2025.1

Algo. & Data Structure II

DCA3702

Prof. Ivanovitch Silva

UFRN DCA

Prazo Para Conclusão (em semestres): Mínimo: 5 **Médio:** 10 **Máximo:** 14

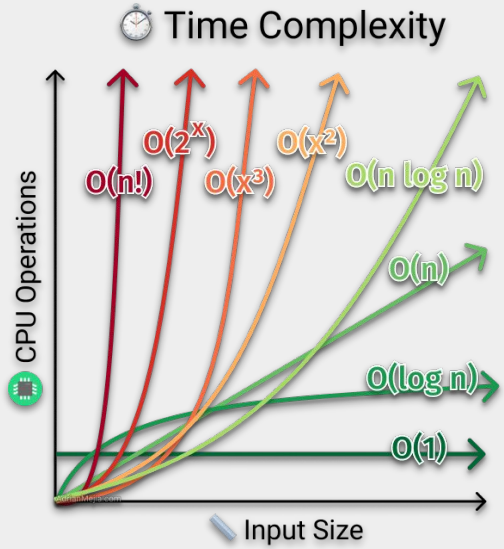
Optativas | Complementares | 1º Nível | 2º Nível | 3º Nível | 4º Nível | 5º Nível | 6º Nível | 7º Nível | 8º Nível | 9º Nível | 10º Nível

7º Nível

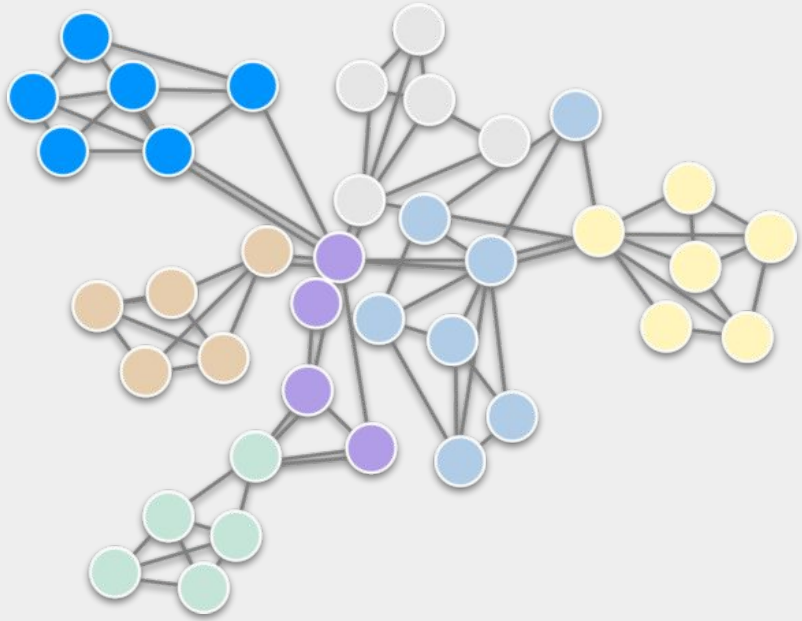
DCA3701 - PROJETO DE SISTEMAS DE CONTROLE - 90h	*Obrigatória*
DCA3702 - ALGORITMOS E ESTRUTURAS DE DADOS II - 60h	*Obrigatória*
DCA3703 - PROGRAMAÇÃO PARALELA - 45h	*Obrigatória*
DCA3704 - SISTEMAS DISTRIBUÍDOS - 45h	*Obrigatória*
DCA3705 - AUTÔMATOS E LINGUAGENS FORMAIS - 60h	*Obrigatória*
DCA3706 - SISTEMAS EMBARCADOS - 60h	*Obrigatória*

Carga Horária Total: 360h

Course Outline



Algorithm Complexity



Graph

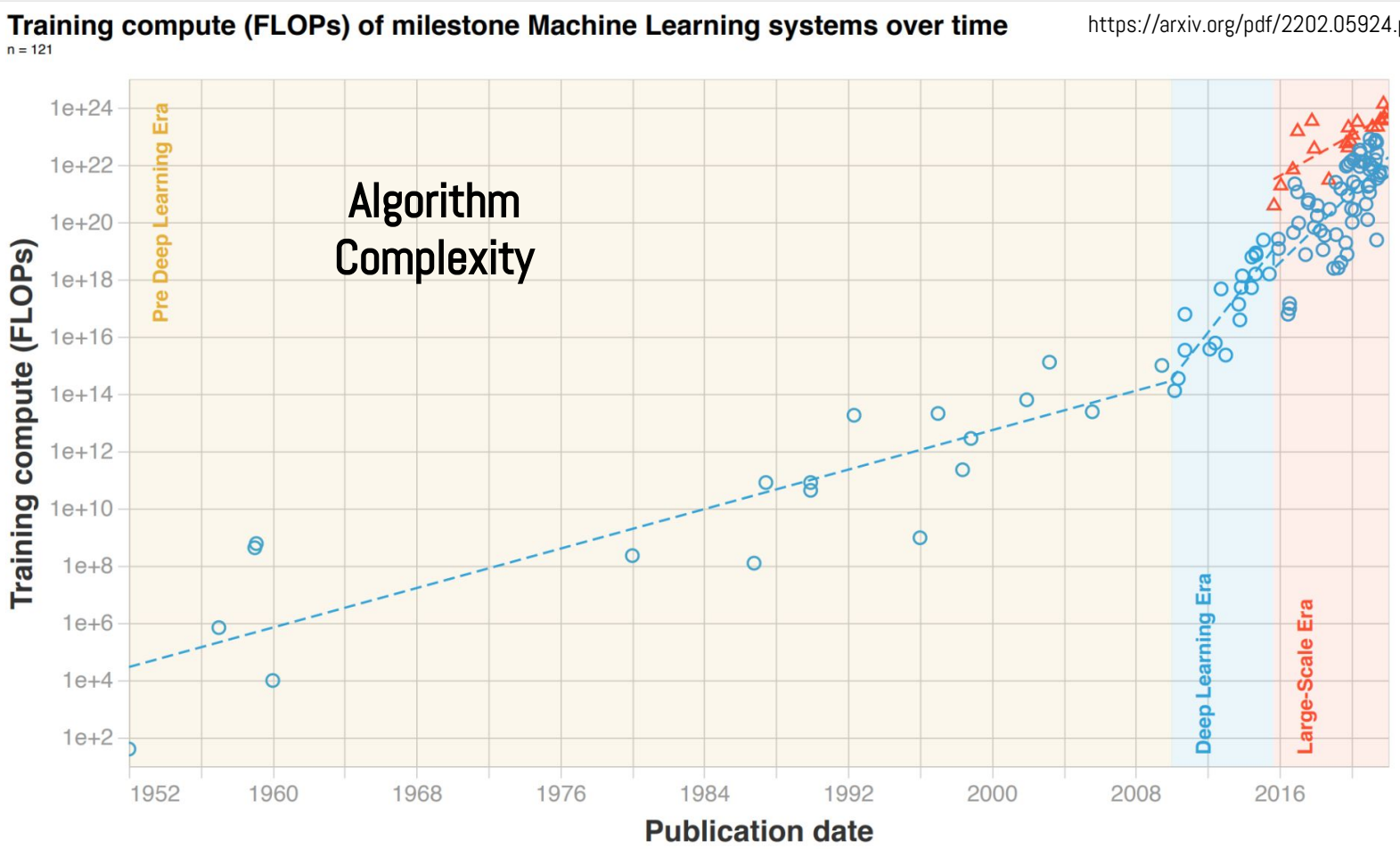
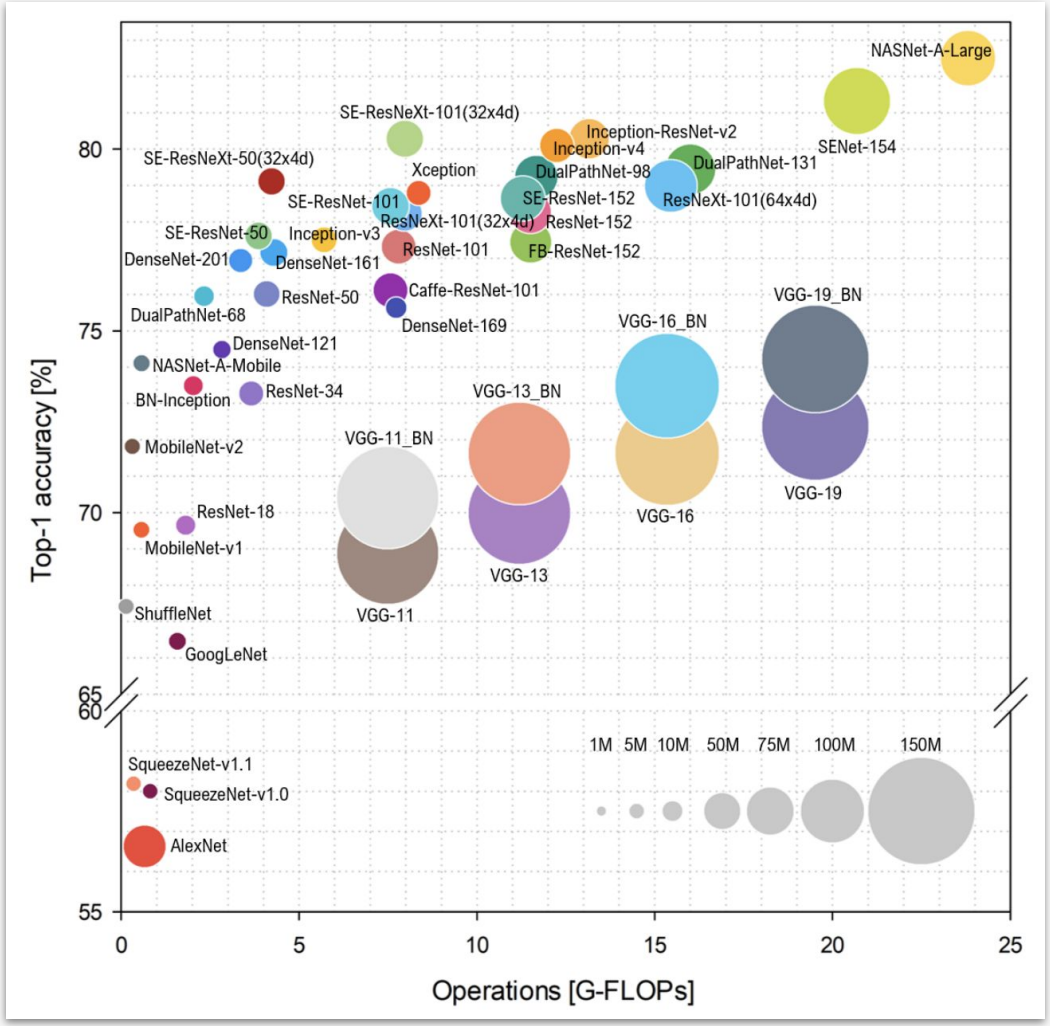


Figure 1: Trends in $n = 121$ milestone ML models between 1952 and 2022. We distinguish three eras. Notice the change of slope circa 2010, matching the advent of Deep Learning; and the emergence of a new large-scale trend in late 2015.

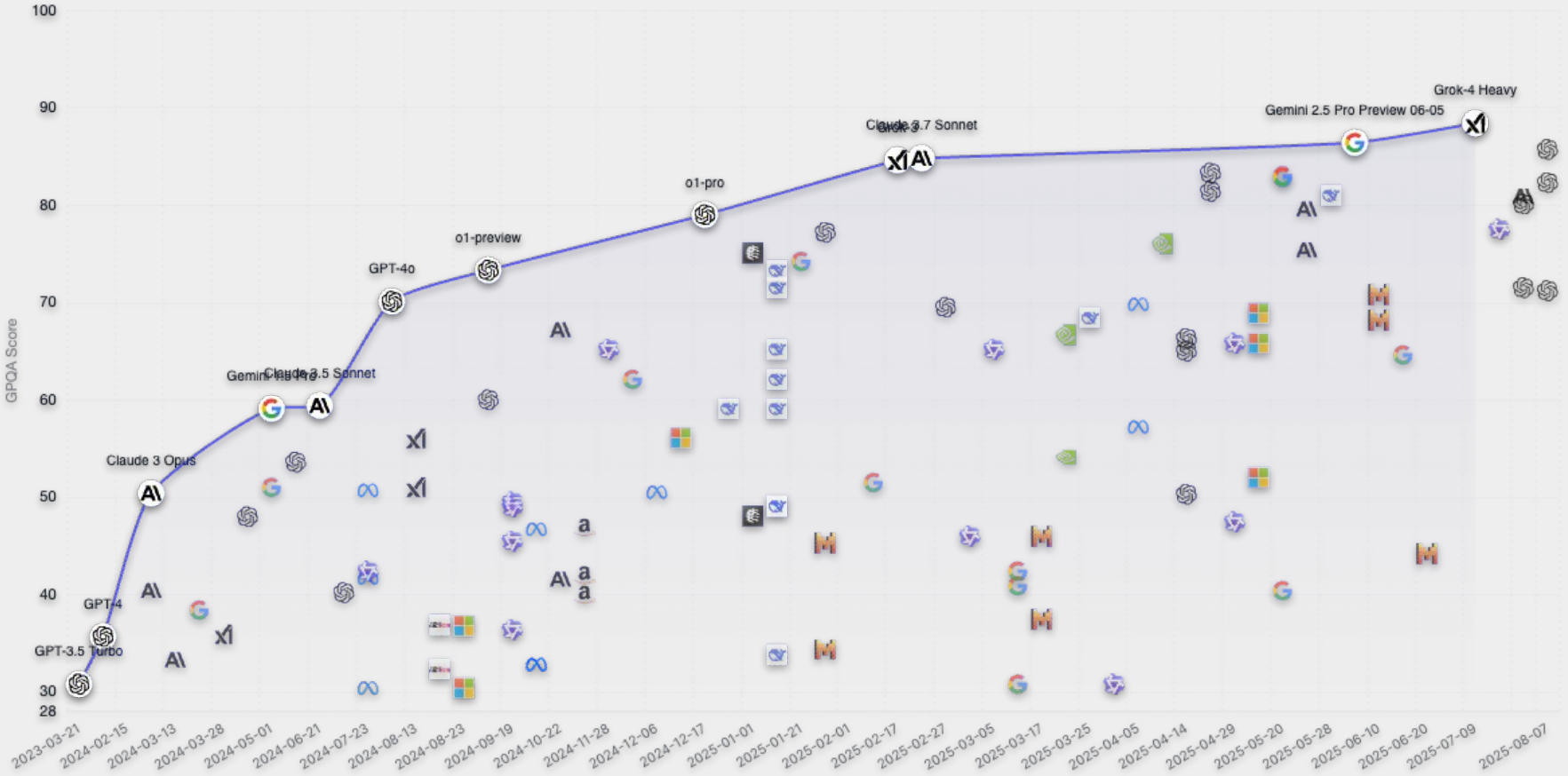


Algorithm Complexity

ML Model Evolution ImageNet

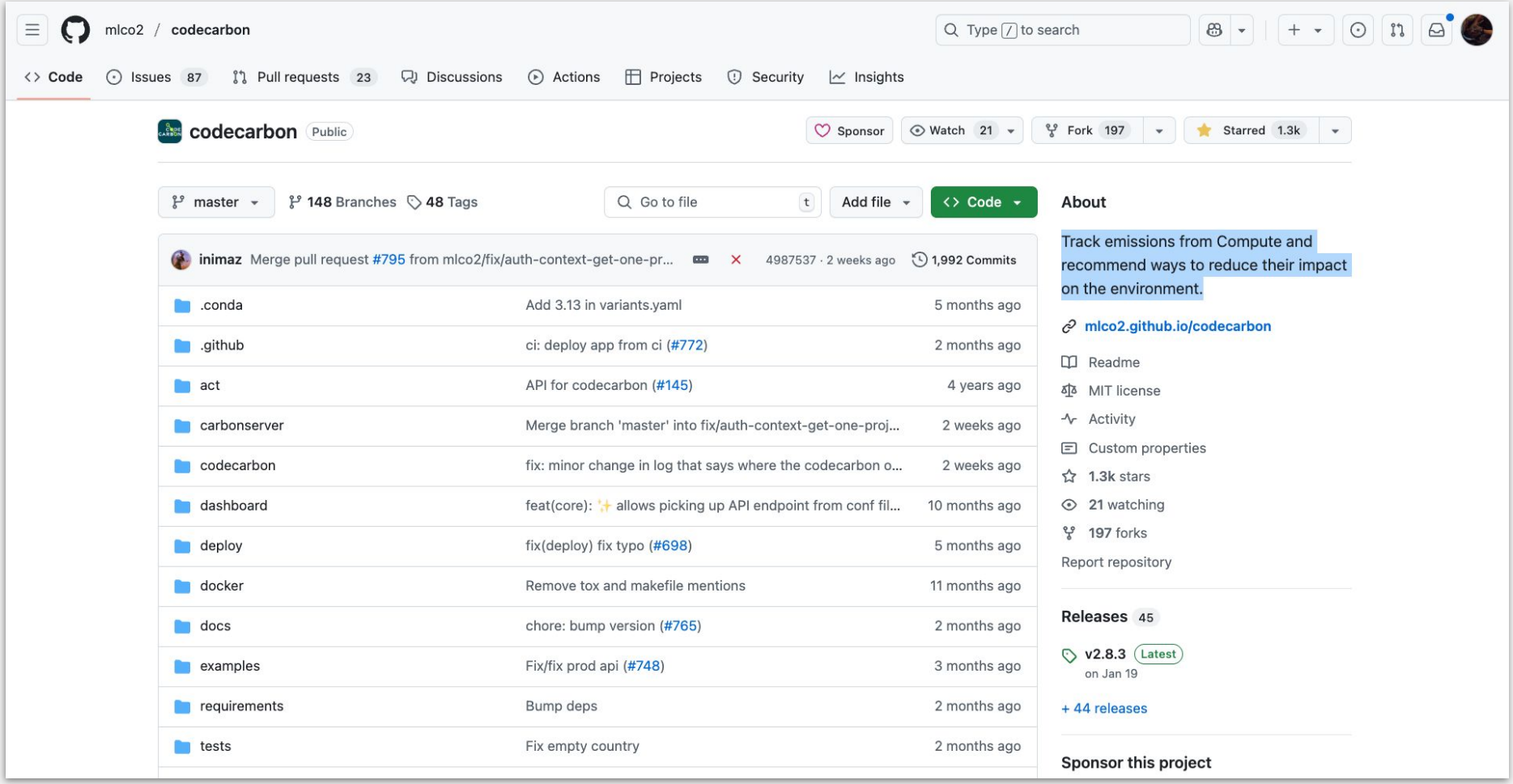
Source: S. Bianco, R. Cadene, L. Celona, and P. Napoletano, "Benchmark analysis of representative deep neural network architectures". IEEE Access, vol. 6, 2018.

LLM Leaderboard



https://llm-stats.com

Last update: 16 august 2025


mlco2 / codecarbon
Type / to search
Code
Issues 87
Pull requests 23
Discussions
Actions
Projects
Security
Insights
codecarbon
Public
Sponsor
Watch 21
Fork 197
Starred 1.3k
master
148 Branches
48 Tags
Go to file
t
Add file
Code
inimaz Merge pull request #795 from mlco2/fix/auth-context-get-one-pr...
4987537 · 2 weeks ago
1,992 Commits
.conda Add 3.13 in variants.yaml 5 months ago
.github ci: deploy app from ci (#772) 2 months ago
act API for codecarbon (#145) 4 years ago
carbonserver Merge branch 'master' into fix/auth-context-get-one-proj... 2 weeks ago
codecarbon fix: minor change in log that says where the codecarbon o... 2 weeks ago
dashboard feat(core): ✨ allows picking up API endpoint from conf fil... 10 months ago
deploy fix(deploy) fix typo (#698) 5 months ago
docker Remove tox and makefile mentions 11 months ago
docs chore: bump version (#765) 2 months ago
examples Fix/fix prod api (#748) 3 months ago
requirements Bump deps 2 months ago
tests Fix empty country 2 months ago
About
Track emissions from Compute and recommend ways to reduce their impact on the environment.
mlco2.github.io/codecarbon
Readme
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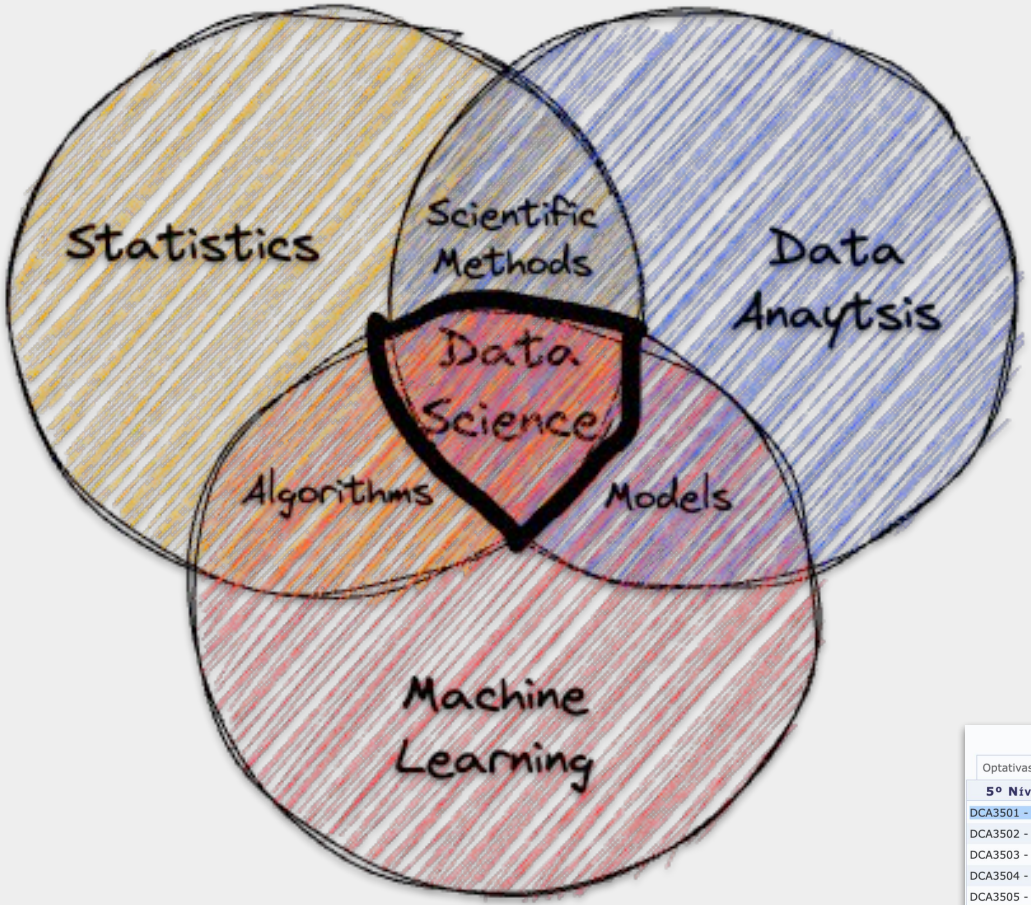
Activity
Custom properties
1.3k stars
21 watching
197 forks
Report repository
Releases 45
v2.8.3 Latest
on Jan 19
+ 44 releases
Sponsor this project

And about graph?
Where and how use them?



Data Science is an interdisciplinary field that use scientific methods, processes, algorithms and systems to extract knowledge and insights from structure and unstructured data.

Data Scientists use data to answer questions.

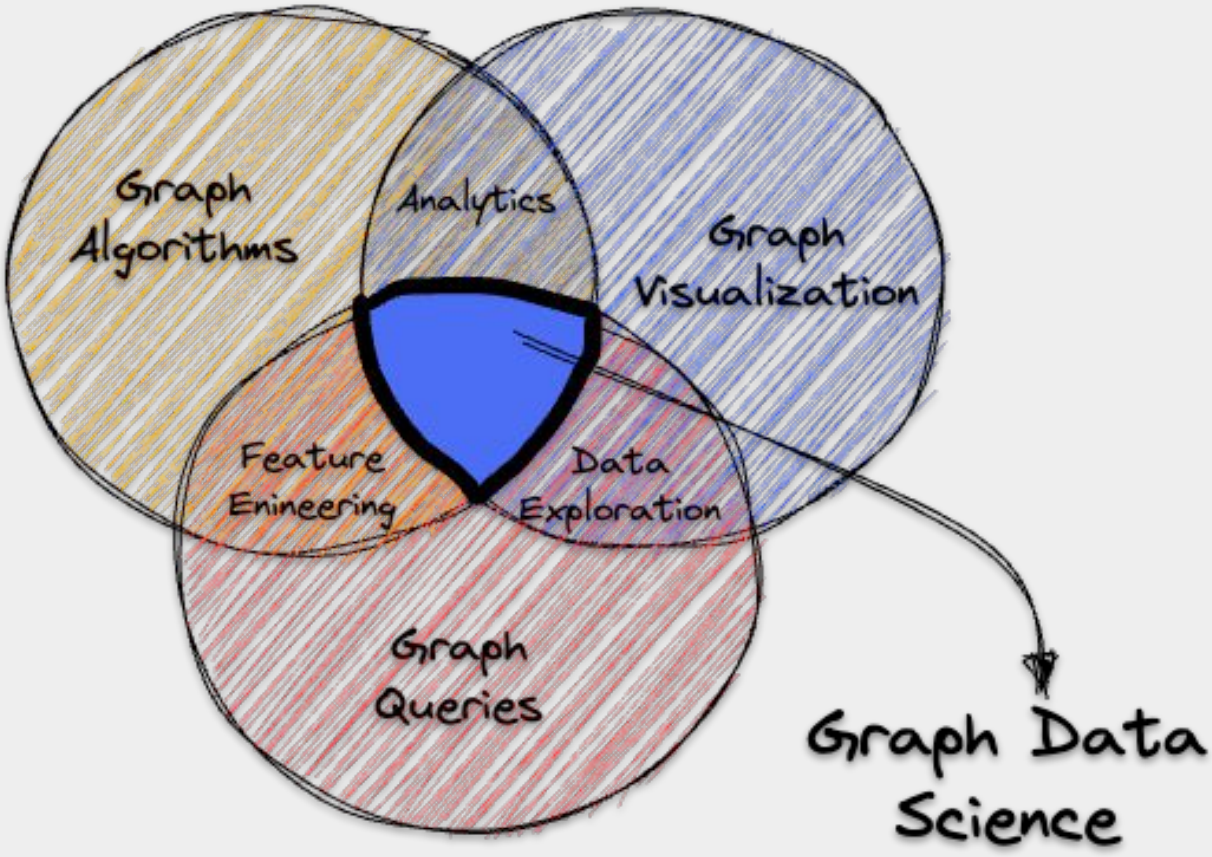
Prazo Para Conclusão (em semestres): Mínimo: 5 **Médio:** 10 **Máximo:** 14

Optativas | Complementares | 1º Nível | 2º Nível | 3º Nível | 4º Nível | 5º Nível | 6º Nível | 7º Nível | 8º Nível | 9º Nível | 10º Nível

5º Nível

DCA3501 - CIÊNCIA DE DADOS - 60h	*Obrigatória*
DCA3502 - SINAIS E SISTEMAS - 60h	*Obrigatória*
DCA3503 - ALGORITMOS E ESTRUTURAS DE DADOS I - 60h	*Obrigatória*
DCA3504 - OTIMIZAÇÃO DE SISTEMAS - 60h	*Obrigatória*
DCA3505 - SISTEMAS OPERACIONAIS - 60h	*Obrigatória*
DCA3506 - ELETRÔNICA - 75h	*Obrigatória*

Carga Horária Total: 375h



Graph Data Science is an science-driven approach to gain knowledge from the relationships and structures in data, typically to power predictions.

Data Scientists use relationships to answer questions.

Building and Environment 274 (2025) 112748

Contents lists available at ScienceDirect

Building and Environment

journal homepage: www.elsevier.com/locate/buildenv

What is a Digital Twin anyway? Deriving the definition for the built environment from over 15,000 scientific publications

Mahmoud Abdelrahman [a], Edgardo Macatulad [a,b], Binyu Lei [a], Matias Quintana [c], Clayton Miller [d], Filip Biljecki [a,e,*]

[a] Department of Architecture, National University of Singapore, 4 Architecture Drive, Singapore, 117566, Singapore
[b] Department of Geodetic Engineering, University of the Philippines, Diliman, Quezon City, 1101, Philippines
[c] Future Cities Lab Global Programme, Singapore-ETH Centre, CREATE campus, #06-01 CREATE Tower, Singapore, 138602, Singapore
[d] Department of the Built Environment, National University of Singapore, 4 Architecture Drive, Singapore, 117566, Singapore
[e] Department of Real Estate, National University of Singapore, 15 Kent Ridge Dr, Singapore, 119245, Singapore

ARTICLE INFO

Keywords:
Digital twin
Terminology
NLP
LLMs
Building digital twin
Urban digital twin
City digital twin

ABSTRACT

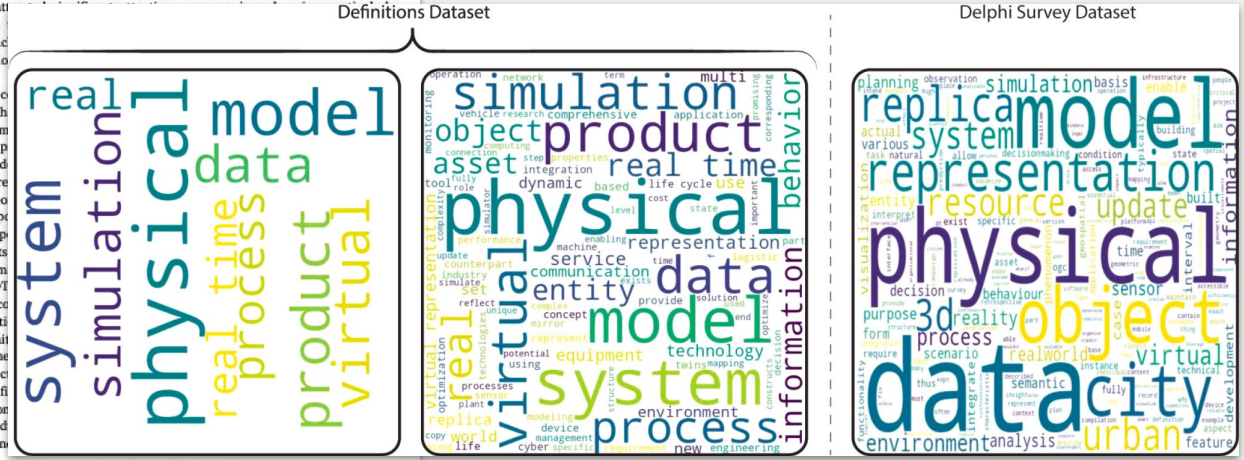
The concept of Digital Twins (DT) has att
within the built environment. However,
consensus remains out of reach. The lac
their conceptualization and implementatio
practitioners.

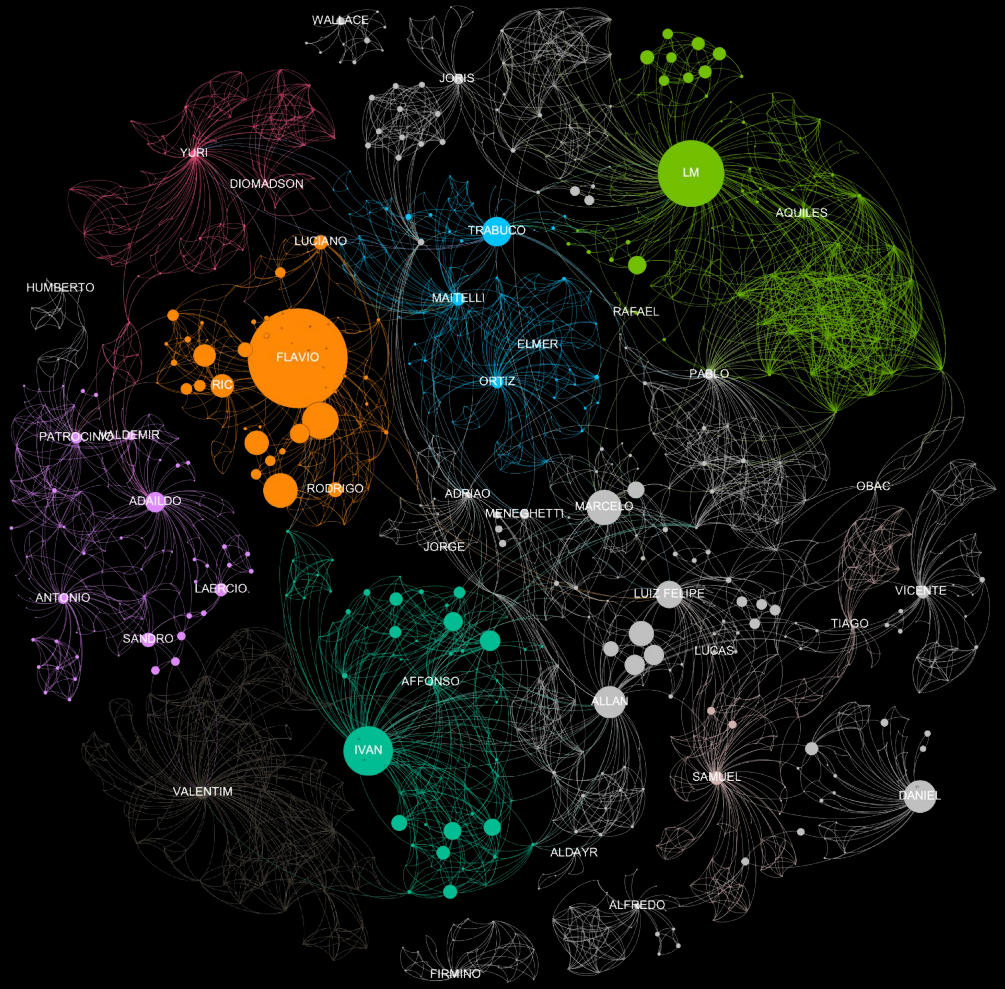
We employed Natural Language Proc
definitions of DTs from a corpus of more th
compares these findings with insights from
concurrence on the components that comp
domains, contrasting them with those that d
twin definitions over time and across differe
perspectives. We extracted the main compo
analysis. Subsequently, we identified compe
test to assess the significance of each comp

Our analysis identified key components
based on application domains, such as m
components reveal two major groups of DT
Decision Support (LTDS) DTs. Contrary to ce
AI/ML, real-time capabilities, and bi-directi
built environment. We derived two definit
Both definitions have a must-have compone
components such as prediction, AI, bi-direct

One of the key findings is that the defi
highlighting the need for ongoing revision
address this, we introduce a novel, reprod
the current definitions in response to techn

Data Science (DS) vs Graph Data Science (GDS)





Edsger W. Dijkstra
co-authored 1 paper with
John R. Rice
co-authored 9 papers with
Dan C. Marinescu
co-authored 2 papers with
Theo Lynn
co-authored 7 papers with
Ivanovitch Silva
distance = 4

https://www.csauthors.net/distance/edsger-w-dijkstra/ivanovitch-silva

Co-authorship Network PPgEEC 2017-2021

Computer Science > Data Structures and Algorithms

[Submitted on 23 Apr 2025 (v1), last revised 30 Jul 2025 (this version, v2)]

Breaking the Sorting Barrier for Directed Single-Source Shortest Paths

Ran Duan, Jiayi Mao, Xiao Mao, Xinkai Shu, Longhui Yin

We give a deterministic $O(m \log^{2/3} n)$-time algorithm for single-source shortest paths (SSSP) on directed graphs with real non-negative edge weights in the comparison-addition model. This is the first result to break the $O(m + n \log n)$ time bound of Dijkstra's algorithm on sparse graphs, showing that Dijkstra's algorithm is not optimal for SSSP.

Comments: 17 pages
Subjects: **Data Structures and Algorithms (cs.DS)**
ACM classes: F.2.2
Cite as: arXiv:2504.17033 **[cs.DS]**
(or arXiv:2504.17033v2 **[cs.DS]** for this version)
https://doi.org/10.48550/arXiv.2504.17033

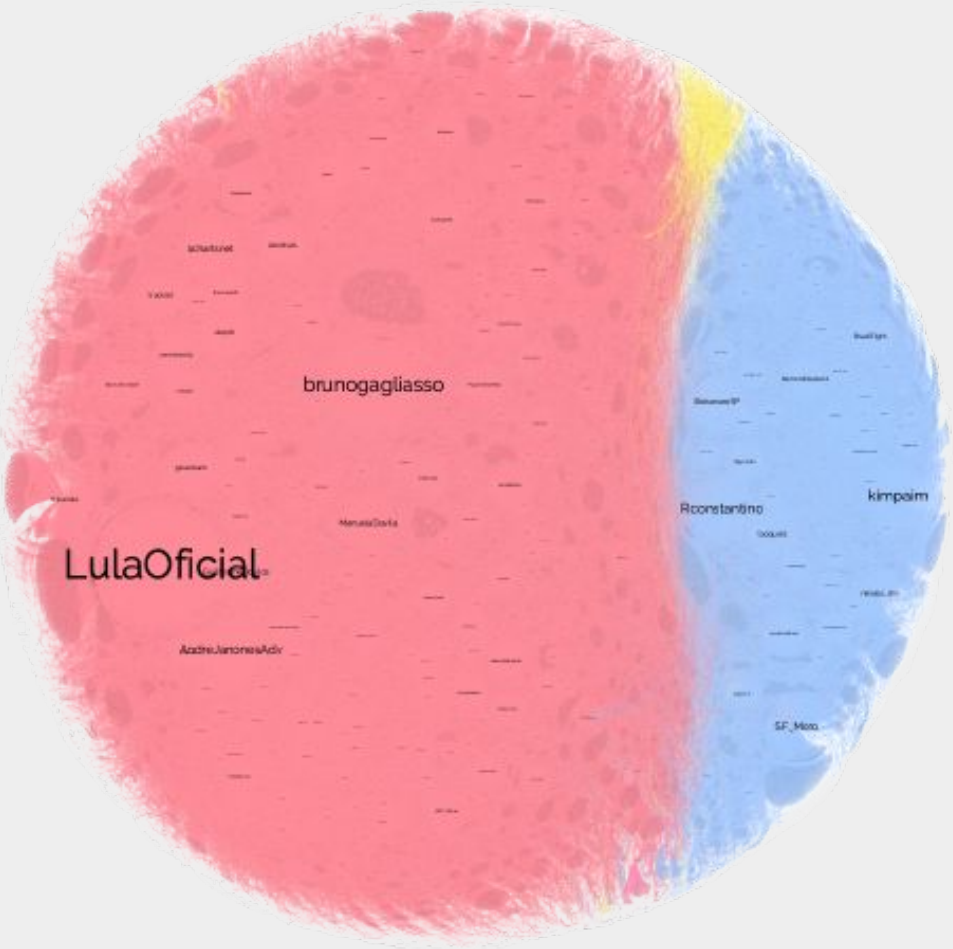
Submission history

From: Ran Duan [view email]
[v1] Wed, 23 Apr 2025 18:26:39 UTC (35 KB)
[v2] Wed, 30 Jul 2025 11:02:48 UTC (49 KB)

Drive

Bike

Bike - Drive

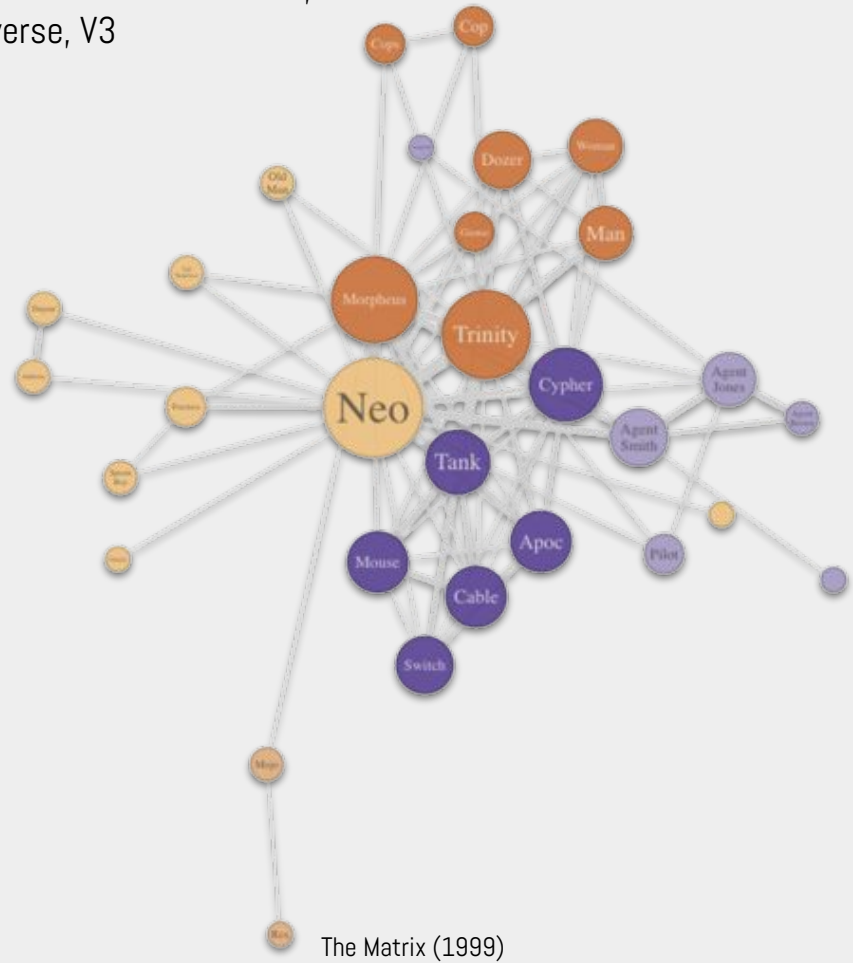


Visualizing Elections Feedback

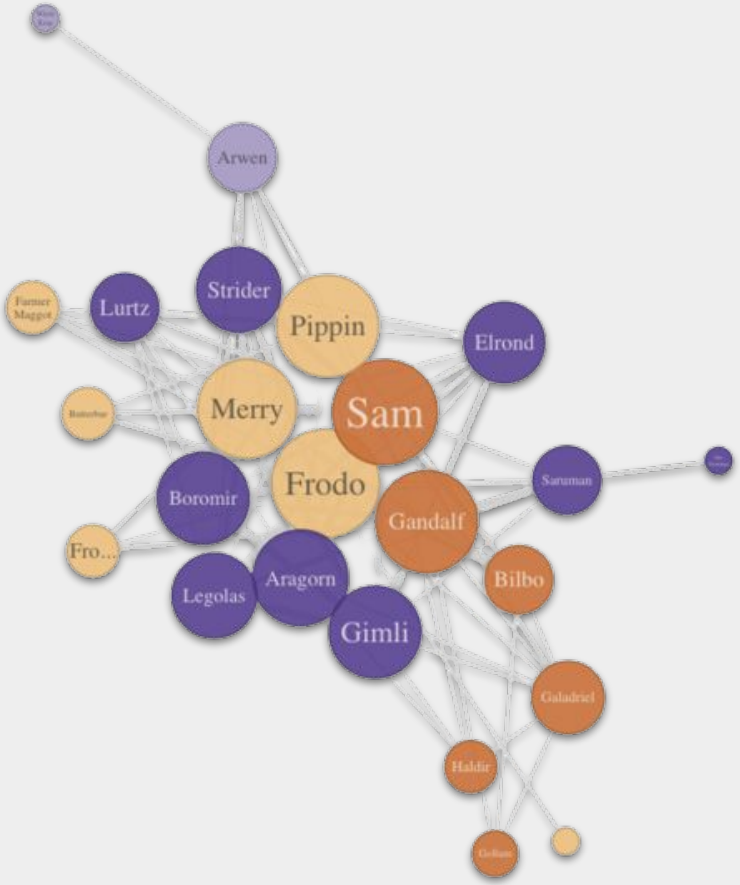
Clustering
Community Detection
Mention network

Kaminski et al., 2018, "Moviegalaxies - Social Networks in Movies", Harvard Dataverse, V3

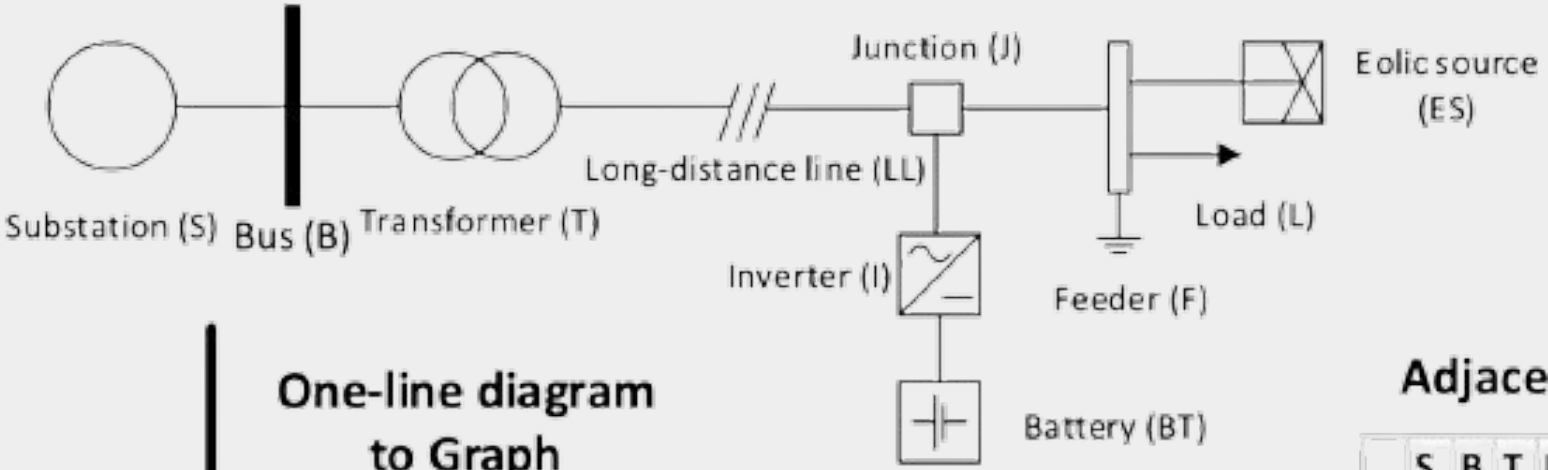
https://moviegalaxies.com



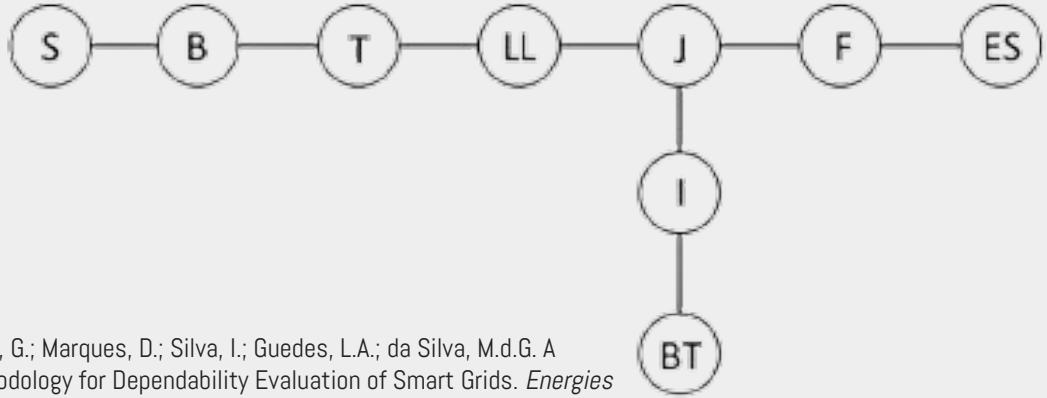
The Matrix (1999)



The Lord of the Rings: The Fellowship of the Ring (2001)



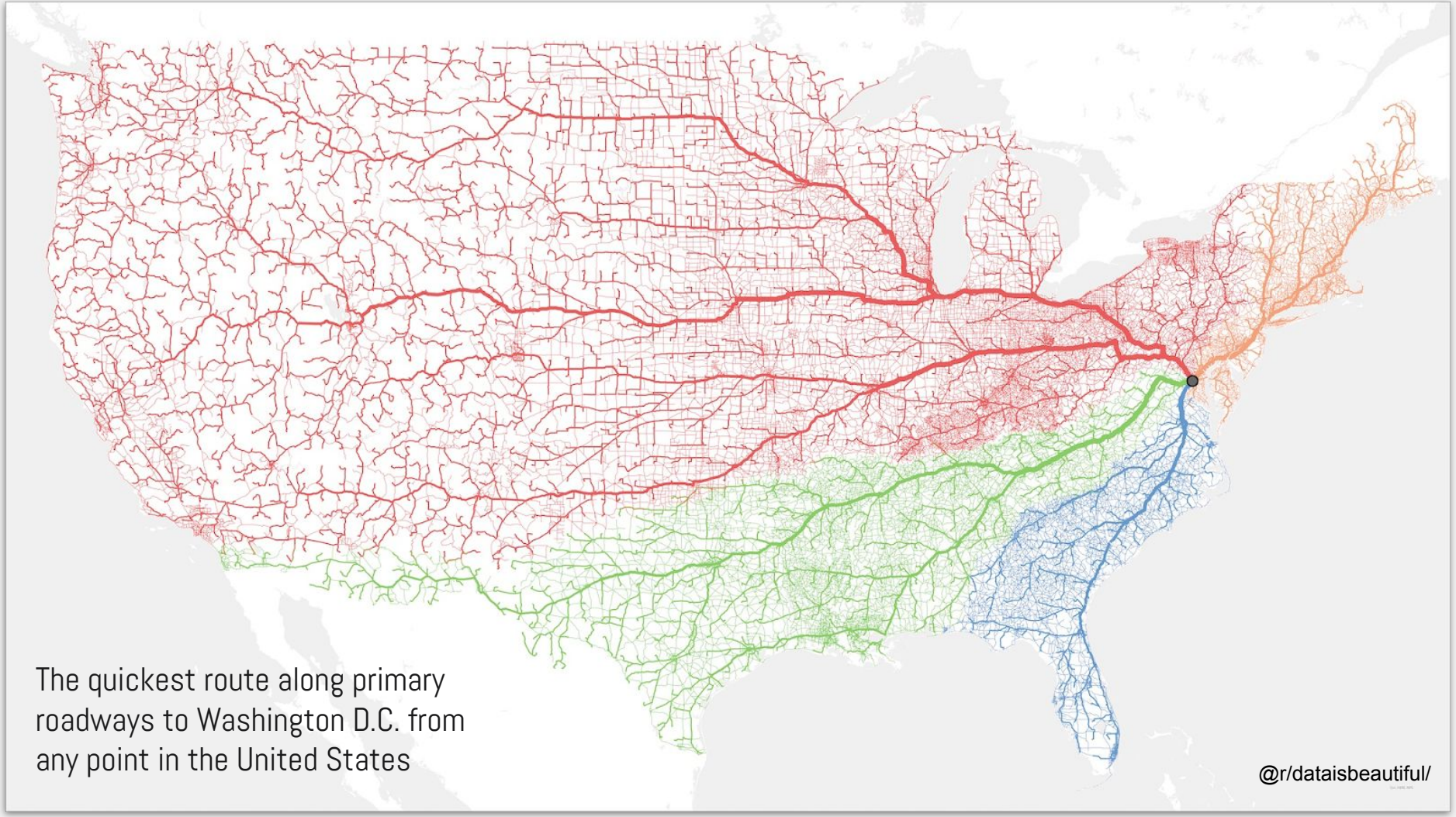
One-line diagram to Graph



Adjacency Matrix

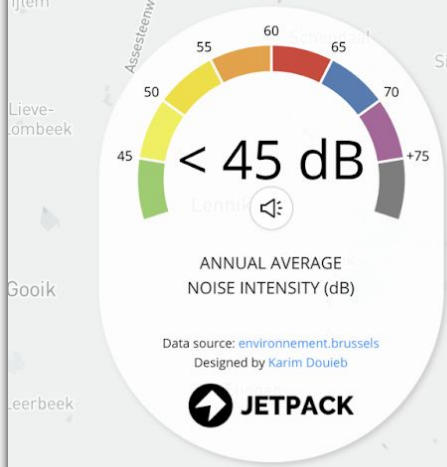
	S	B	T	LL	J	I	BT	F	ES
S	0	1	0	0	0	0	0	0	0
B	1	0	1	0	0	0	0	0	0
T	0	1	0	1	0	0	0	0	0
LL	0	0	1	0	1	0	0	0	0
J	0	0	0	1	0	1	0	1	0
I	0	0	0	0	1	0	1	0	0
BT	0	0	0	0	0	1	0	0	0
F	0	0	0	0	1	0	0	0	1
ES	0	0	0	0	0	0	0	1	0

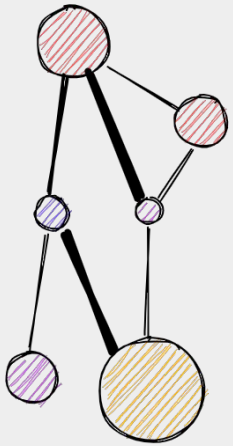
Alves, G.; Marques, D.; Silva, I.; Guedes, L.A.; da Silva, M.d.G. A Methodology for Dependability Evaluation of Smart Grids. *Energies* **2019**, *12*, 1817. https://doi.org/10.3390/en12091817


The quickest route along primary roadways to Washington D.C. from any point in the United States
@r/dataisbeautiful/

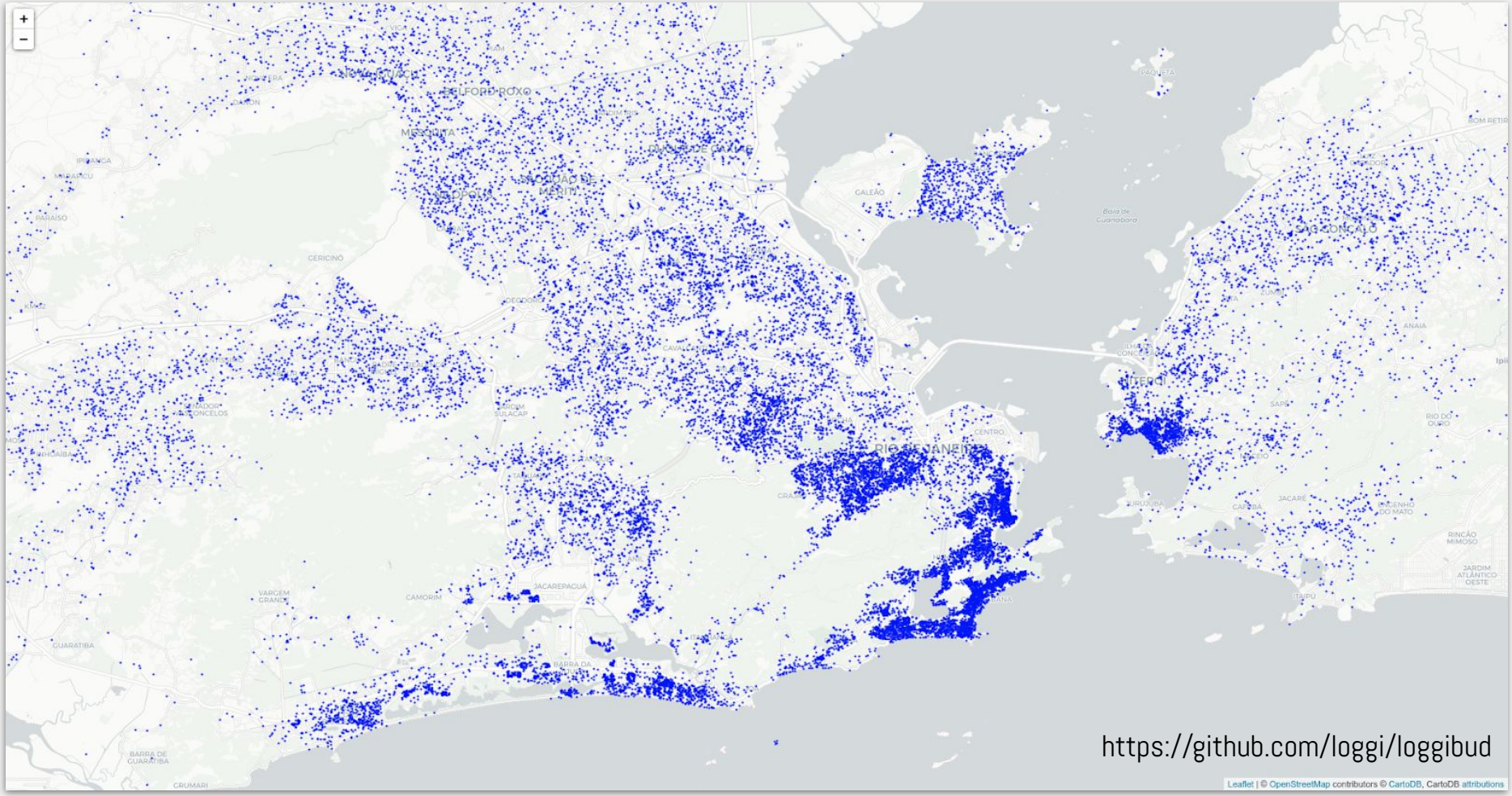
Noisy City

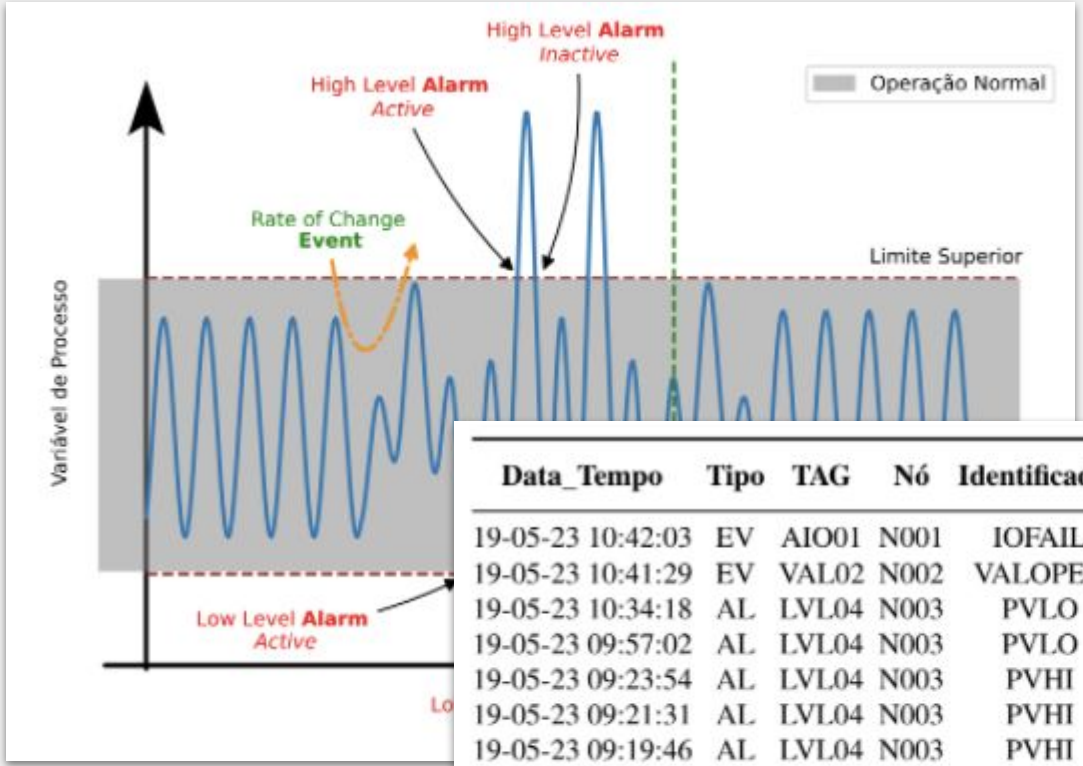
Audible data visualization on Brussels noise pollution.
Crank up the volume and mouse over the city.





https://noisy-city.jetpack.ai/


https://github.com/loggi/loggibud
Leaflet | © OpenStreetMap contributors © CartoDB, CartoDB attributions



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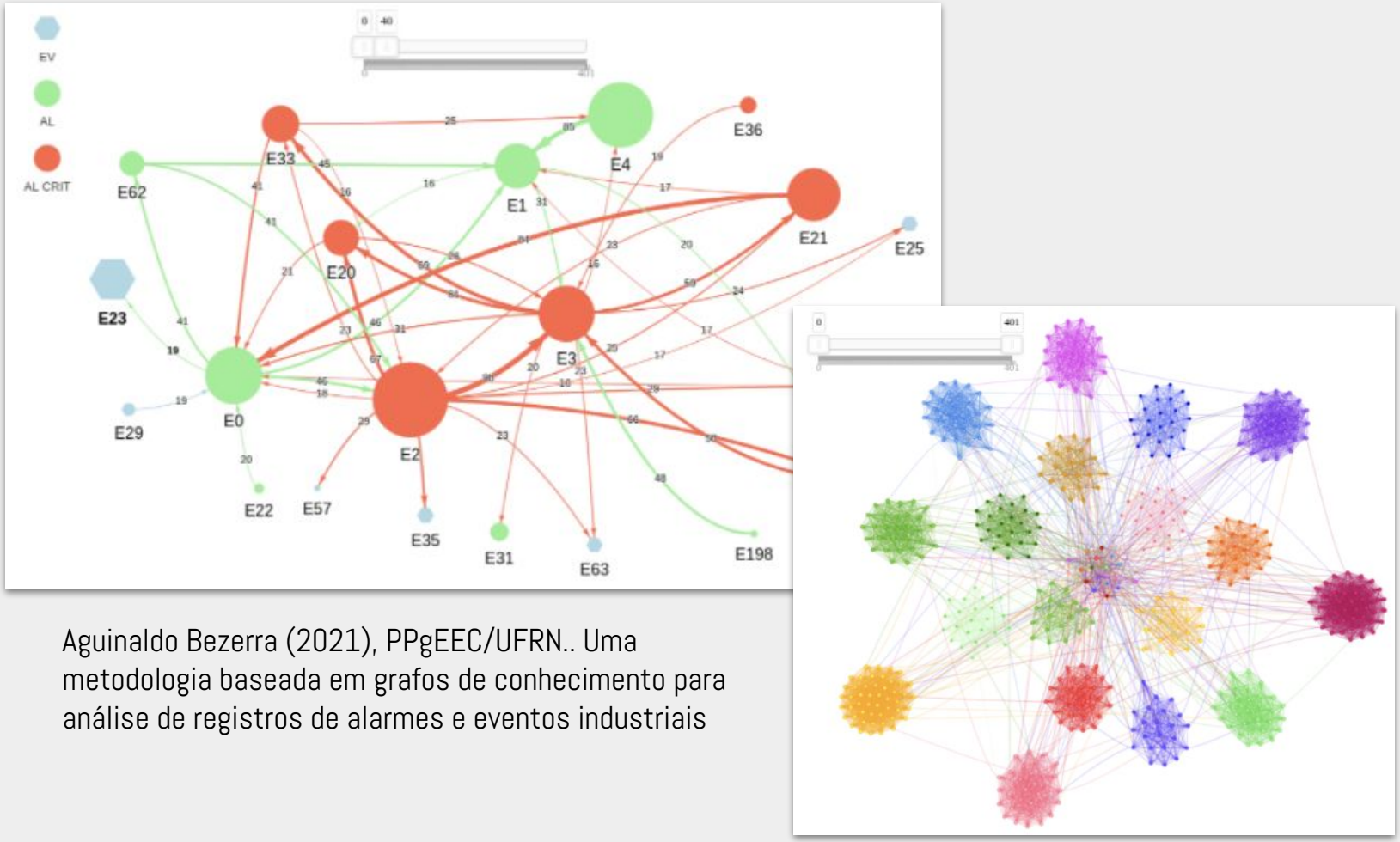
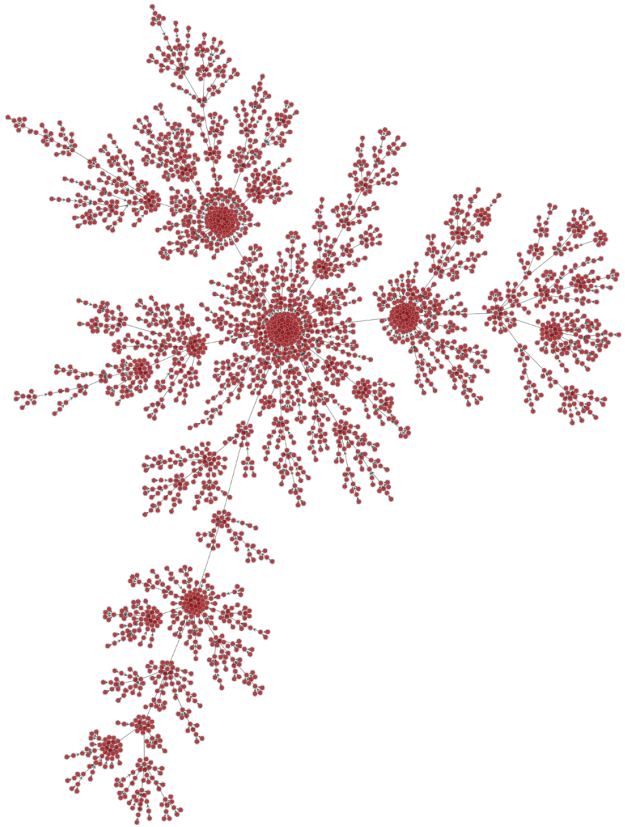
19-05-23 10:41:29	EV	VAL02	N002	VALOPEN	ACTIVE	INFO	...	Valve Open ...	1045
19-05-23 10:34:18	AL	LVL04	N003	PVLO	INACTIVE	CRITICAL	...	Low Level ...	1037
19-05-23 09:57:02	AL	LVL04	N003	PVLO	ACTIVE	CRITICAL	...	Low Level ...	1031
19-05-23 09:23:54	AL	LVL04	N003	PVHI	INACTIVE	CRITICAL	...	High Level ...	1027
19-05-23 09:21:31	AL	LVL04	N003	PVHI	ACTIVE	CRITICAL	...	High Level ...	1025
19-05-23 09:19:46	AL	LVL04	N003	PVHI	INACTIVE	CRITICAL	...	High Level ...	1022
19-05-23 09:17:34	AL	LVL04	N003	PVHI	ACTIVE	CRITICAL	...	High Level ...	1019
19-05-23 09:15:16	AL	LVL04	N003	PVLO	INACTIVE	CRITICAL	...	Low Level ...	1017
19-05-23 09:12:57	AL	LVL04	N003	PVLO	ACTIVE	CRITICAL	...	Low Level ...	1010
19-05-23 09:04:22	EV	LVL04	N003	PVRATE	ATIVO	WARNING	...	Rate of Chan...	0996

Aguinaldo Bezerra (2021), PPgEEC/UFRN. Uma metodologia baseada em grafos de conhecimento para análise de registros de alarmes e eventos industriais

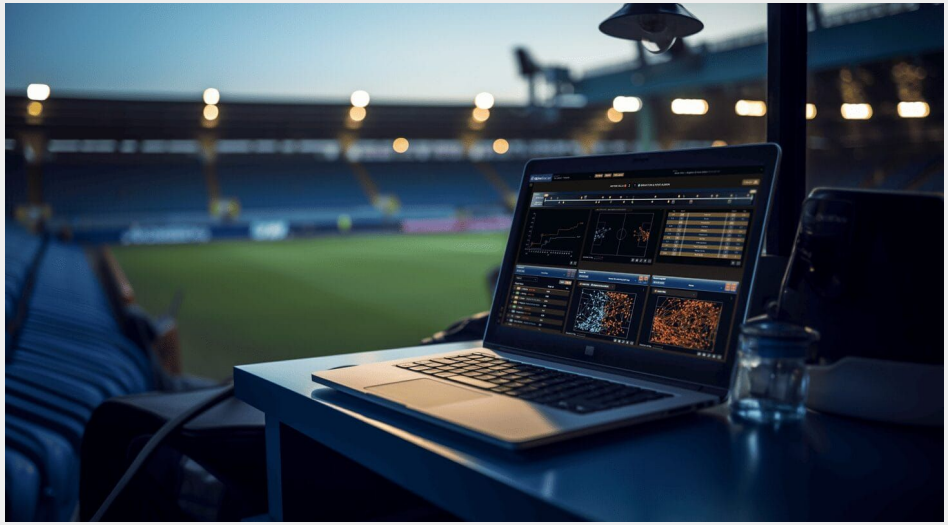


Aguinaldo Bezerra (2021), PPgEEC/UFRN.. Uma metodologia baseada em grafos de conhecimento para análise de registros de alarmes e eventos industriais

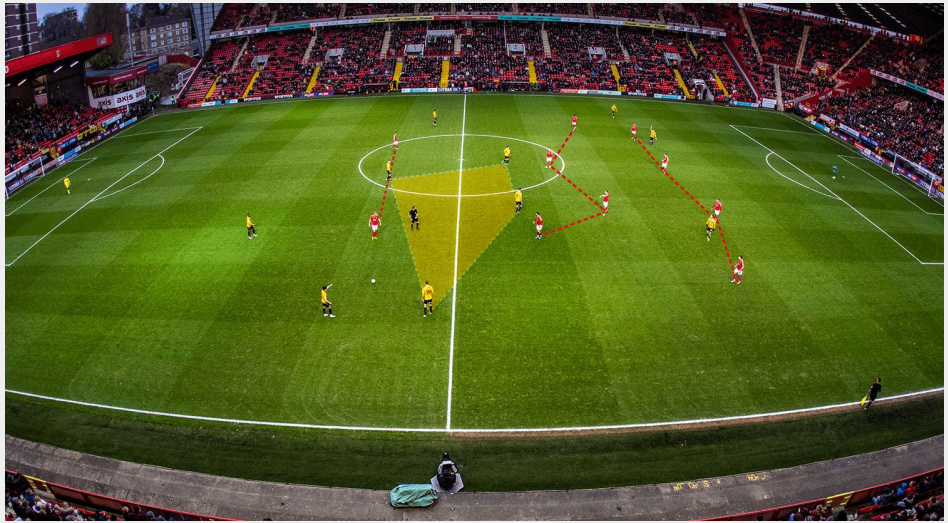


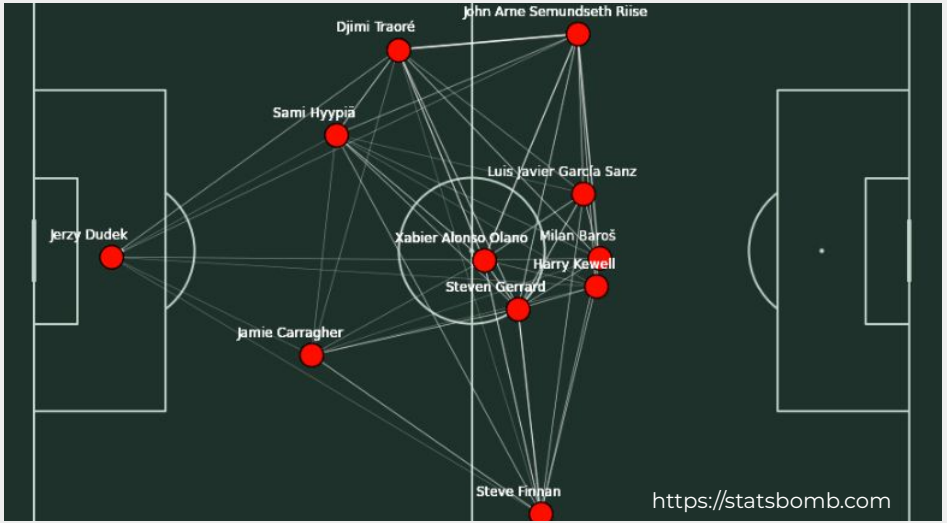
Descreva em detalhes todos os ingredientes desse prato.

Este prato parece ser composto por camarões empanados com uma crosta crocante, possivelmente feita com farinha panko, sementes de gergelim ou quinoa. Eles são servidos sobre um molho agridoce vermelho-escuro, provavelmente à base de frutas ou mel. Ao centro, há um risoto cremoso, possivelmente preparado com arroz arbóreo ou carnaroli, enriquecido com pequenos cubos de legumes como abobrinha e finalizado com lâminas crocantes de amêndoas torradas. A decoração inclui um ramo fresco de alecrim. Ao lado, há também um molho adicional avermelhado, que pode ser o mesmo molho que decora o prato. O prato está apresentado sobre folhas decorativas verdes, destacando a apresentação elegante e tropical.



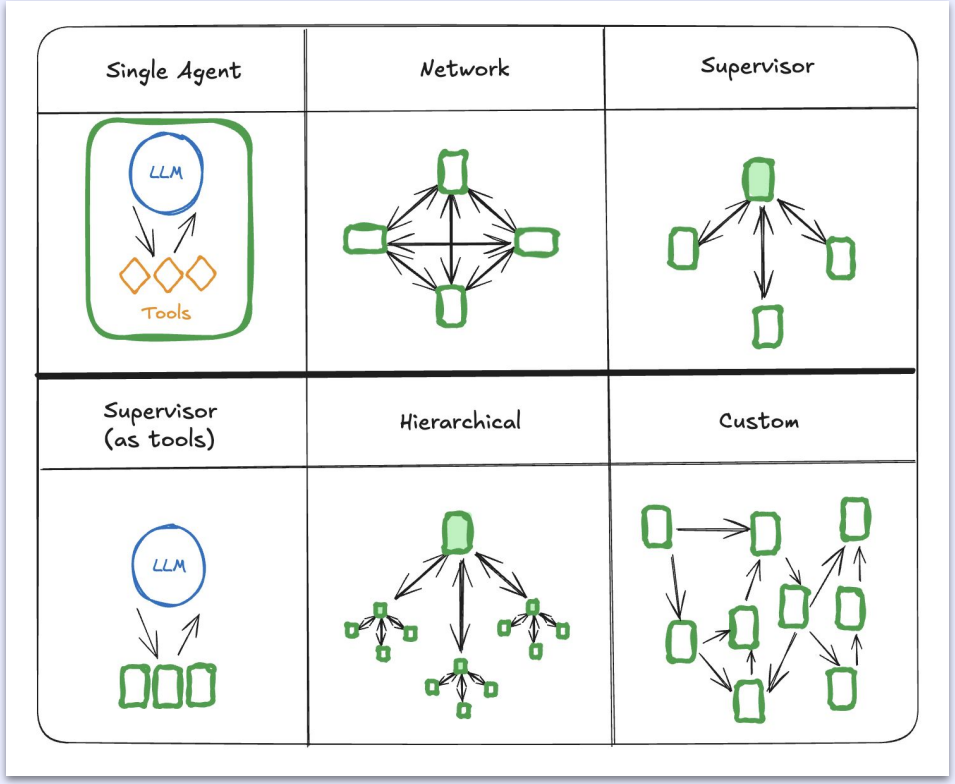

360
360

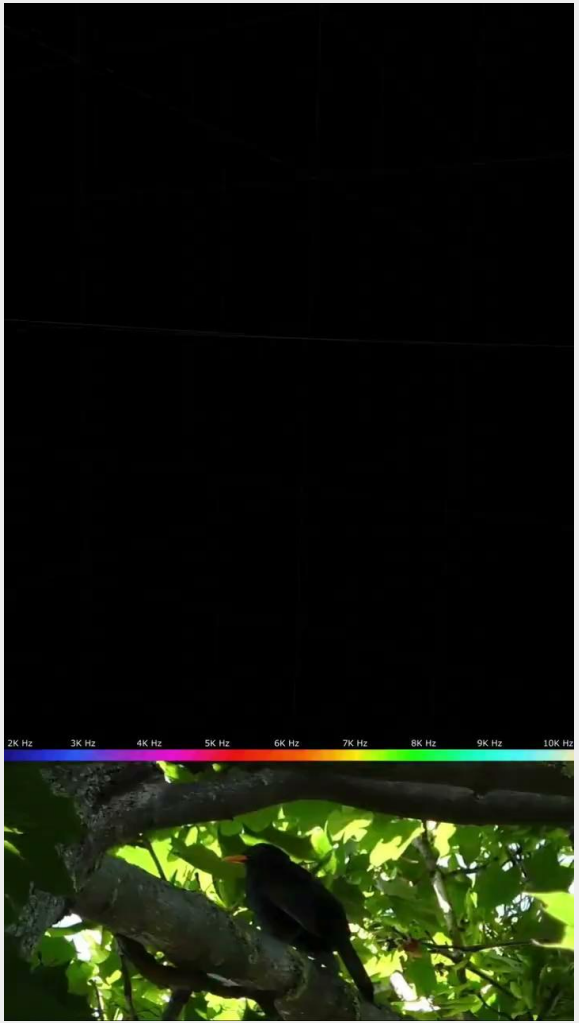


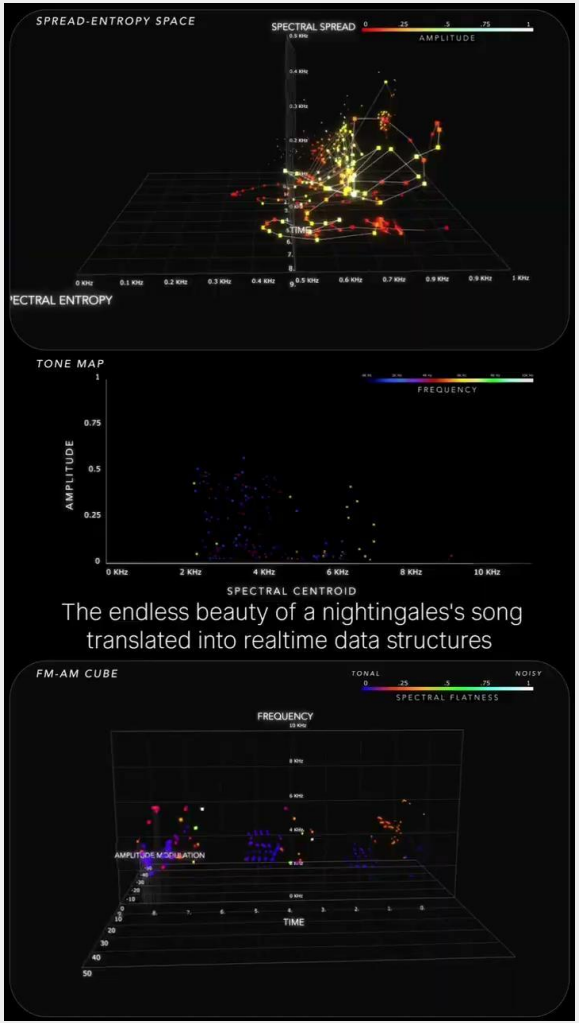

John Arne Semundseth Riise
Djimi Traoré
Sami Hyypiä
Luis Javier García Sanz
Jerzy Dudek
Xabier Alonso Olano
Milán Baroš
Harry Kewell
Steven Gerrard
Jamie Carragher
Steve Finnan
https://statsbomb.com

Multi-Agents Architecture

LangGraph

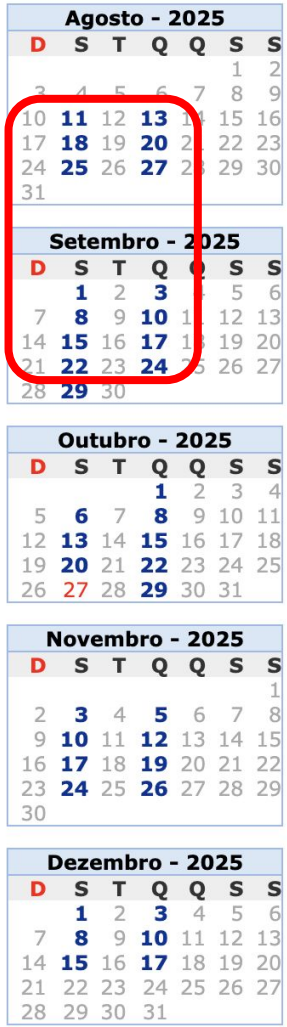






The endless beauty of a nightingales's song translated into realtime data structures

https://www.instagram.com/lucioarese



Unit 01

11/08 to 24/09

Week 01
11/08 and 13/08 - Planning

Week 02
18/08 - Course Presentation
20/08 - Network Elements I (Networkx)

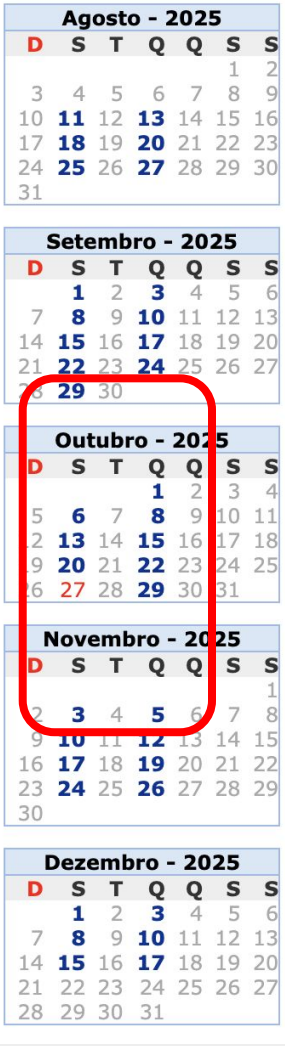
Week 03
25/08 - Network Elements II (Networkx)
27/08 - Homophily and Assortativity (Networkx)

Week 04
01/09 - Paths, Distance, and Walks (Networkx)
03/09 - [Project #01] - Description

Week 05
08/09 - [Project #01] doing
10/09 - [Project #01] doing

Week 06
15/09 - [Project #01] doing
17/09 - [Project #01] doing

Week 07
22/09 - [Project #01] Pitch Presentation (10min) + Peer Q&A + Report
24/09 - [Project #01] Pitch Presentation (10min) + Peer Q&A + Report



Week 08
29/09 - Shortest path algorithm (Dijsktra)
01/10 - Shortest path algorithm (Dijsktra + Min-Heap)

Week 09
06/10 - Shortest path algorithm (Bellman-Ford)
08/10 - Shortest path algorithm (A*)

Week 10
13/10 - Minimum spanning tree (Kruskal)
15/10 - Minimum spanning tree (Prim)

Week 11
20/10 -[Project #02] - Description
22/10 - [Project #02] - Doing

Week 12
27/10 - **no class**
29/10 - [Project #02] doing

Week 13
03/11 - [Project #02] Pitch Presentation (10min) + Peer Q&A + Report
05/11 - [Project #02] Pitch Presentation (10min) + Peer Q&A + Report

Unit 02

29/09 to 05/11

Week 14
10/11 - Key Centrality Metrics
12/11 - Core Decomposition

Week 15
17/11 - Case study (wikipedia) + Advanced Visualization (Gephi)
19/11 - NLP and Network

Week 16
24/11 - [Project #03] Description
26/11 - [Project #03] Doing

Week 17
01/12 - [Project #03] Follow-up
03/12 -[Project #03] Doing

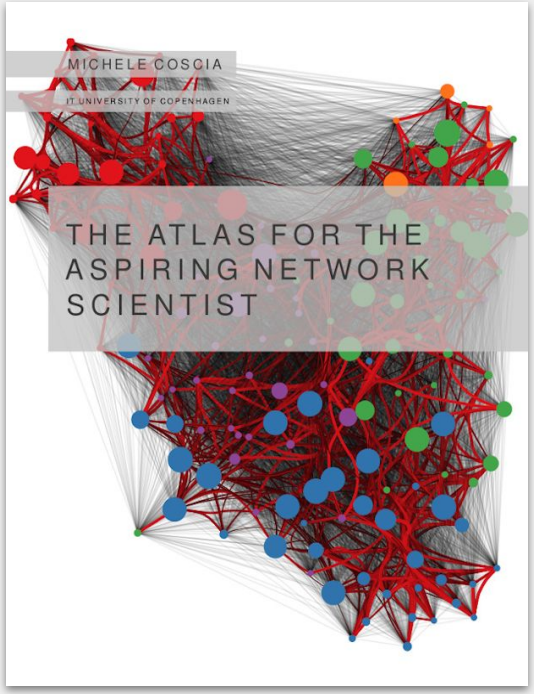
Week 18
08/12 - [Project #03] Pitch Presentation (10min) + Peer Q&A + Report
10/12 - [Project #03] Pitch Presentation (10min) + Peer Q&A + Report

Week 19
15/12 - no class
17/12 - Final exam

Unit 03

10/11 to 17/12

References


MICHELE COSCIA
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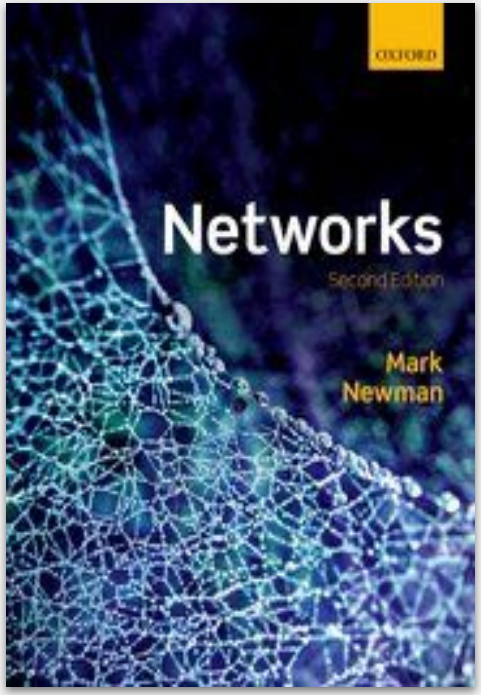
THE ATLAS FOR THE ASPIRING NETWORK SCIENTIST


OXFORD
Networks
Second Edition
Mark Newman

Clone me!!!!

https://github.com/ivanovitchm/datastructure