Algorithms & Data Structures II
DCA 0209

ivanovitch.silva@ufrn.br
@ivanovitchm

Drive

Bike

Bike - Drive

Matriz Curricular: ENGENHARIA DE COMPUTAÇÃO - NATAL - BACHARELADO - Presencial - MT

Período Letivo de Entrada em Vigor: 2020.1

Prazos e Cargas Horárias

Total Mínima: 3885h

Carga Horária Obrigatória

Subtotal de CH de Aula: 2970h

Subtotal de CH de Orientação Acadêmica/Profissional: 220h

Total: 3190h

Carga Horária Optativa Mínima: 495h

Carga Horária Complementar Mínima: 200h

Carga Horária Obrigatória Atividade Acadêmica Específica: 0h

Carga Horária Máxima de Componentes Eletivos: 120h

Carga Horária Máxima por Período Letivo: 600h

Prazo Para Conclusão (em semestres): **Mínimo:** 10 **Médio:** 10 **Máximo:** 12

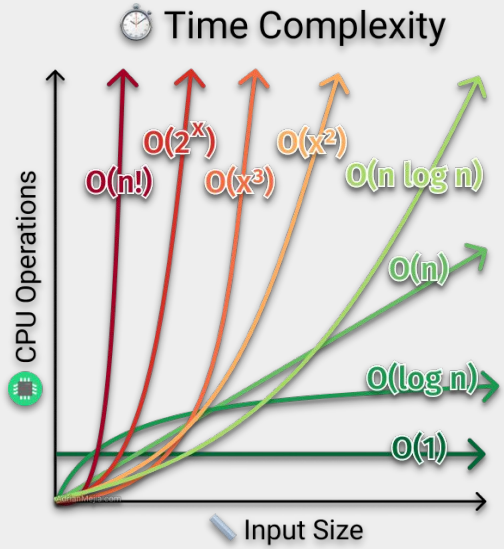
Optativas | Complementares | 1º Nível | 2º Nível | 3º Nível | 4º Nível | 5º Nível | 6º Nível | 7º Nível | 8º Nível | 9º Nível | 10º Nível

7º Nível

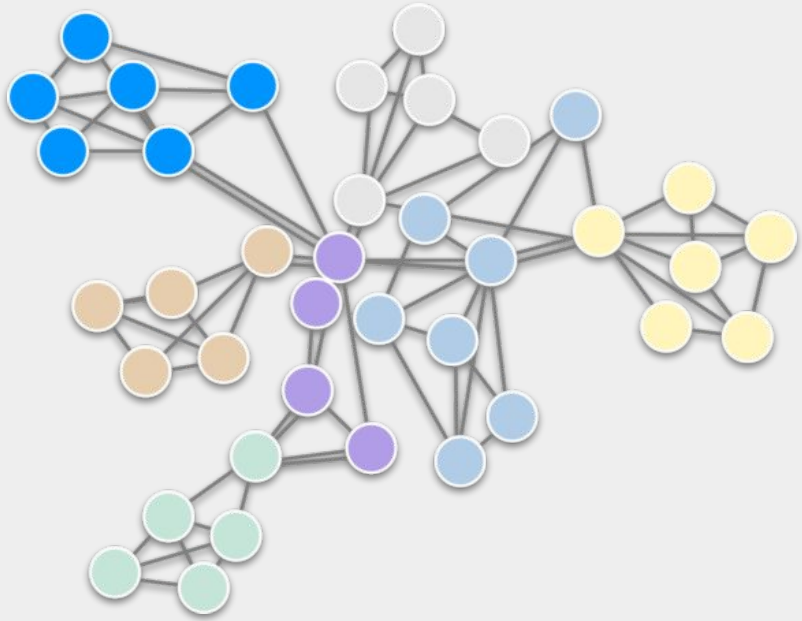
DCA0108 - SISTEMAS OPERACIONAIS - 60h	*Obrigatória*
DCA0114 - COMPUTACAO GRAFICA - 60h	*Obrigatória*
DCA0119 - SISTEMAS DIGITAIS - 60h	*Obrigatória*
DCA0200 - INTELIGÊNCIA ARTIFICIAL - 60h	*Obrigatória*
DCA0209 - ALGORITMOS E ESTRUTURAS DE DADOS II - 60h	*Obrigatória*
DCA0210 - LINGUAGENS FORMAIS E AUTÔMATOS - 45h	*Obrigatória*
DCA0211 - COMPILADORES - 45h	*Obrigatória*

Carga Horária Total: 390h

Course Outline



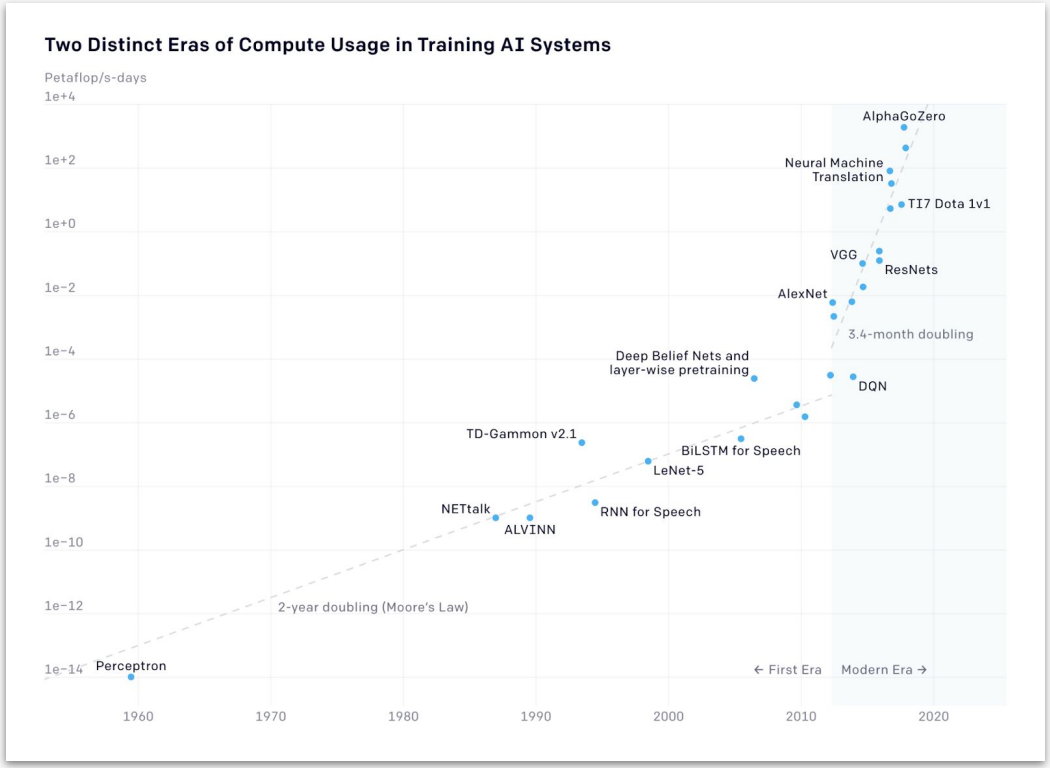
Algorithm Complexity



Graph

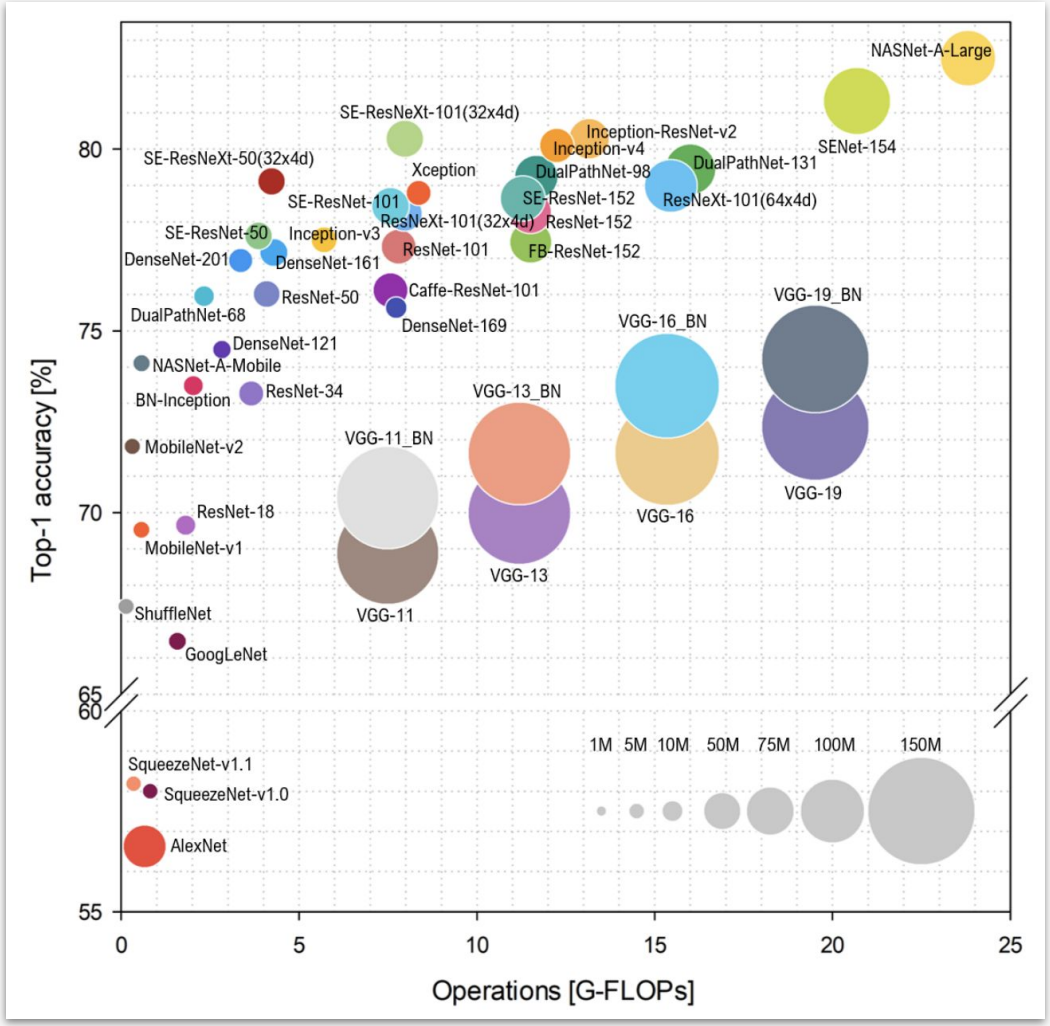
ML Compute Needs (from the 1960s)

Algorithm Complexity



In recent years, the amount of computing needed has grown remarkably fast.

Computer requirements are **doubling nearly every 3 to 4 months.**

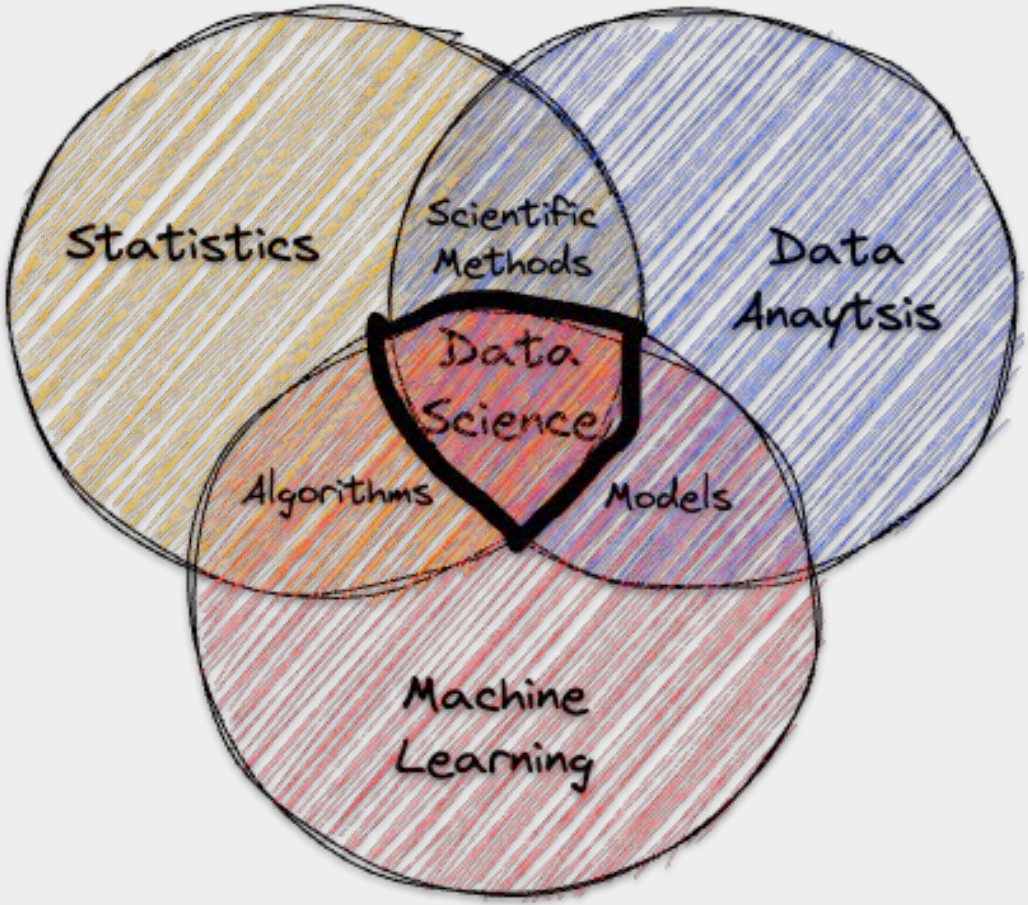


Algorithm Complexity

ML Model Evolution ImageNet

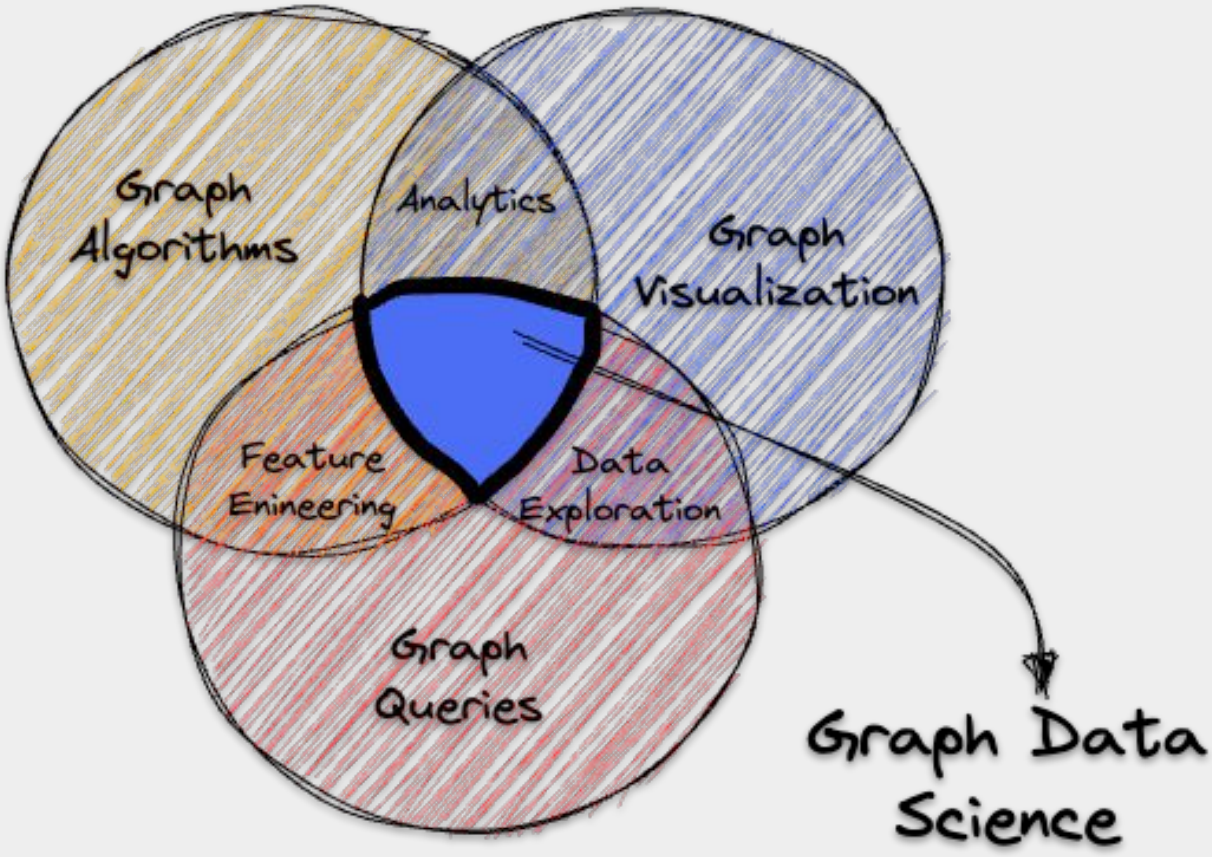
Source: S. Bianco, R. Cadene, L. Celona, and P. Napoletano, "Benchmark analysis of representative deep neural network architectures". IEEE Access, vol. 6, 2018.

And about graph?
Where and how use them?



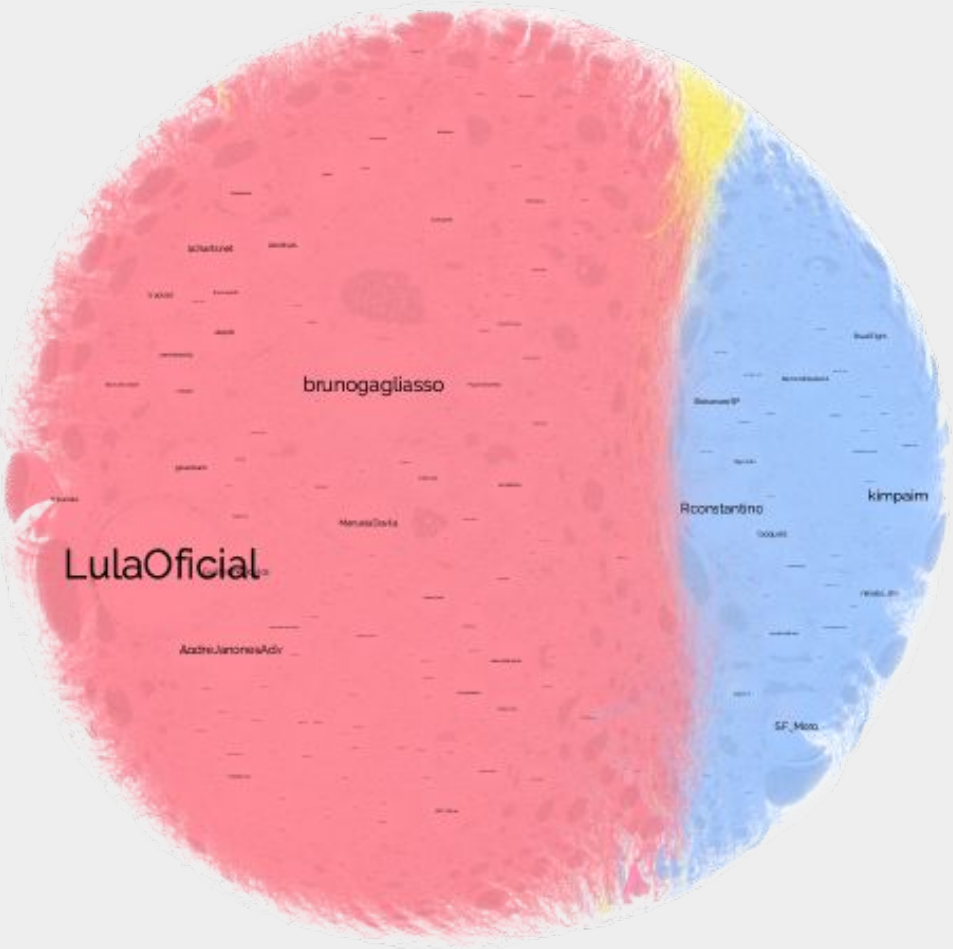
Data Science is an interdisciplinary field that use scientific methods, processes, algorithms and systems to extract knowledge and insights from structure and unstructured data.

Data Scientists use data to answer questions.



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.

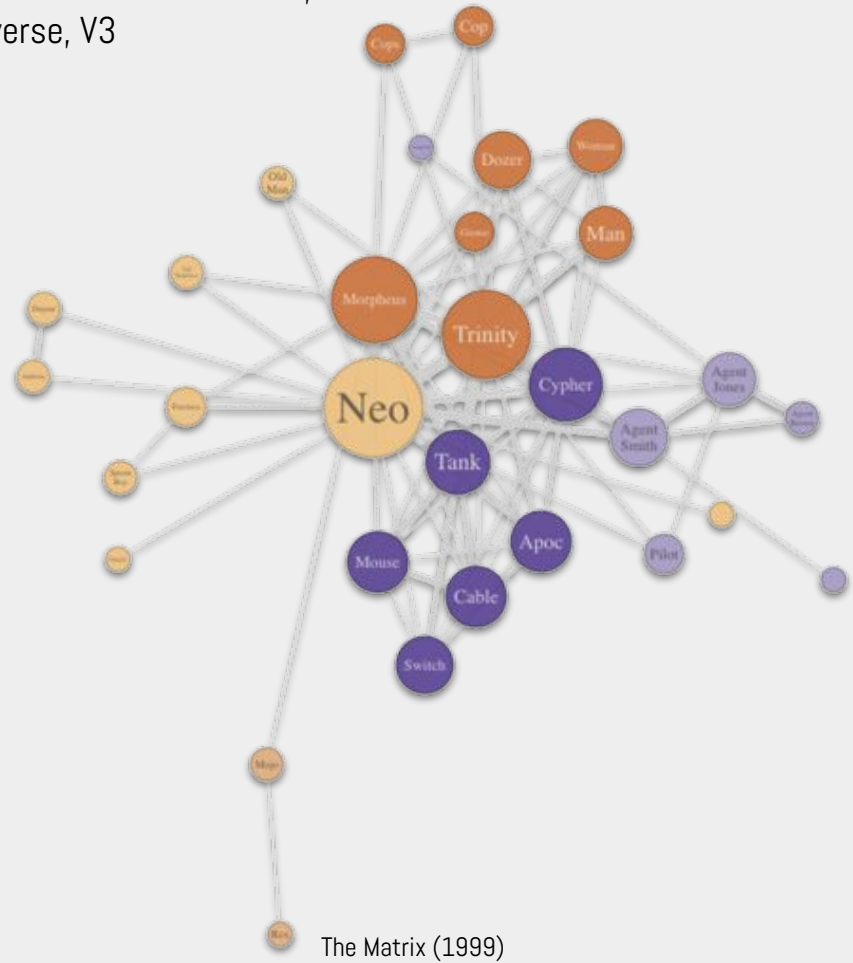


Visualizing Elections Feedback

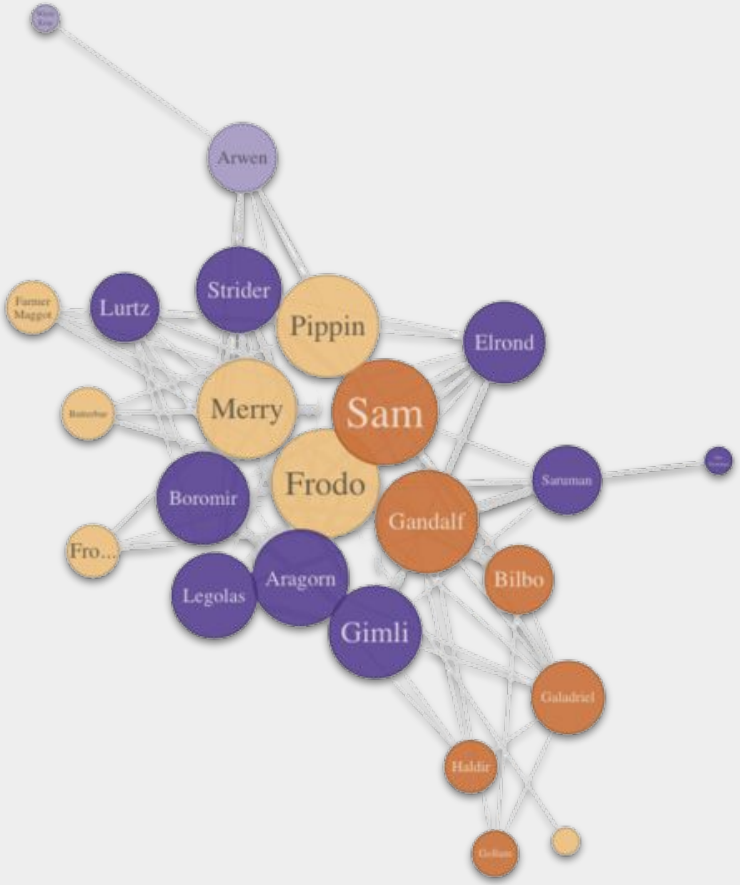
Clustering
Community Detection
Mention network

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

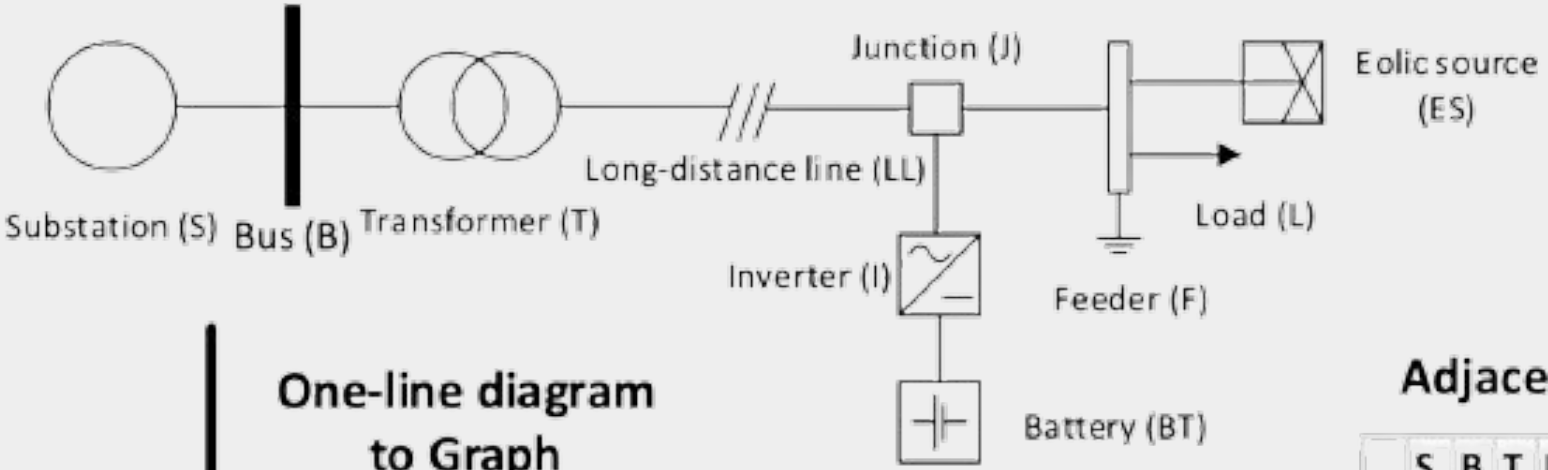
https://moviegalaxies.com



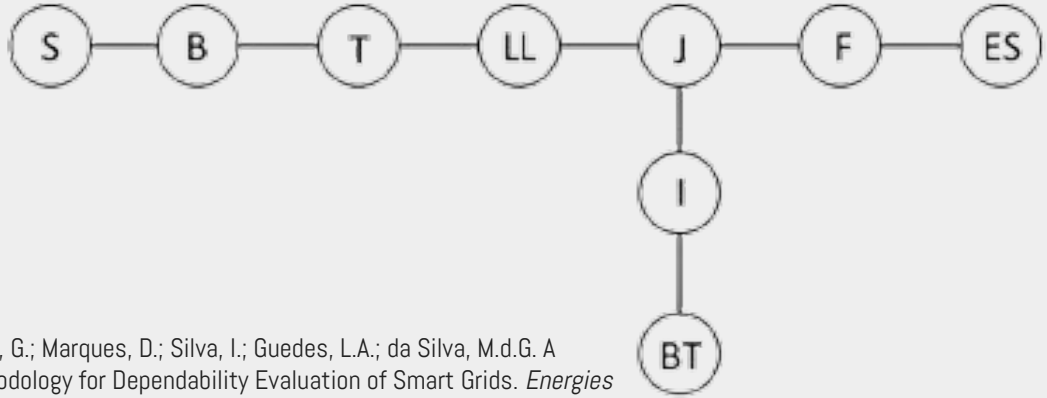
The Matrix (1999)



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



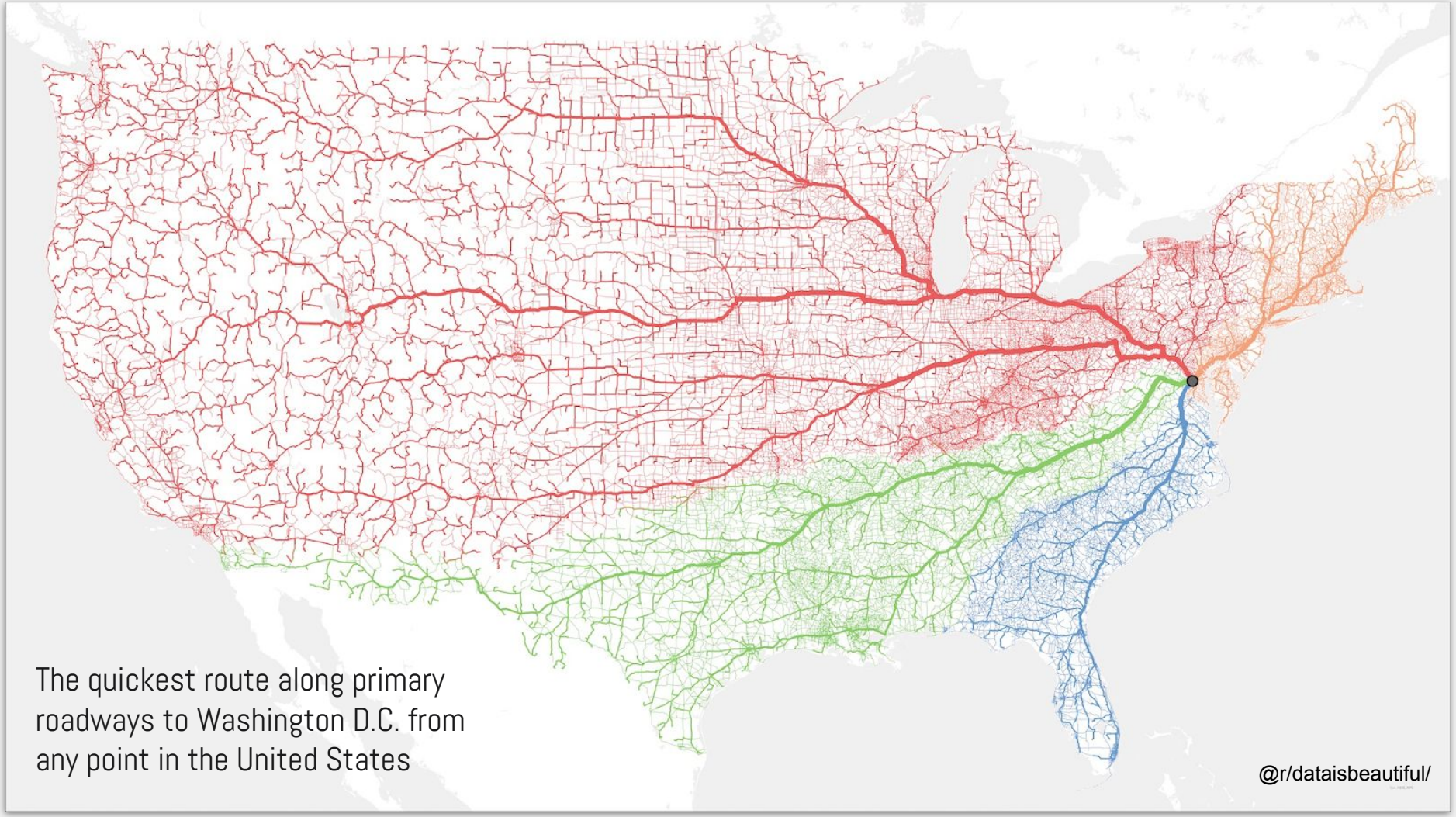
One-line diagram to Graph



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

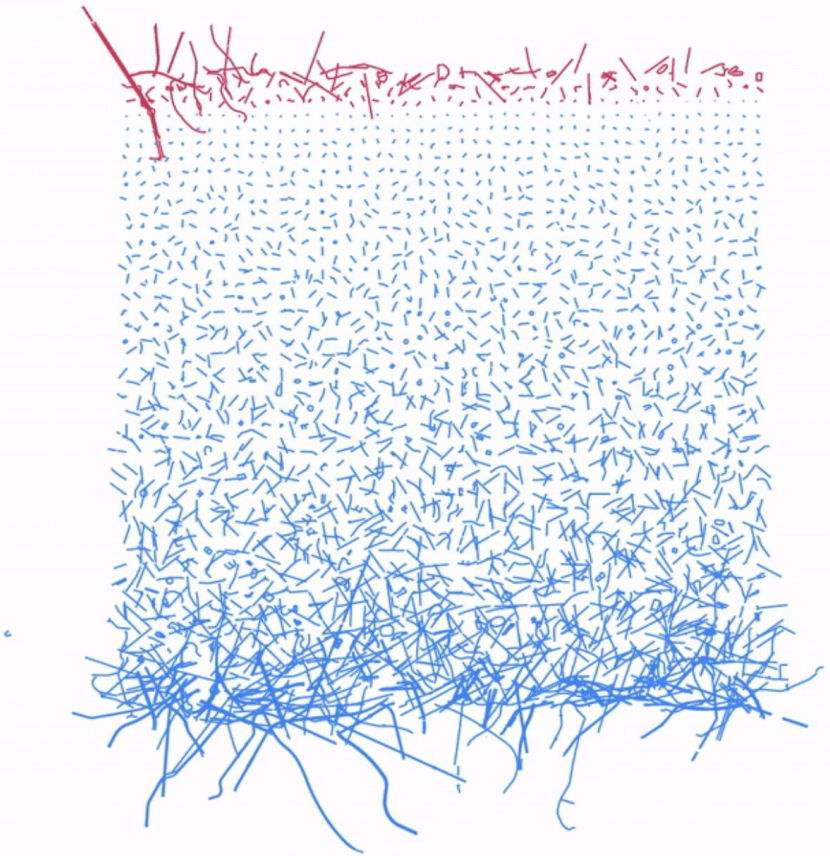

The quickest route along primary roadways to Washington D.C. from any point in the United States
@r/dataisbeautiful/

Drive

Bike

Bike - Drive

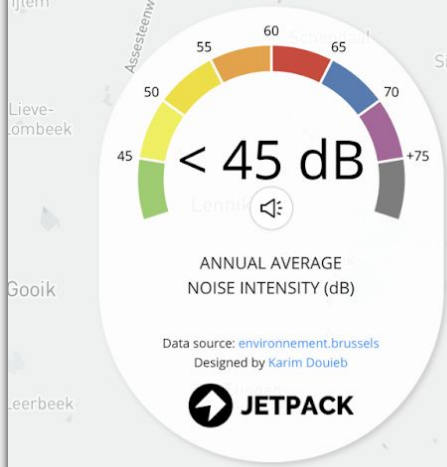
Only 6% of Brussels streets are named after women. Open Knowledge BE organized the production of these statistics with the help of 60 volunteers who tagged the gender of each street in Brussels.

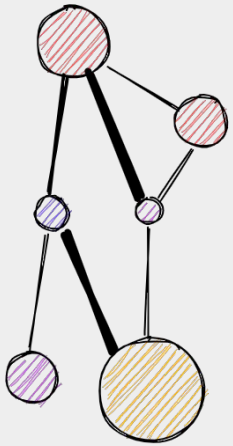


https://www.karim.news/project/street-gender

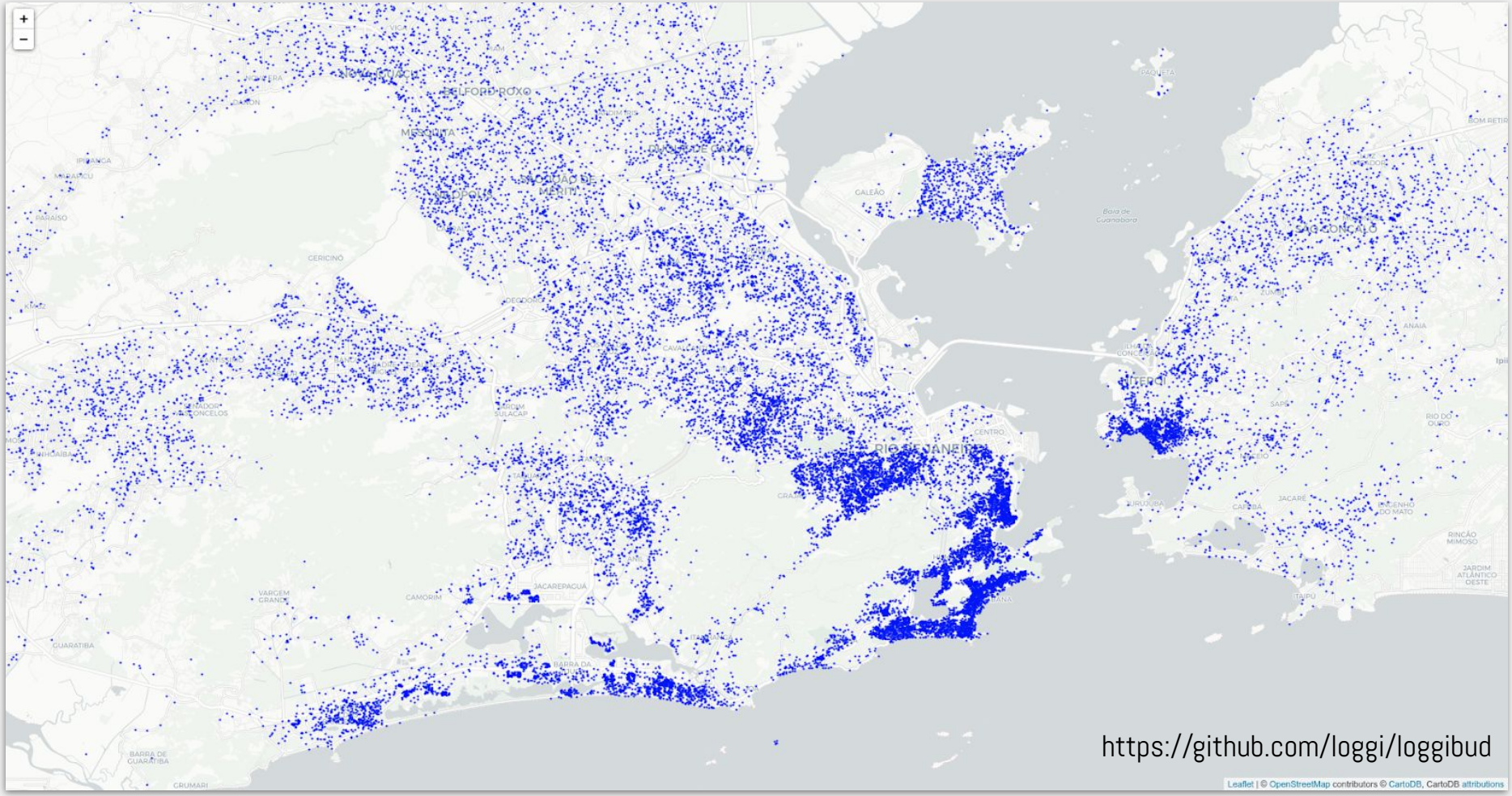
Noisy City

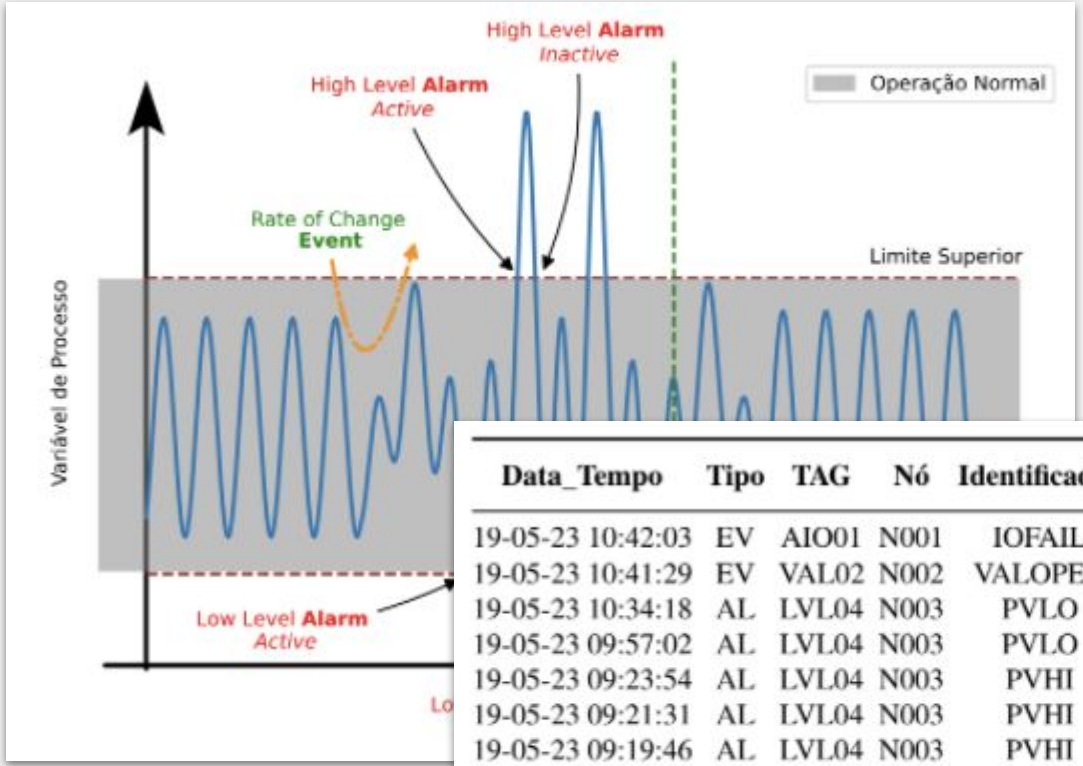
Audible data visualization on Brussels noise pollution.
Crank up the volume and mouse over the city.





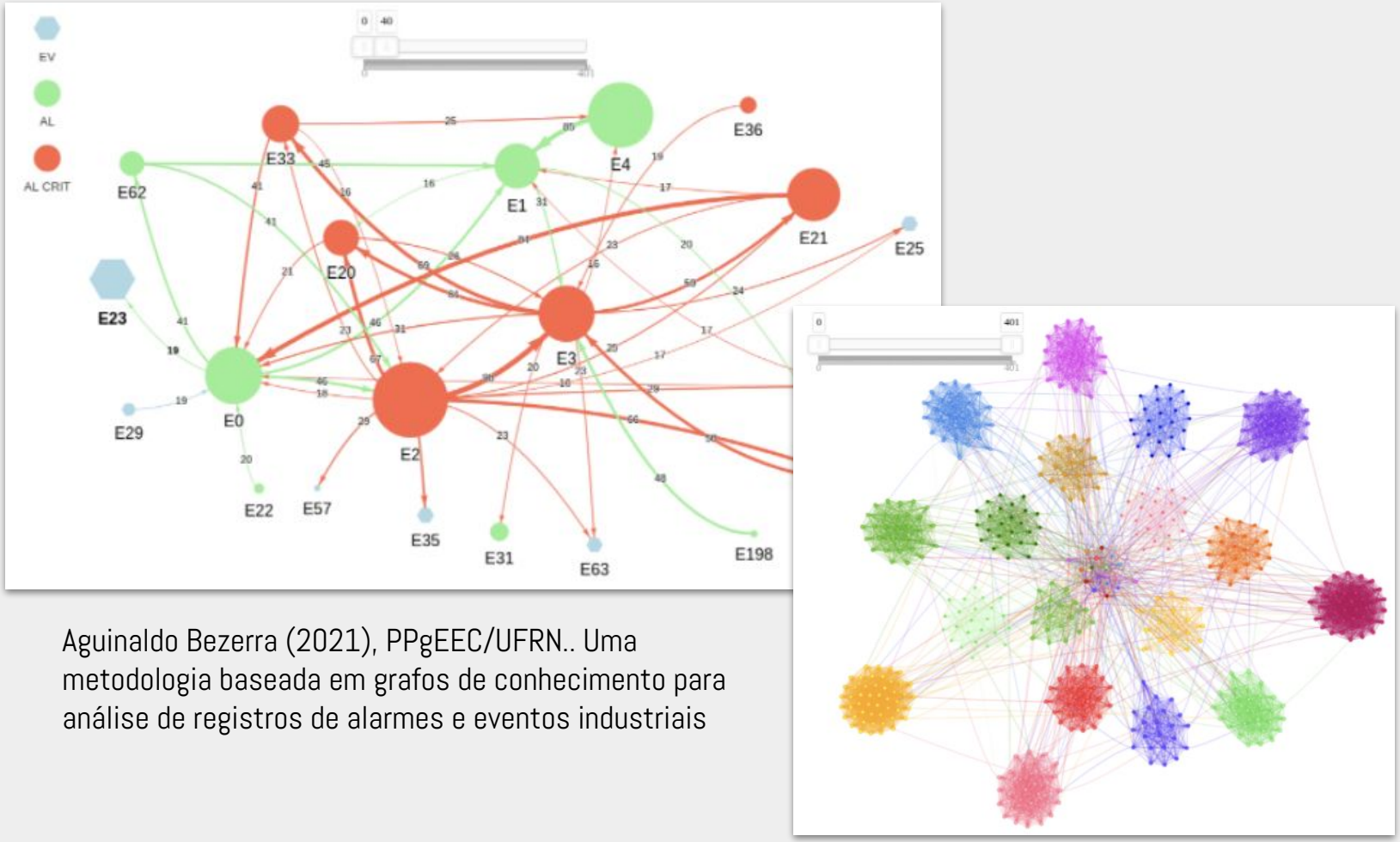
https://noisy-city.jetpack.ai/


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

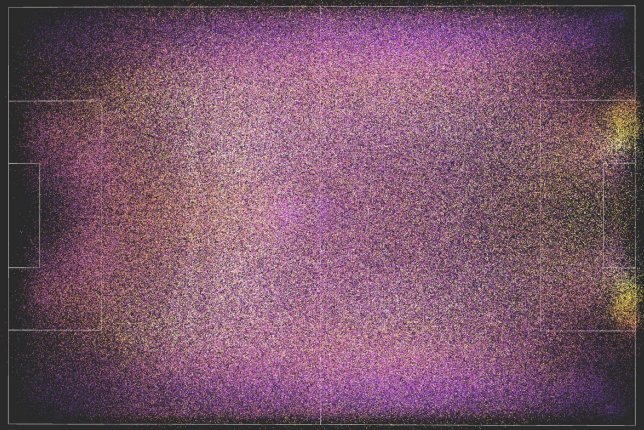


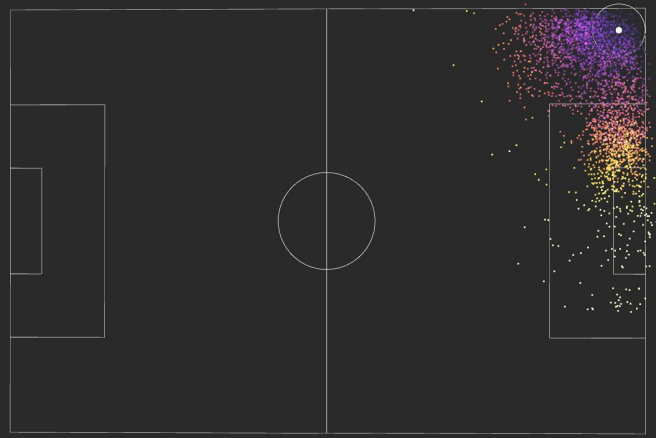
Data_Tempo	Tipo	TAG	Nó	Identificador	Estado	Prioridade	...	Descrição	Id
19-05-23 10:42:03	EV	AIO01	N001	IOFAIL	ACTIVE	WARNING	...	I/O Failure ...	1048
19-05-23 10:41:29	EV	VAL02	N002	VALOPEN	ACTIVE	INFO	...	Valve Open ...	1045
19-05-23 10:34:18	AL	LVL04	N003	PVLO	INACTIVE	CRITICAL	...	Low Level ...	1037
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

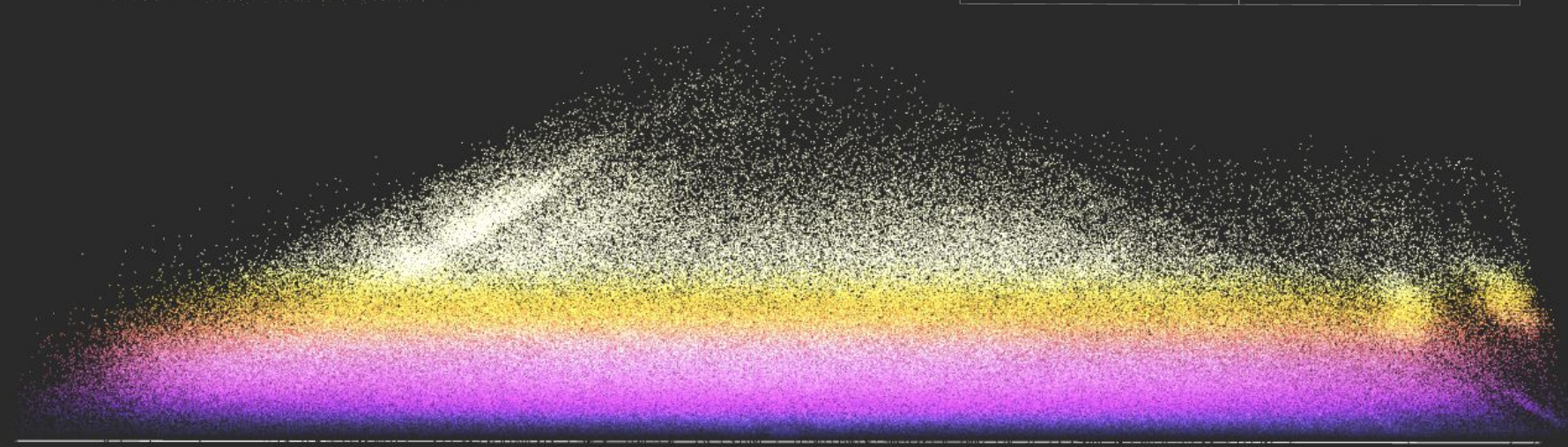
Aguinaldo Bezerra (2021), PPgEEC/UFRN. Uma metodologia baseada em grafos de conhecimento para análise de registros de alarmes e eventos industriais



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



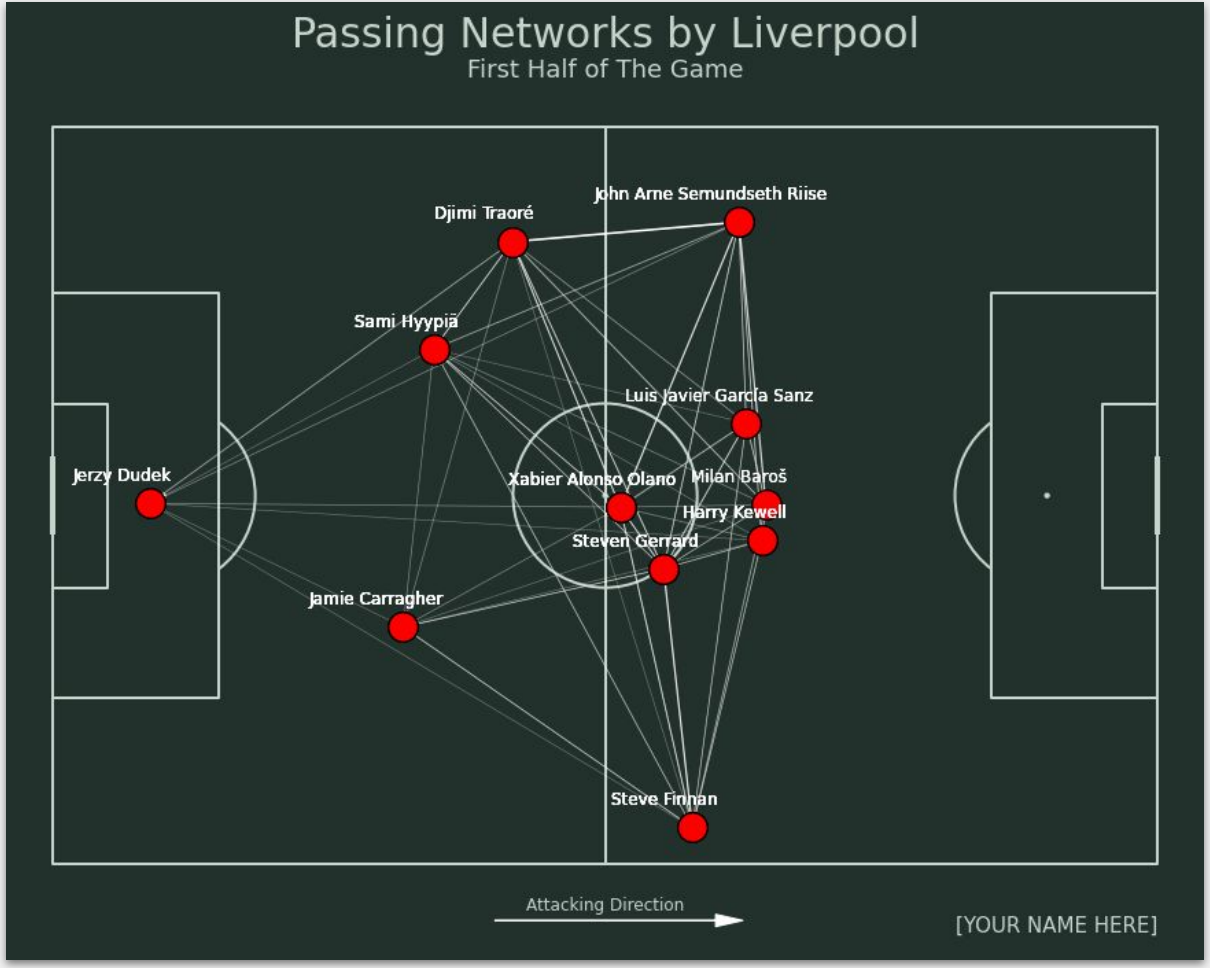




https://statsbomb.com/

https://github.com/statsbomb/open-data

@karim_douieb



https://betterprogramming.pub/how-to-visualize-football-passing-networks-using-python-6f6582aa8005

Appetite 159 (2021) 105048

Contents lists available at ScienceDirect

Appetite

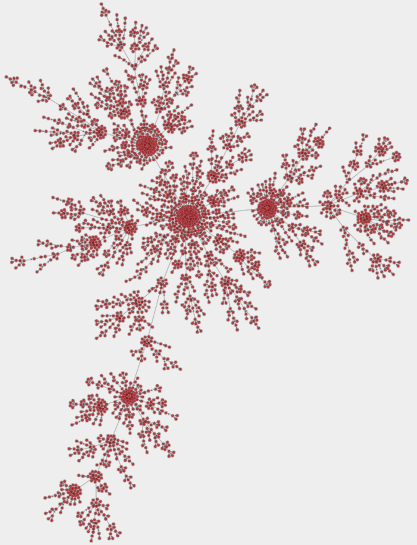
journal homepage: www.elsevier.com/locate/appet

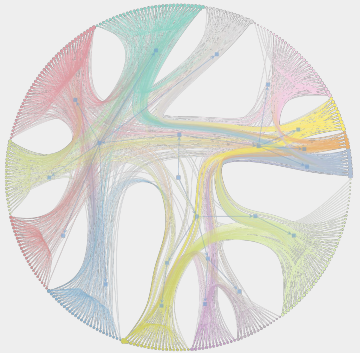
Research review

The contribution of network science to the study of food recipes. A review paper

Juan C.S. Herrera

Nutrition and Food Studies, Food Studies, New York University, New York, NY, 10003, USA





A B S T R A C T

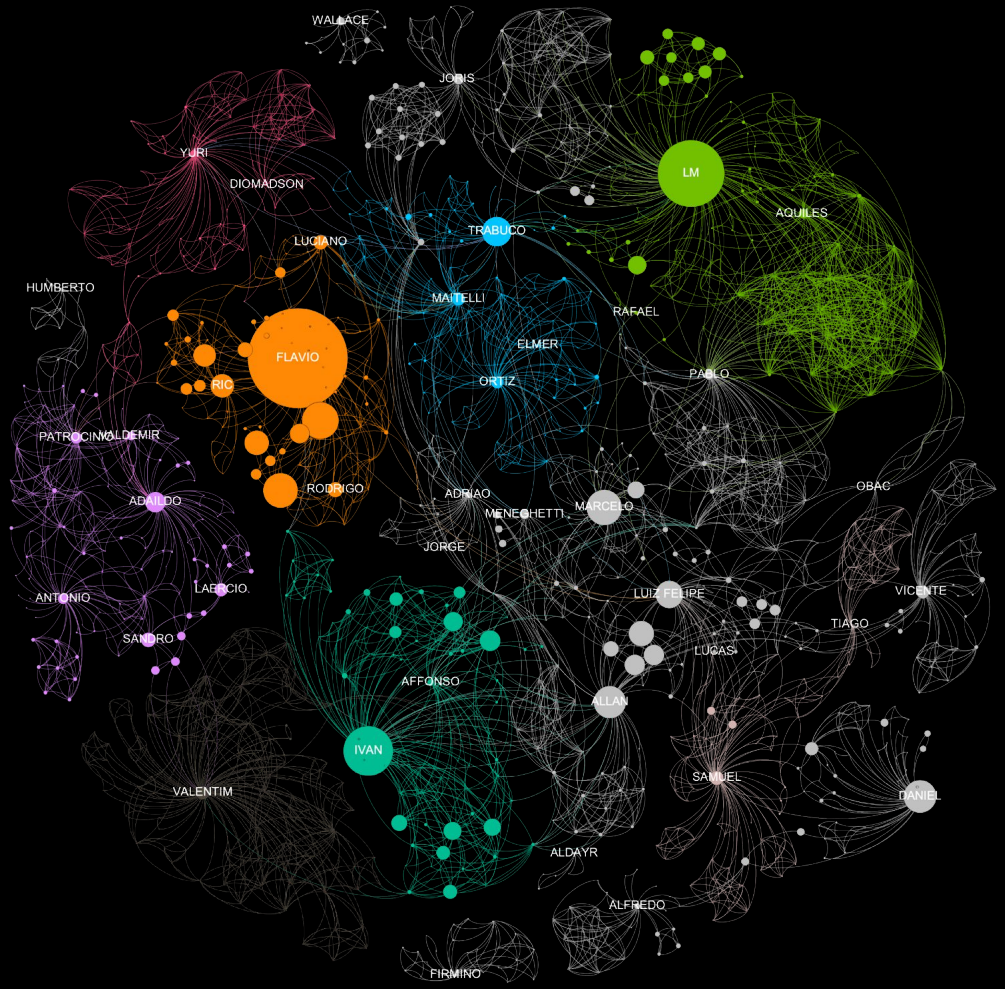
Recently, scholars have applied network science, which examines interconnected systems, to the study of food recipes. By examining the current literature, this review paper analyses the contribution of network science to recipes, and finds evidence of two main contributions. First, the pioneer studies showed the potential of network science for reducing the complexity of recipes and proposing theories to model ingredient pairings and recipe evolution. The second contribution built upon the previous theories and expanded them to cover different regions of the world as the field moved towards understanding the granularity of human culture with rich and detailed studies that examine different cuisines as more recipe datasets became available. Network science studies of recipes allowed researchers to discover insights in recipes to explain sociocultural aspects of cuisines, and include large numbers of recipes in the analysis, which would be nearly impossible using other techniques.

1. Introduction

Network science is a well-established quantitative method that researchers use when studying relationships in systems. Scholars have recently adopted this methodology to study recipes, where recipe networks might have ingredients, preparation techniques, and recipe titles linked to one another and in doing so, has made many contributions to the food studies literature. This paper presents a review of the literature

Catanzaro, 2004), among other academic disciplines. Network science was first used in 1736 in mathematics (Barabási and Pósfai 2016) and the 1940s in sociology (Moreno, 1945), and has gained popularity in the 21st century as it empowers "everything from Google to Facebook, CISCO, and Twitter" (Barabási and Pósfai 2016).

Since the late 2000s, a combination of factors –such as the recent abundance of recipes on the Internet, a general growing social interest in food, and food politics movements– led to the emergence of a body of



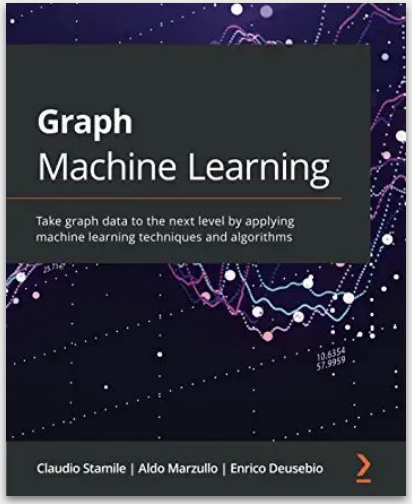
Edsger W. Dijkstra
co-authored 1 paper with
John R. Rice
co-authored 9 papers with
Dan C. Marinescu
co-authored 2 papers with
Theo Lynn
co-authored 7 papers with
Ivanovitch Silva
distance = 4

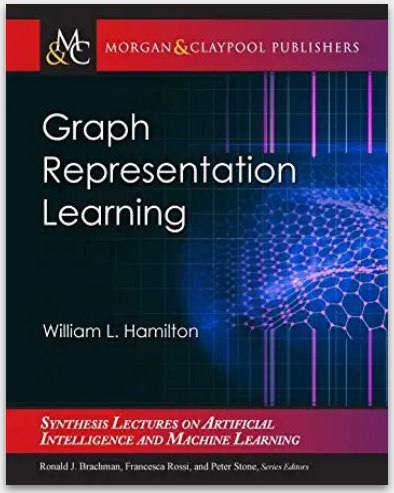
https://www.csauthors.net/distance/edsger-w-dijkstra/ivanovitch-silva

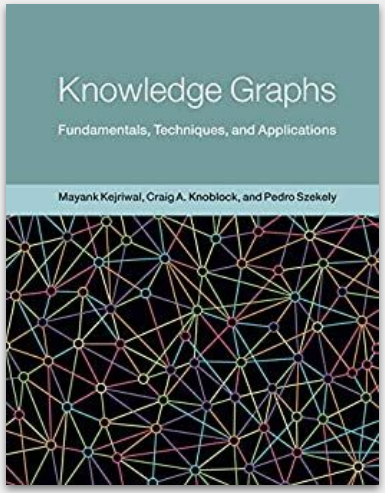
Co-authorship Network PPgEEC 2017-2021

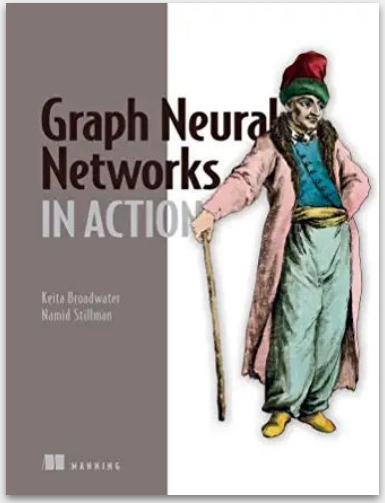
State of AI Report 2022

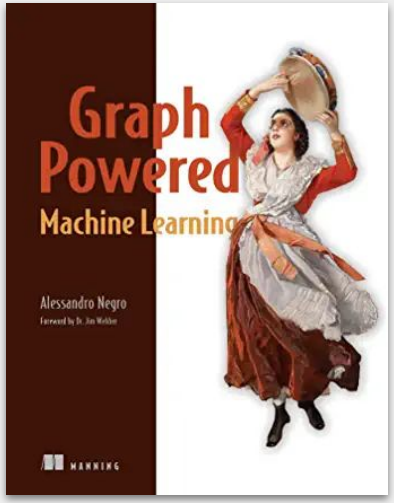
The **State of AI Report** analyses the most interesting developments in AI. We aim to trigger an informed conversation about the state of AI and its implication for the future. The Report is produced by AI investors **Nathan Benaich** and **Ian Hogarth**.











SOTA Papers

https://paperswithcode.com/area/graphs

Course Syllabus

1. Fundamentals of Python
2. Data structure review
3. Algorithms complexity
4. Network elements, Small worlds, Hub, Communities
5. Directed Networks
6. Case Studies
    a. Social Networks
    b. Documents
    c. Community Detection
    d. Anomalies and others.
    e. Maps

Medium

Unit 1

March 2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

April 2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

START

Week 01

Course Outline, Git, Python (1,00)

Week 02

Dict, Funct. OOP (1,00)

Week 03

List, Queue, Stacks, Dict (2,00)

Week 04

Recursion, B-Trees, Heap

Week 05

Boost B-Tree, Project (3,00)

Week 06

Time and Space Complexity, Case Study (3,0)

12 April 2023

Unit 2

April 2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

May 2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

June 2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

Unit 3

June 2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11		13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

July 2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11		13	14	
16	17	18		20	21	22
23	24	25	26	27	28	29
30	31					

START

Week 15

Advanced Applications using Graph

Week 16

Advanced Applications using Graph

Week 17

Advanced Applications using Graph

#Project

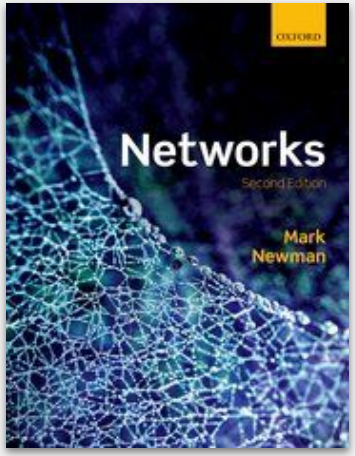
Week 18

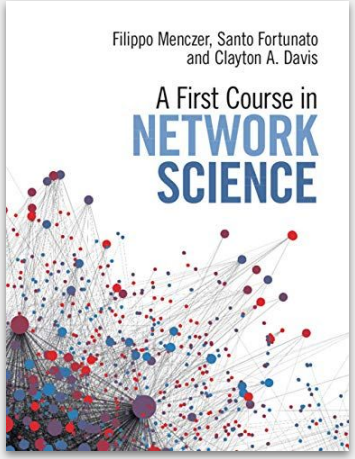
#Project

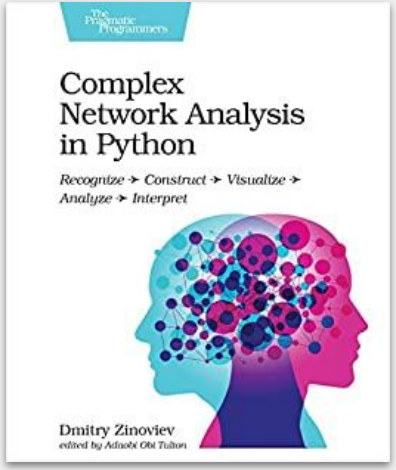
Week 19

#Project Talk

12 July 2023


OXFORD
Networks
Second Edition
Mark
Newman


Filippo Menczer, Santo Fortunato
and Clayton A. Davis
A First Course in
NETWORK
SCIENCE


The Pragmatic Programmers
Complex
Network Analysis
in Python
Recognize → Construct → Visualize →
Analyze → Interpret
Dmitry Zinoviev
edited by Adaobi Obi Tulton

DATAQUEST

Make a clone of me!!!!

https://github.com/ivanovitchm/datastructure