing** - Writing / Video / Demo
Project, **Remixing & Resampling Three Dimensional Objects, Use of Volumetric Representation and Machine Learning in Design** - link / video
Project, **Politics of Space and Its Shadows** - link / video
Project, **Built Environment Assessment** - link / video **Analytical hosing prediction model with spatial observation in City of Boston**
link 4-Smart Drawing
link Linear-regression , Polynomial Regression , Regression Model , XOR
Codepen - Tensorflow playground stater, Typescript

SEARCH

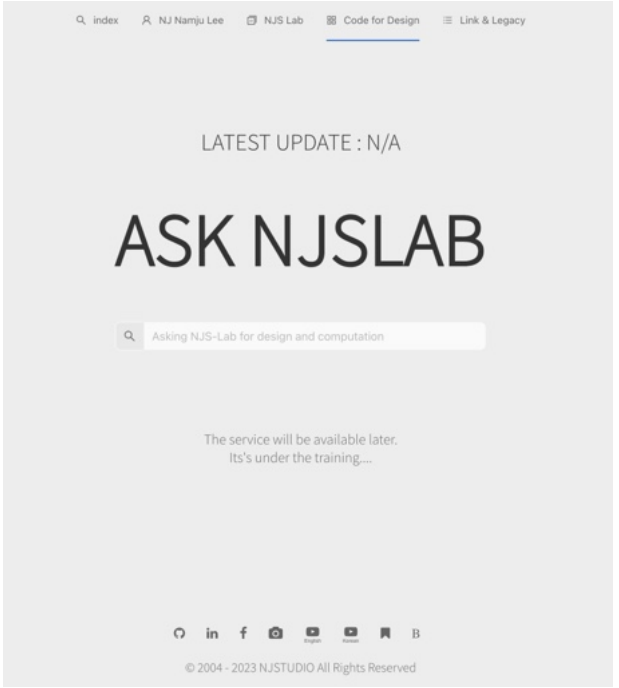
Design and Computation



https://namjulee.github.io/njs-lab-public/?search=vector

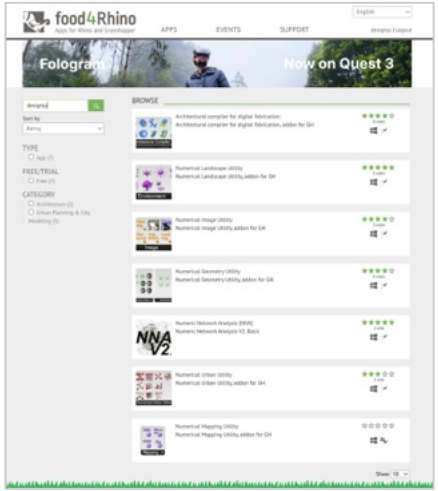
LLM

for Design and Computation

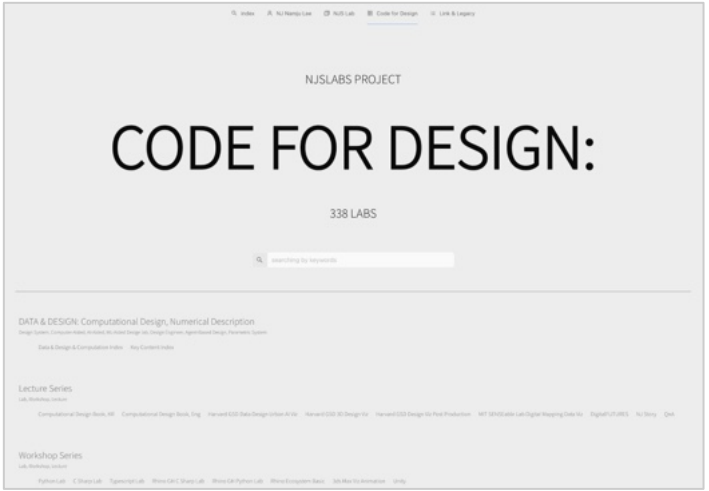


https://namjulee.github.io/njs-lab-public/search

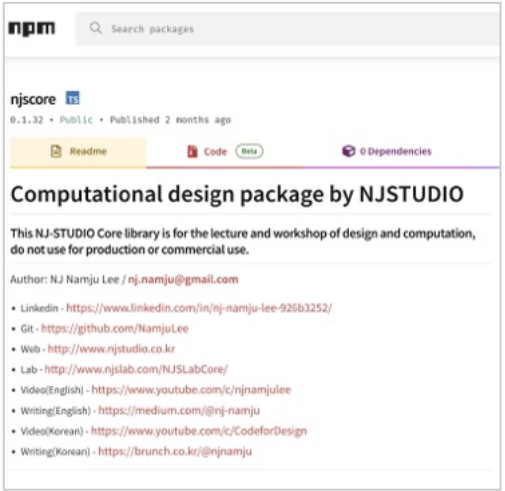
Rhino & Addon



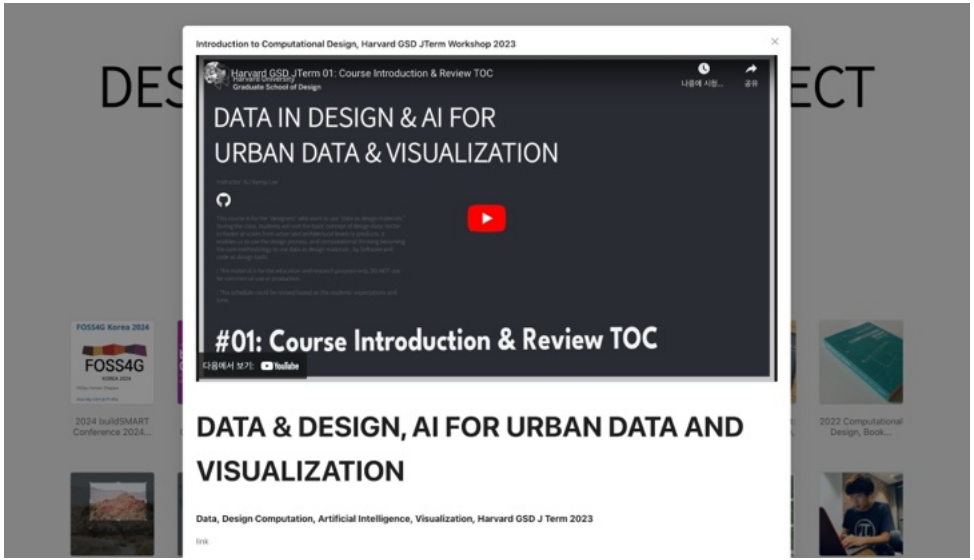
Lab / workshop



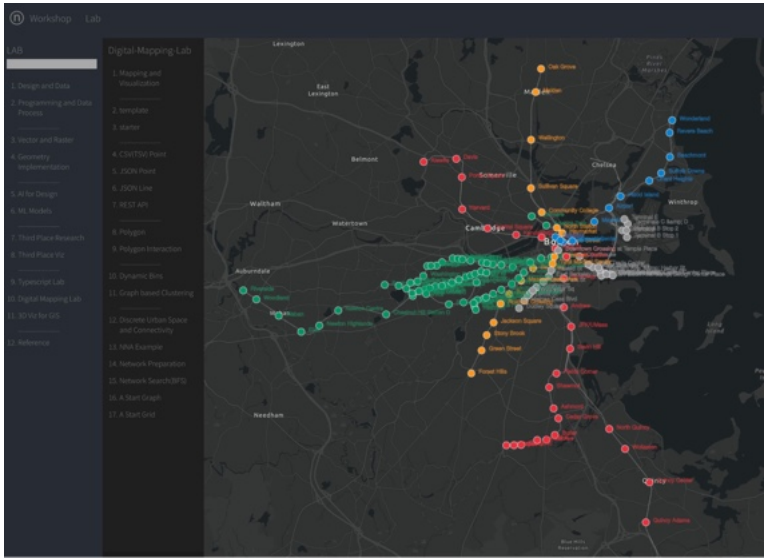
njscore.js



Digital mapping and data visualization - link



https://namjulee.github.io/njs-lab-public/work?id=2023-harvard-gsd-jterm



https://namjulee.github.io/Data-Design-AI-for-Urban-Data-and-Viz-Harvard-GSD-public/lab/digital-mapping-lab

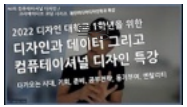
21 세기 데이터 기반 사회

1. 변화하는 것 & 변화하지 않는 것

"전략은 변하지 않는 것에 토대를 두어야 한다. 사람들은 나에게 5년 후나 10년 후 무엇이 변할 것인지는 묻지만, 무엇이 변하지 않을 것인지는 묻지 않는다." 아마존의 창업자 제프 베조스(Jeff Bezos)는 말한다. 우리가 무엇을 예측할 때, 변하지 않는 것에 기초해야 한다.

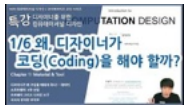
Reference : https://webzine.kps.or.kr/?p=4&idx=274

서울여자대학교



link

연세대학교 특강



link

감사합니다 :)

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NJ Design Studio - http://www.njstudio.co.kr

NJS Lab - https://namjulee.github.io/njs-lab-public

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Linkedin - https://www.linkedin.com/in/nj-namju-lee-926b3252/

Medium(Eng) - https://nj-namju.medium.com/

Daum Brunch(Kr) - https://brunch.co.kr/@njnamju#articles