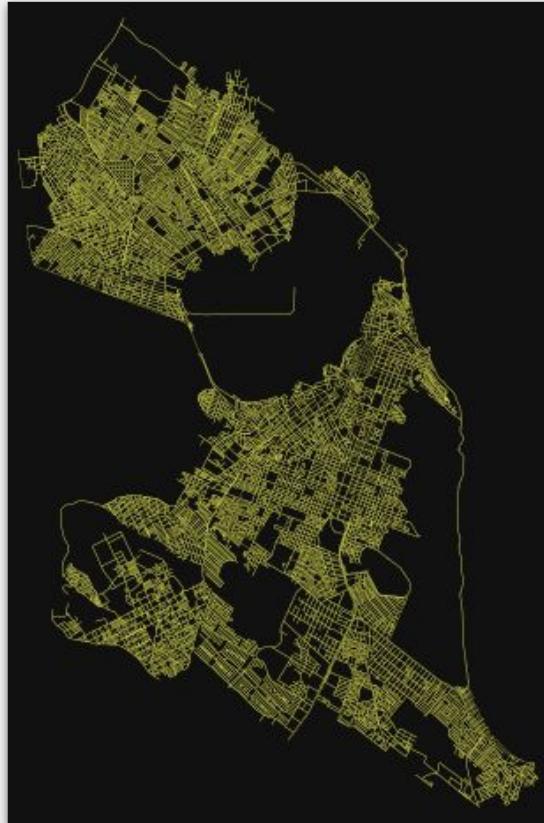


Algorithms & Data Structures II

DCA 3702

ivanovitch.silva@ufrn.br
@ivanovitchm

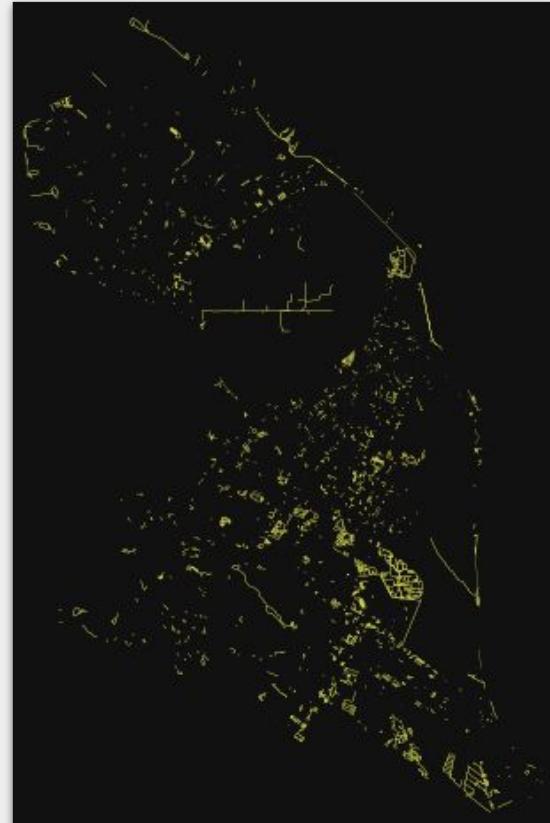




Drive



Bike



Bike - Drive

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

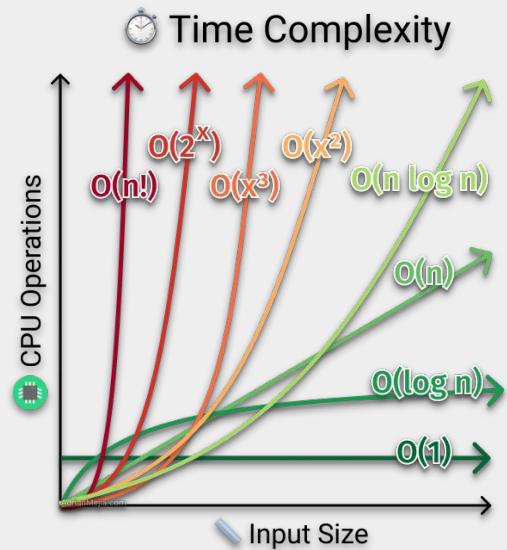
10º Nível

7º NÍVEL

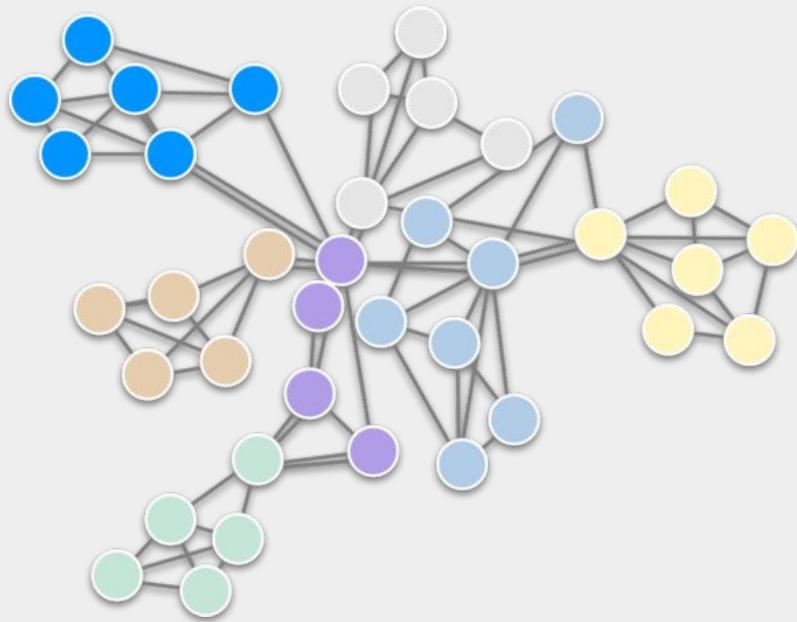
DCA3701 - PROJETO DE SISTEMAS DE CONTROLE - 90h	Obrigatória	
DCA3702 - ALGORITMOS E ESTRUTURAS DE DADOS II - 60h	Obrigatória	
DCA3703 - PROGRAMAÇÃO PARALELA - 45h	Obrigatória	
DCA3704 - SISTEMAS DISTRIBUÍDOS - 45h	Obrigatória	
DCA3705 - AUTÔMATOS E LINGUAGENS FORMAIS - 60h	Obrigatória	
DCA3706 - SISTEMAS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

Carga Horária Total: 360h

Course Outline



Algorithm Complexity



Graph

Training compute (FLOPs) of milestone Machine Learning systems over time

$n = 121$

<https://arxiv.org/pdf/2202.05924.pdf>

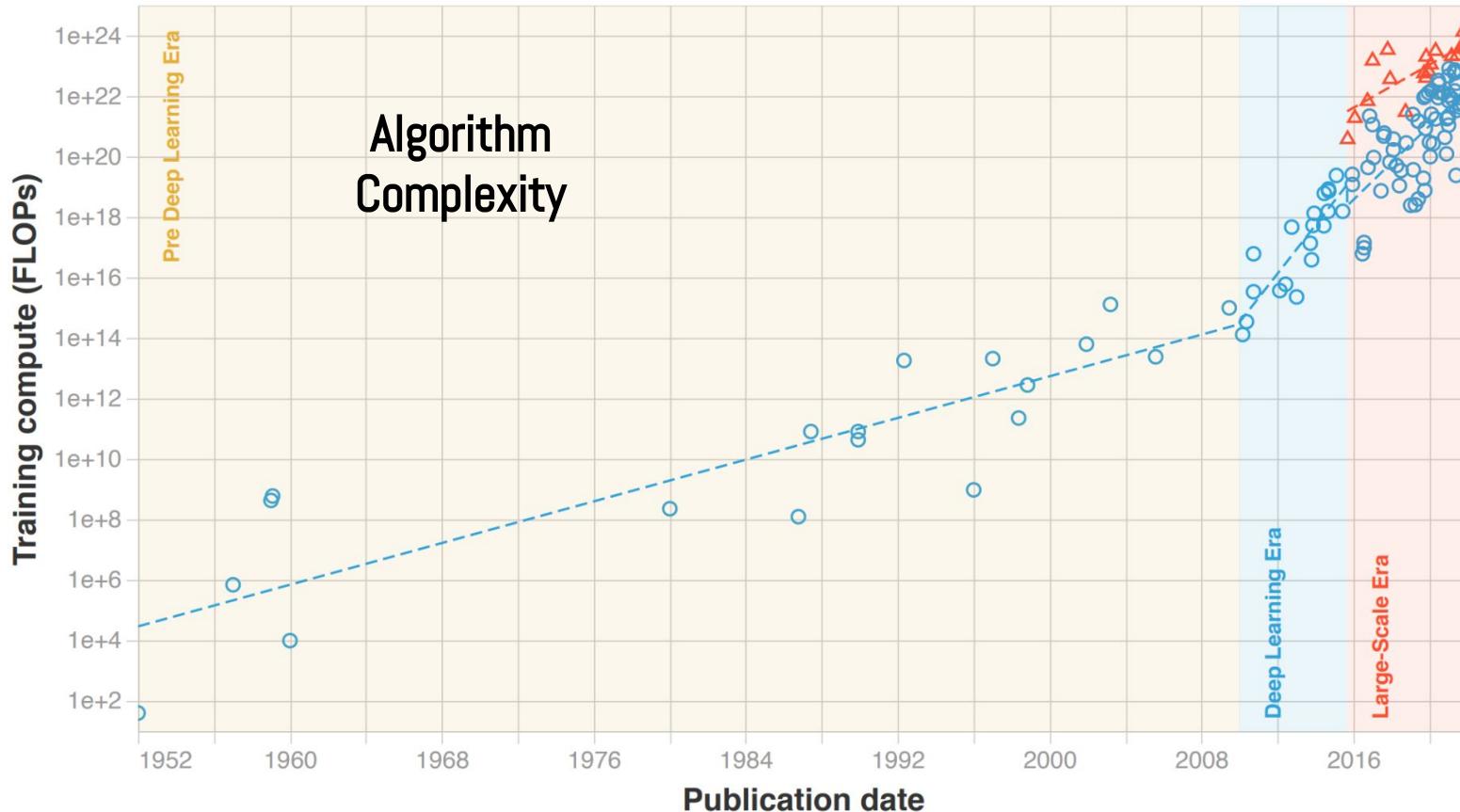
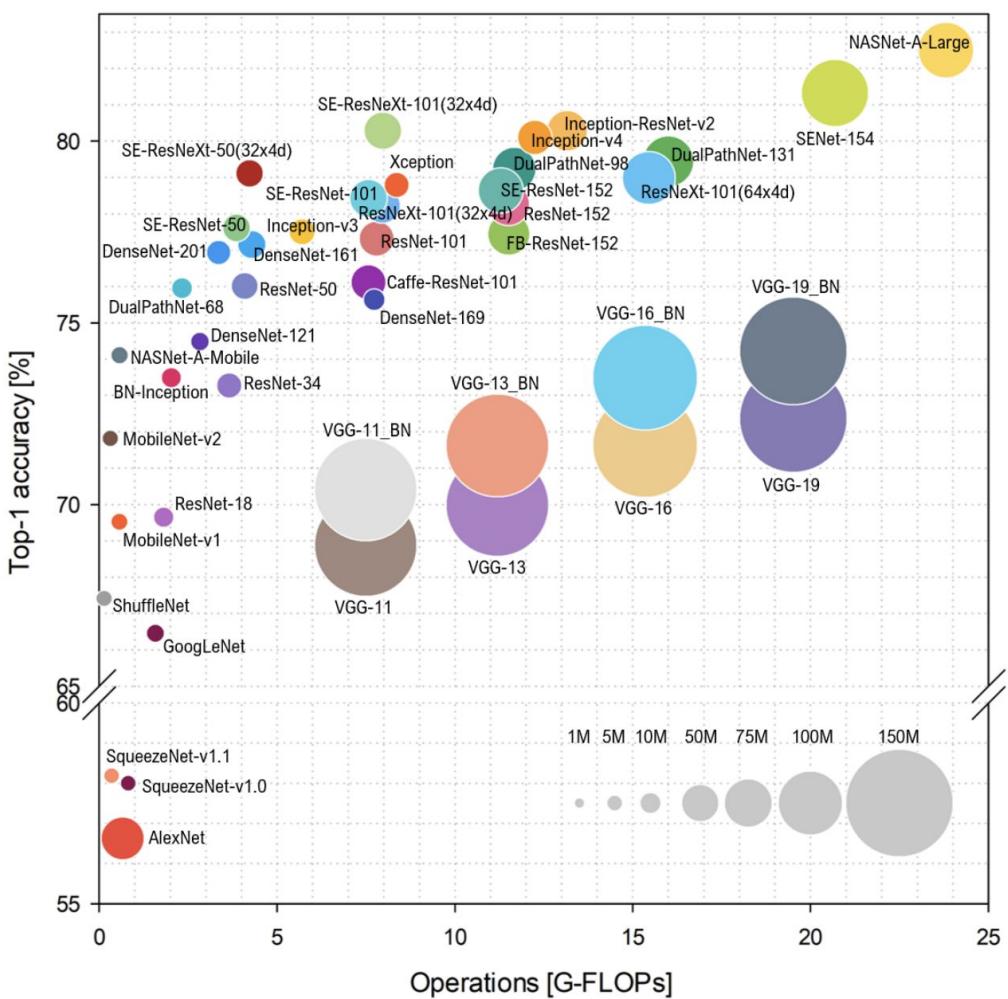


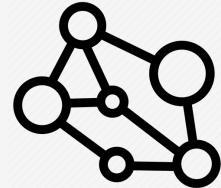
Figure 1: Trends in $n = 121$ milestone ML models between 1952 and 2022. We distinguish three eras. Notice the change of slope circa 2010, matching the advent of Deep Learning; and the emergence of a new large-scale trend in late 2015.

Algorithm Complexity

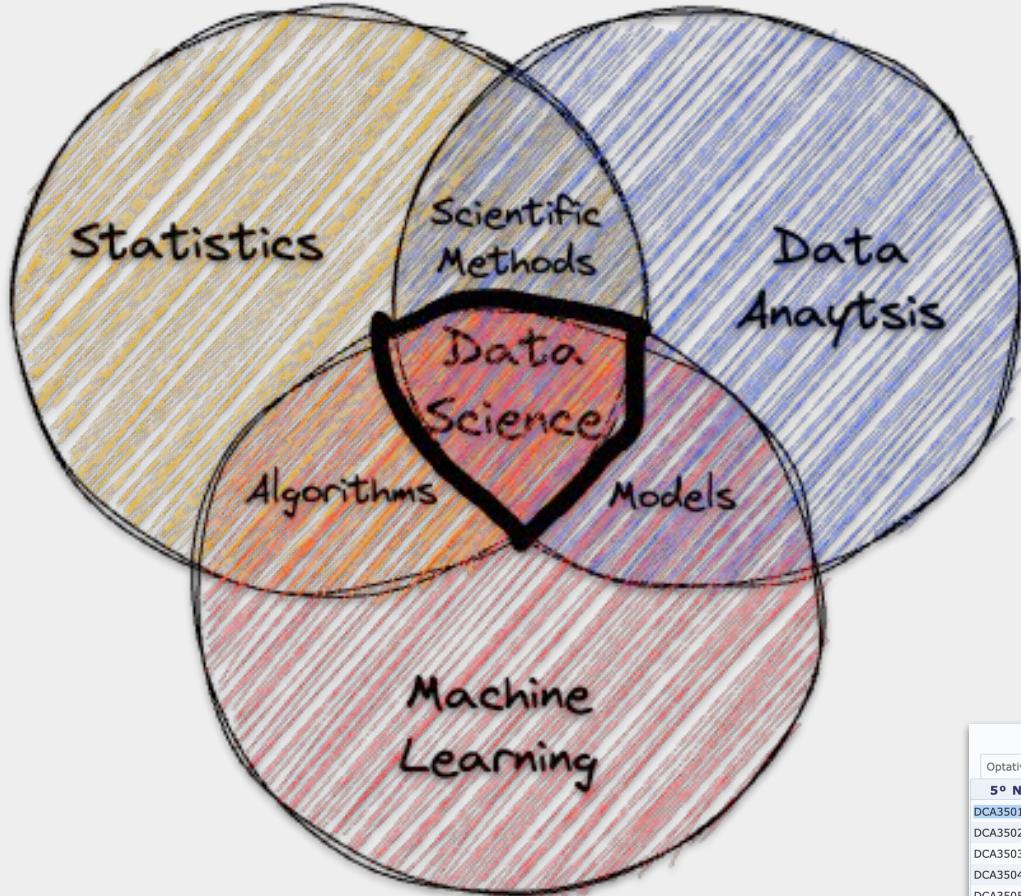


ML Model Evolution ImageNet

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



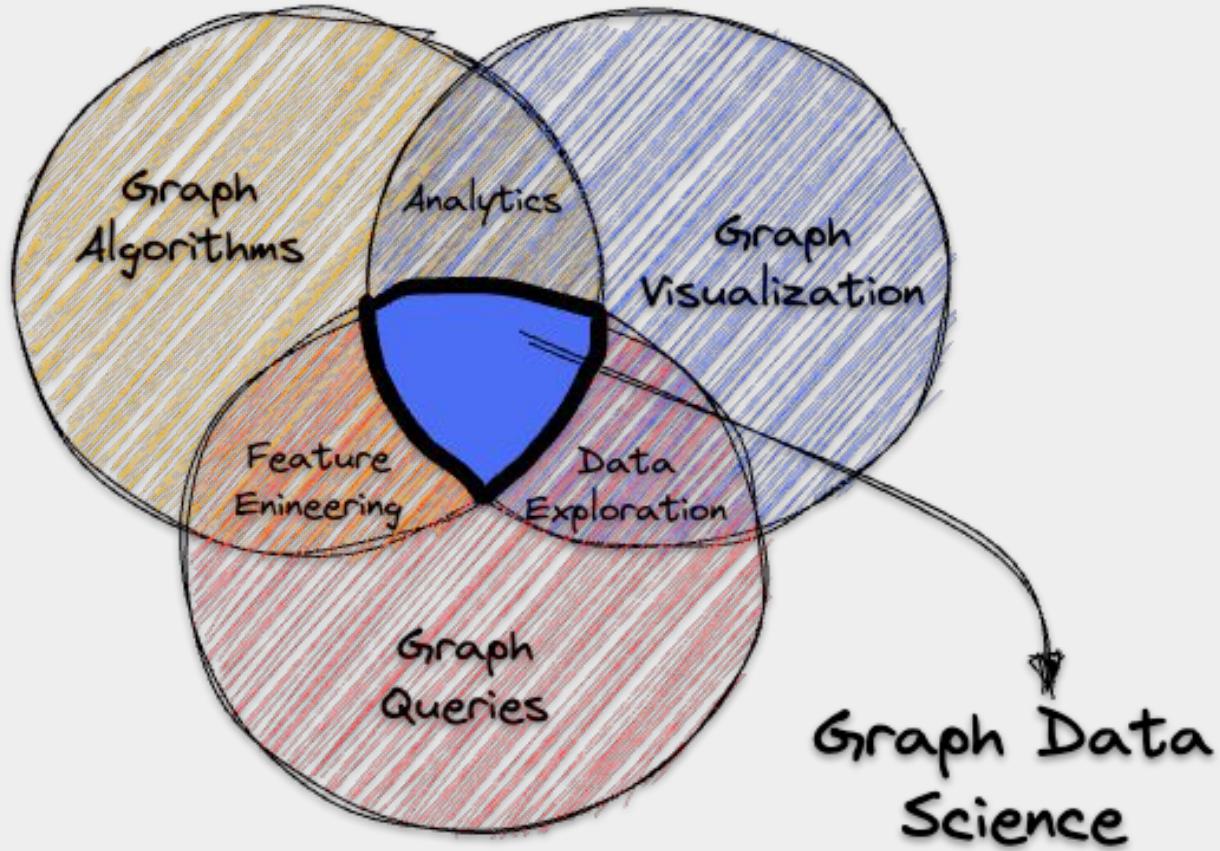
And about graph?
Where and how use them?



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

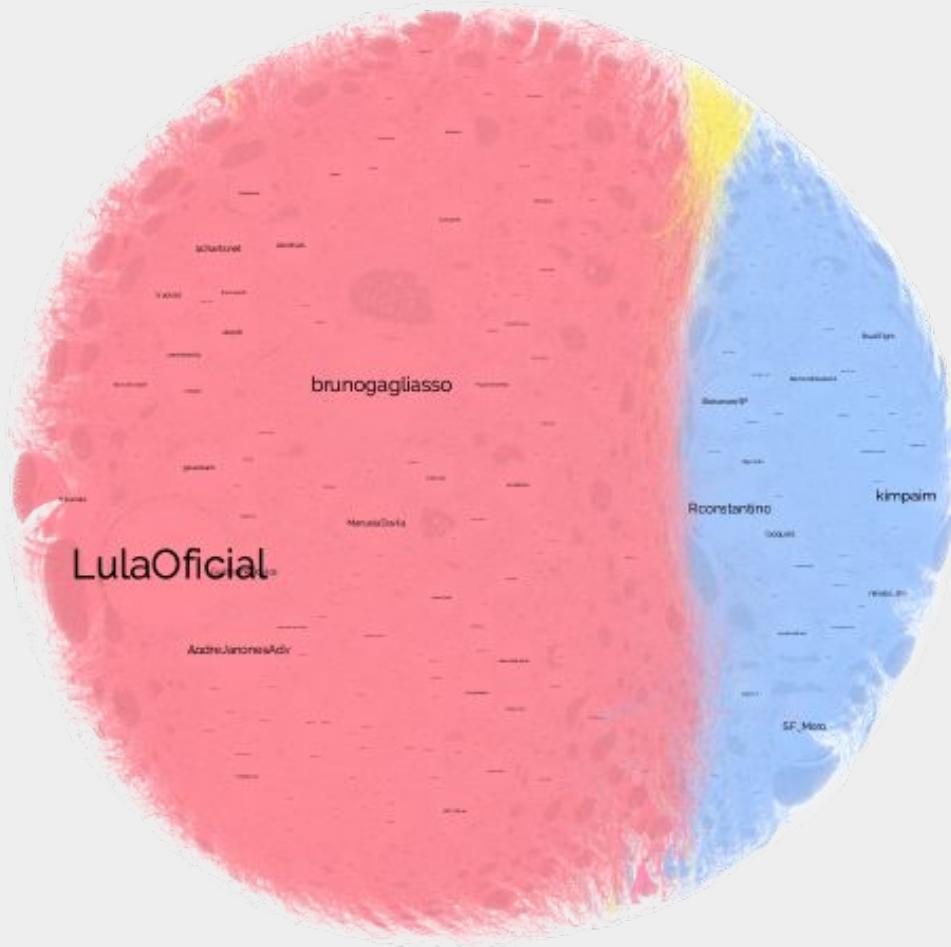
Data Scientists use data to answer questions.

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	Obrigatória										



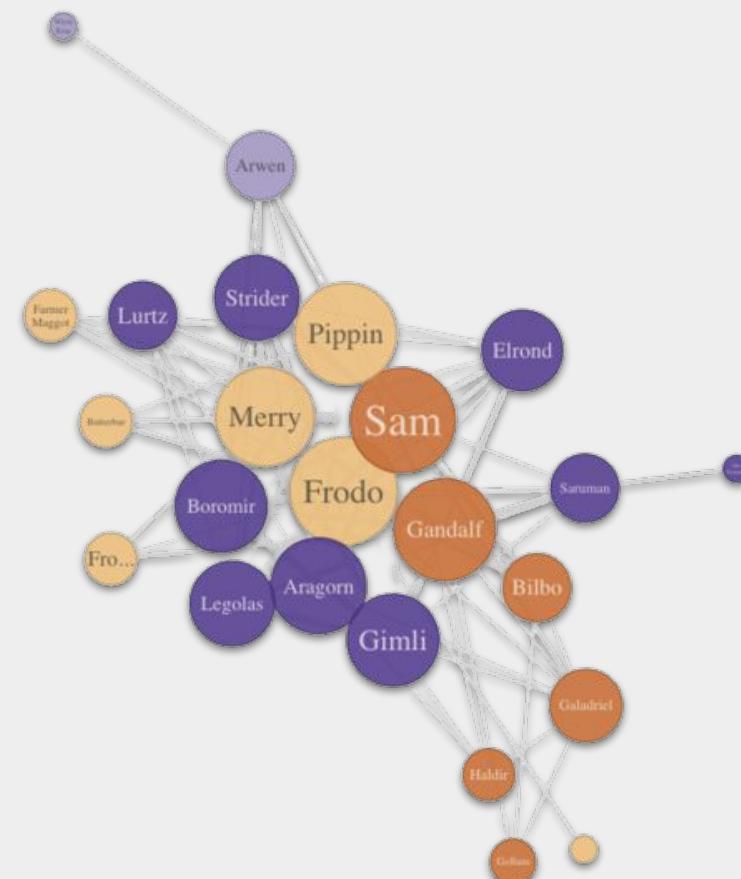
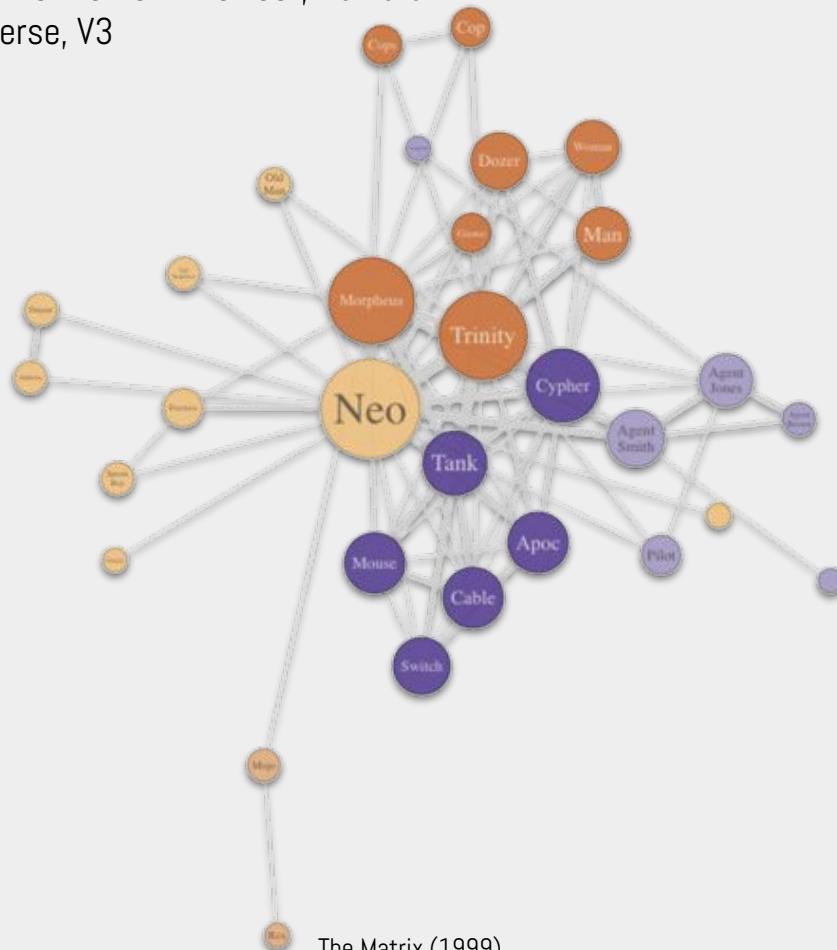
Graph Data Science is a science-driven approach to gain knowledge from the relationships and structures in data, typically to power predictions.

Data Scientists use relationships to answer questions.

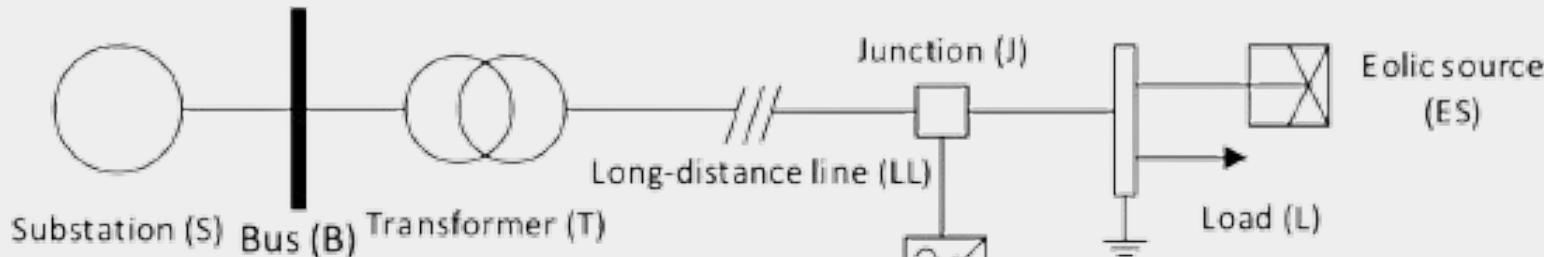


Visualizing Elections Feedback

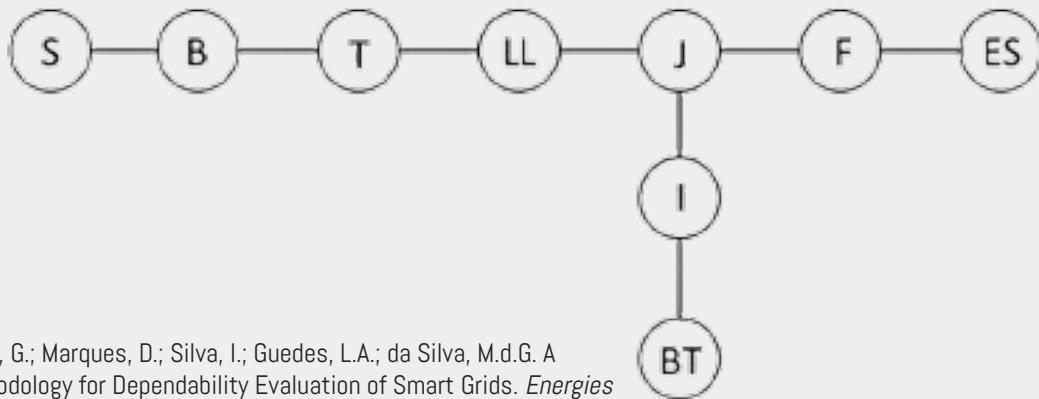
Clustering
Community Detection
Mention network



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

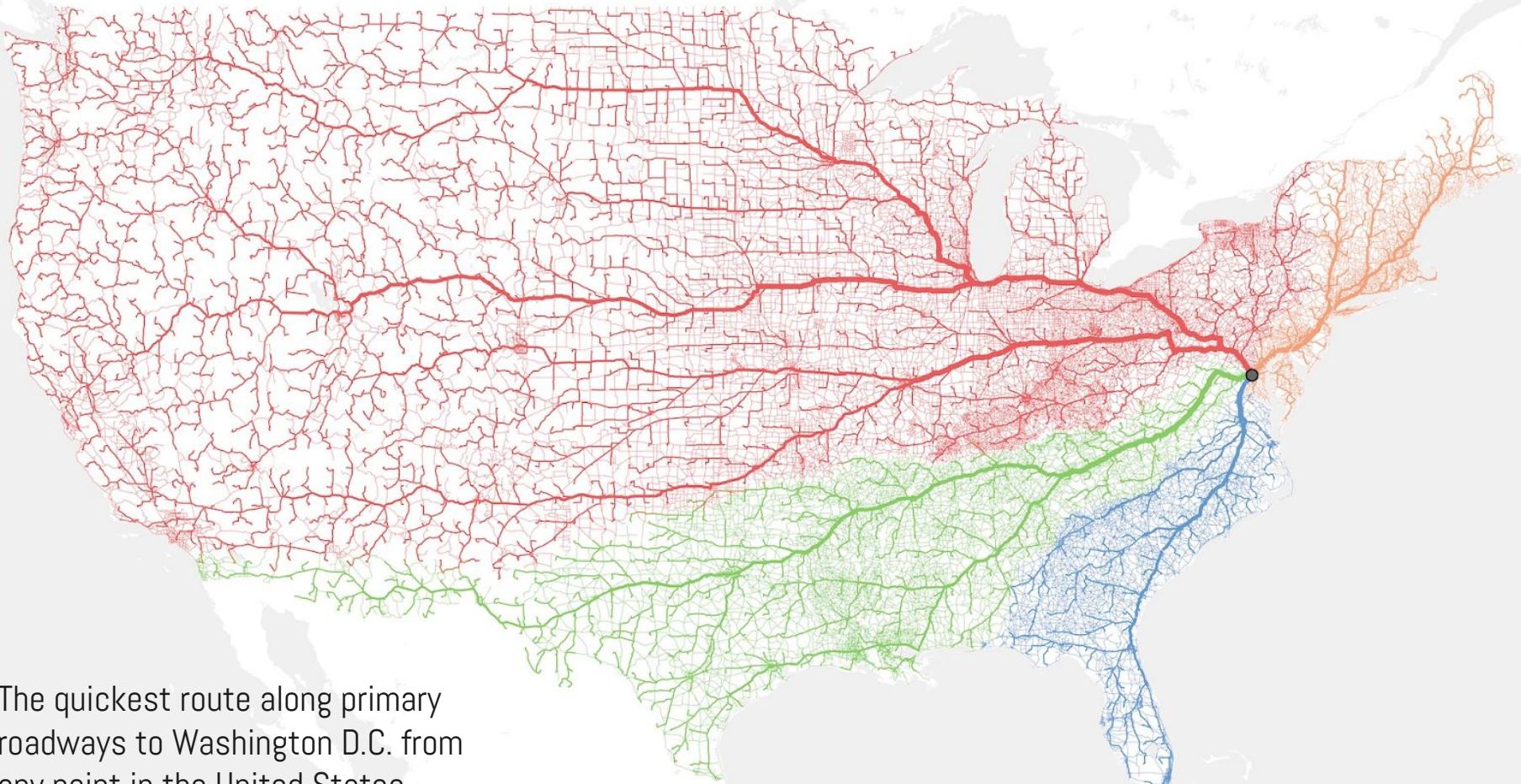


**One-line diagram
to Graph**



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



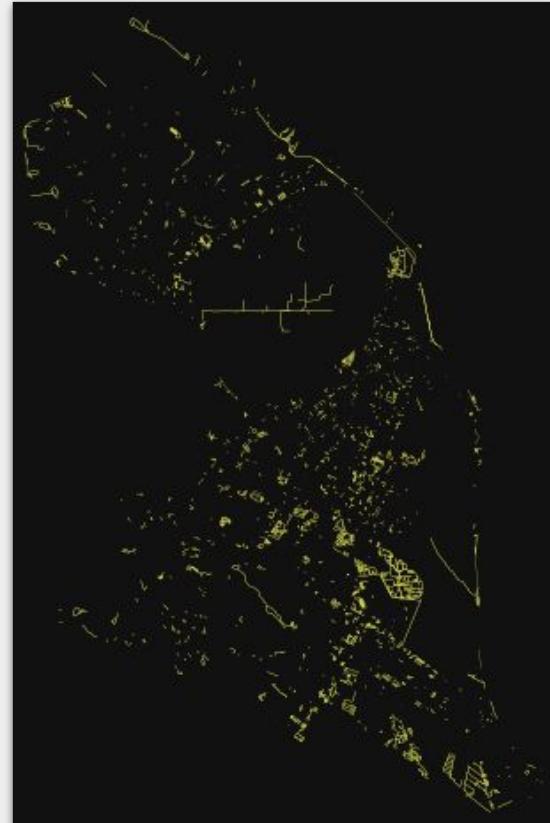
The quickest route along primary
roadways to Washington D.C. from
any point in the United States



Drive

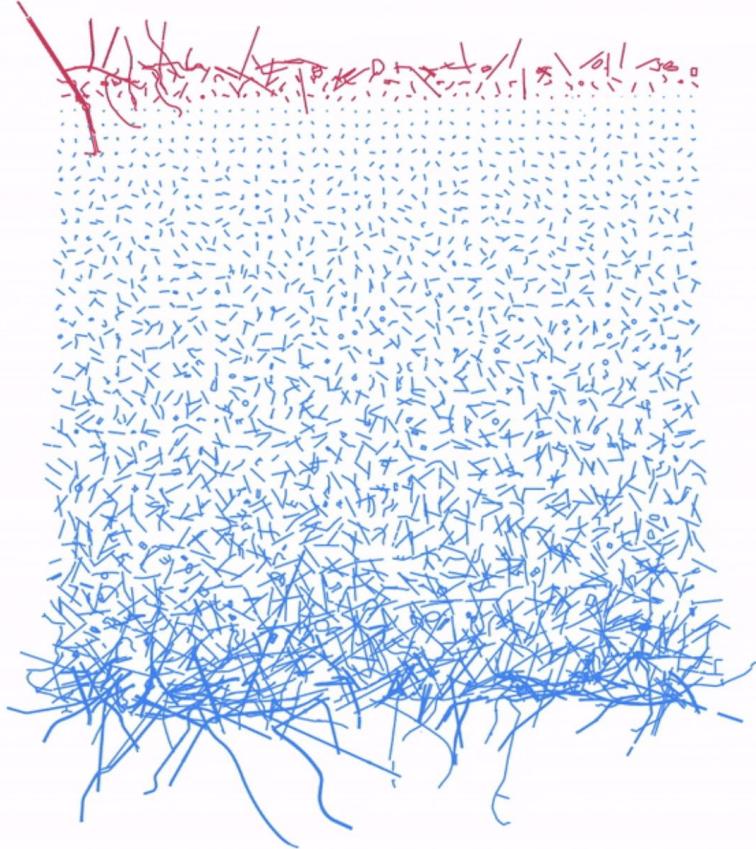


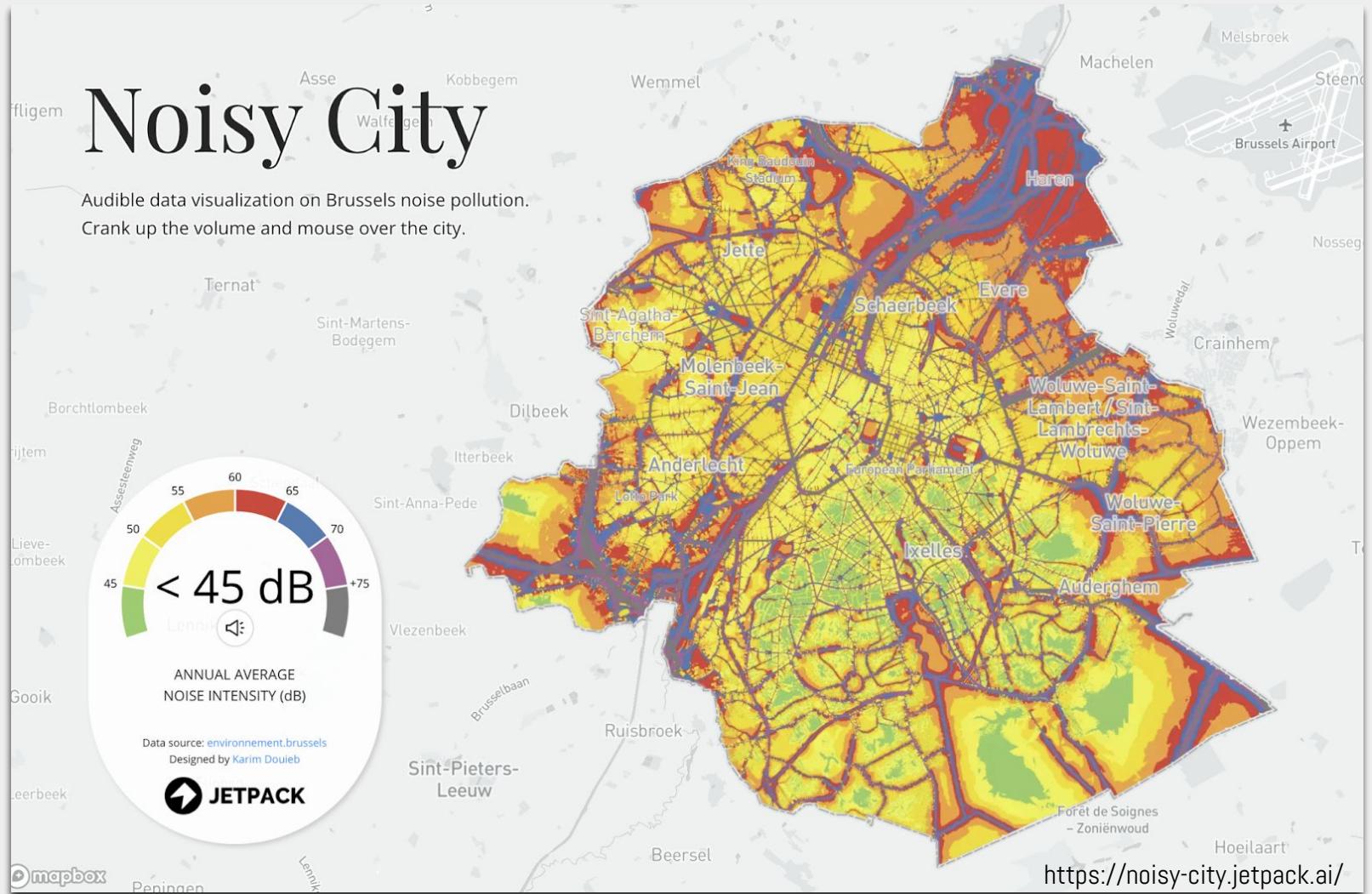
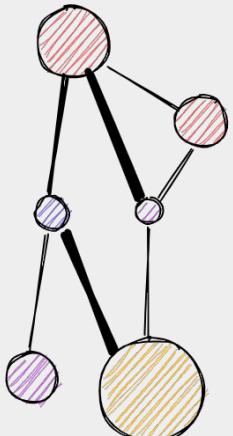
Bike

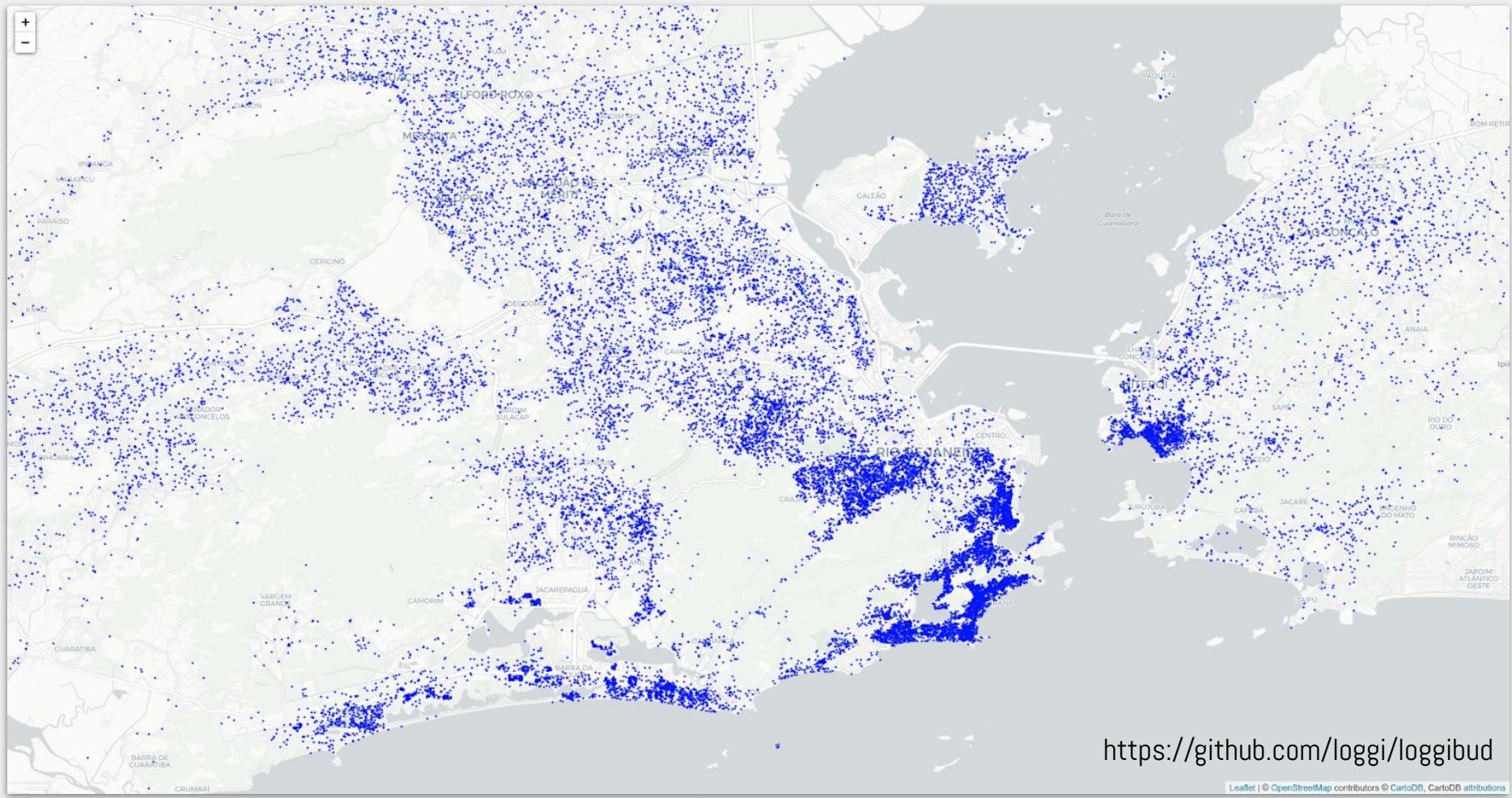


Bike - Drive

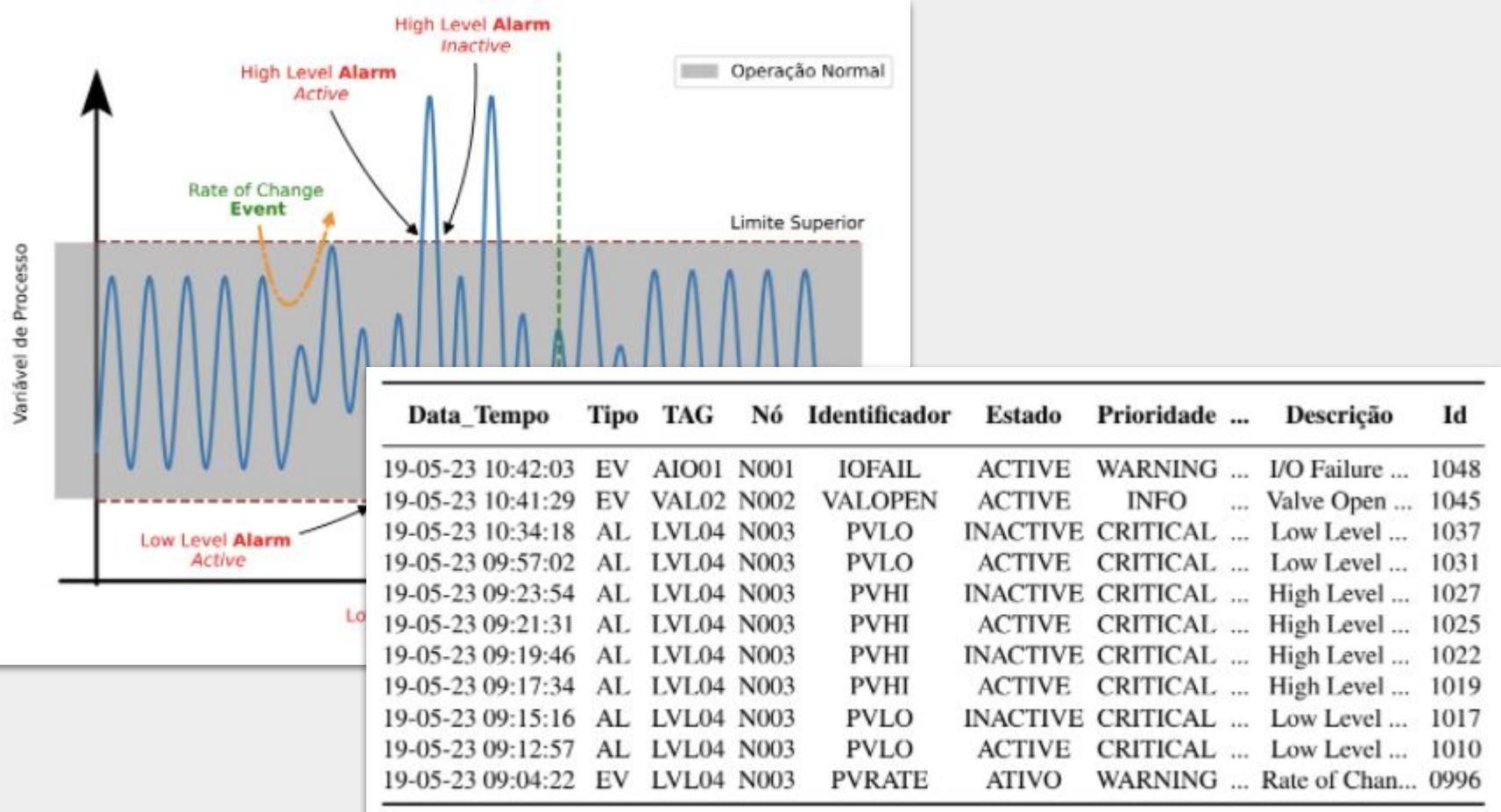
Only 6% of Brussels streets are named after women. [Open Knowledge BE](#) organized the production of these statistics with the help of 60 volunteers who tagged the gender of each street in Brussels.



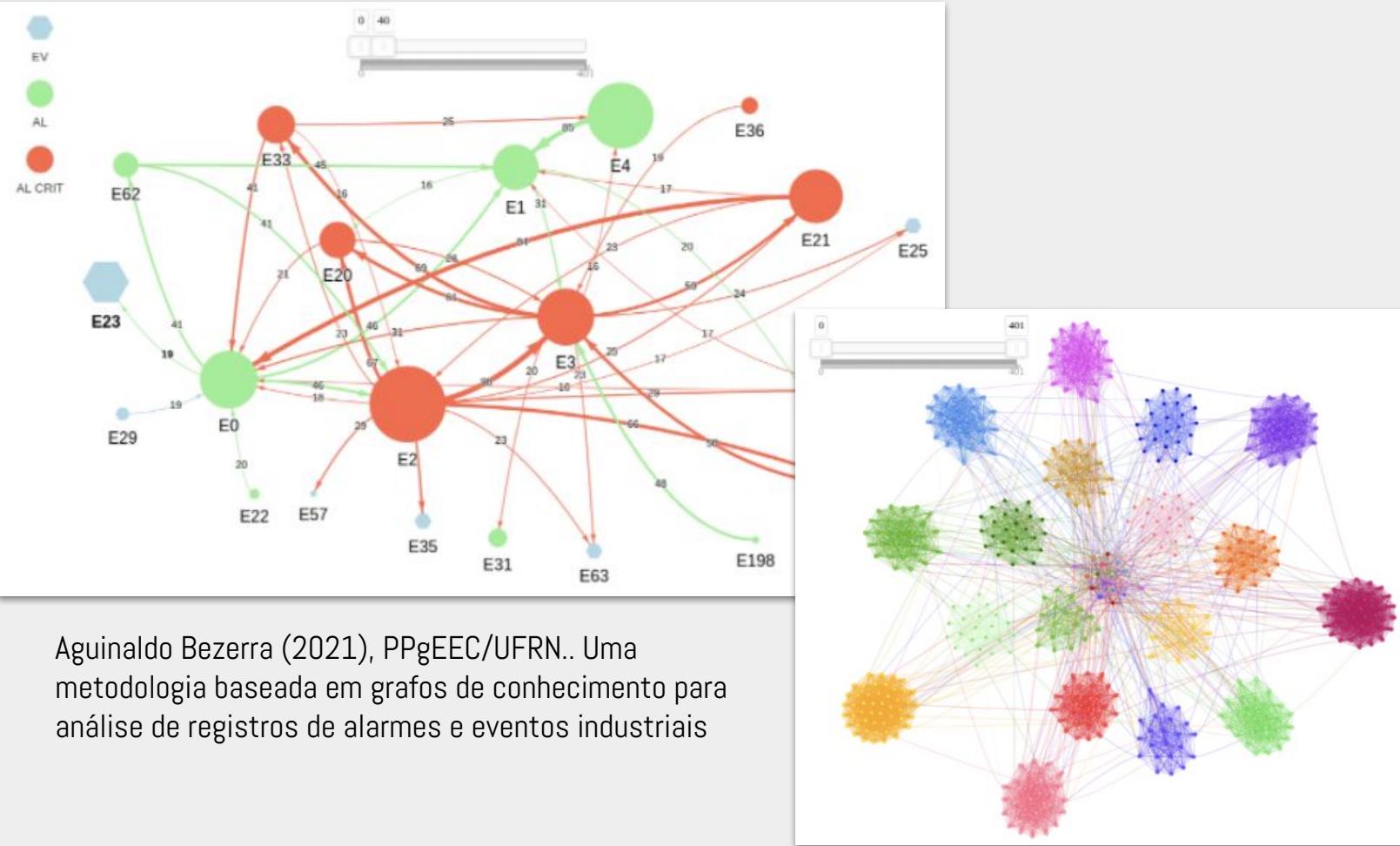




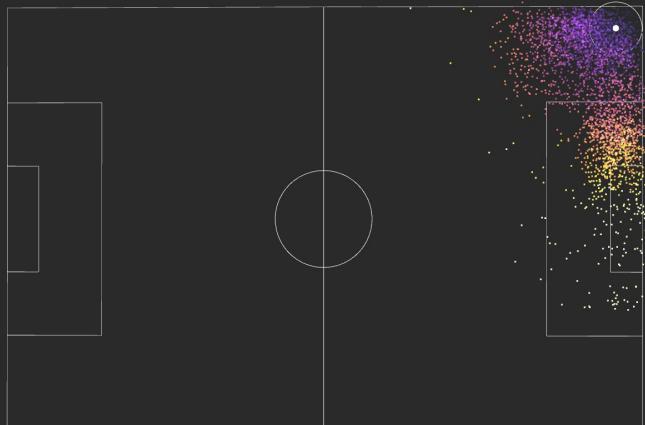
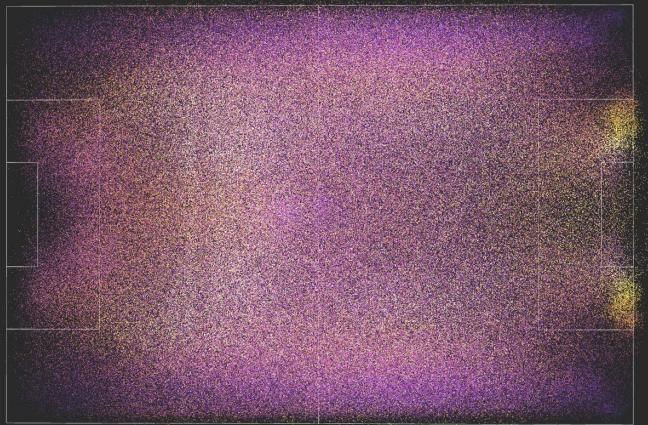
<https://github.com/loggi/loggibud>



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



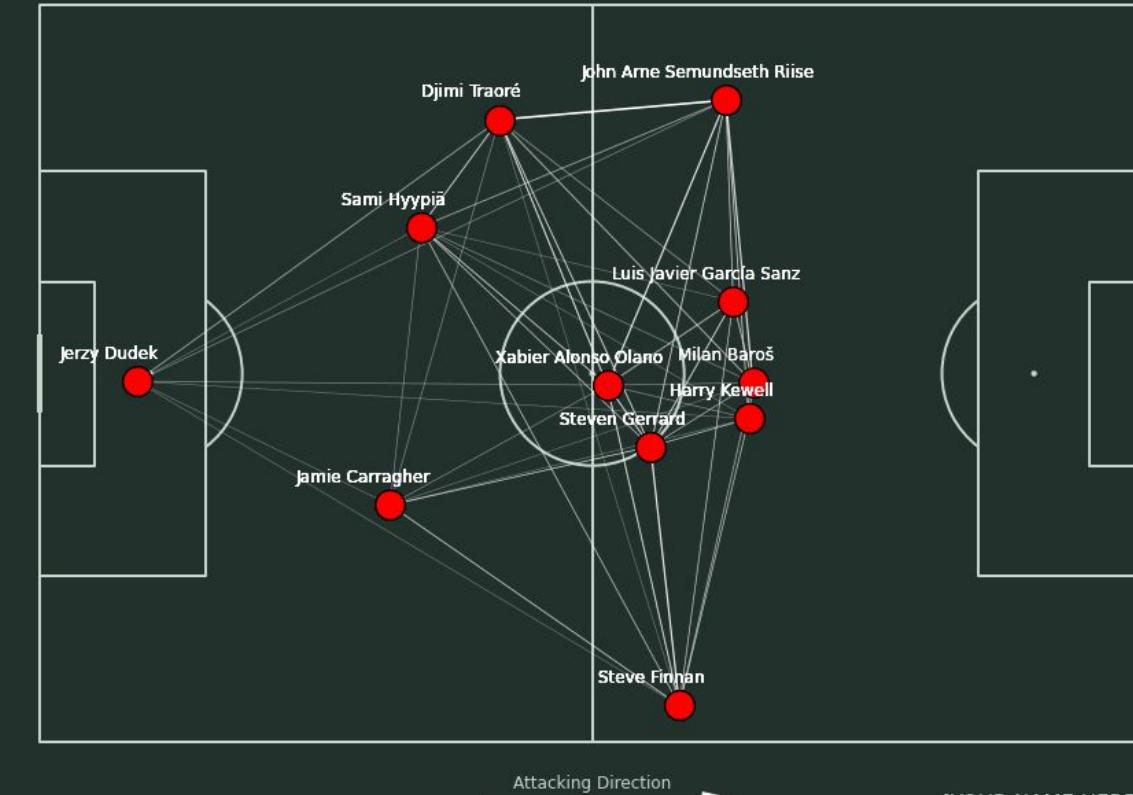
<https://statsbomb.com/>

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

@karim_douieb

Passing Networks by Liverpool

First Half of The Game





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

ABSTRACT

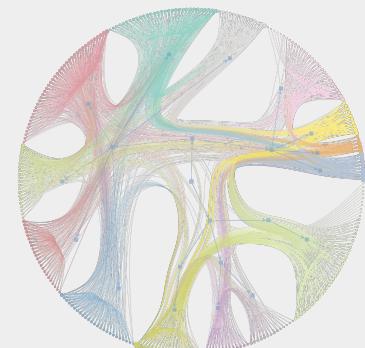
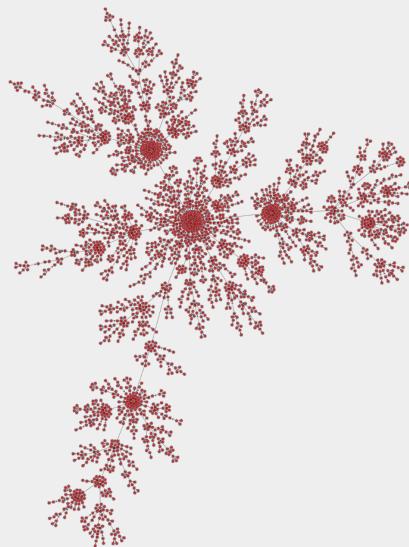
Recently, scholars have applied network science, which examines interconnected systems, to the study of food recipes. By examining the current literature, this review paper analyses the contribution of network science to recipes, and finds evidence of two main contributions. First, the pioneer studies 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.

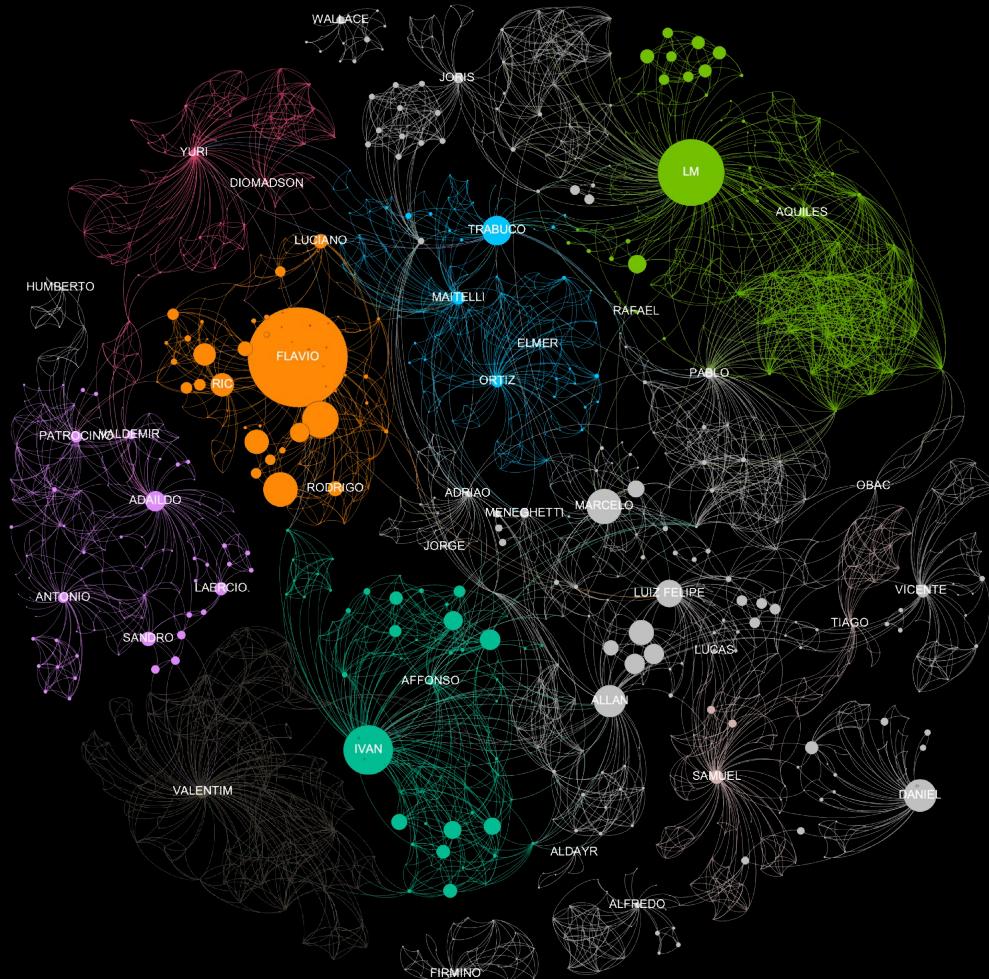
1. Introduction

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





Co-authorship Network PPgEEC 2017-2021

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>

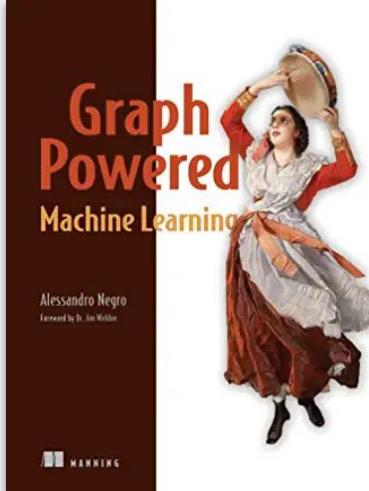
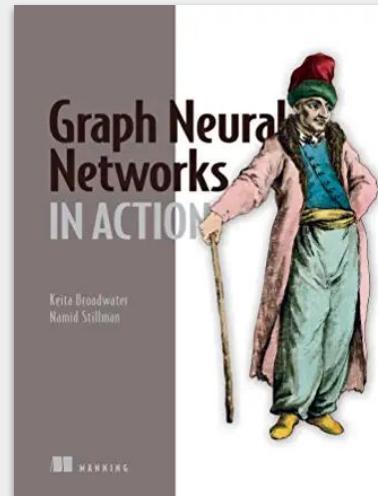
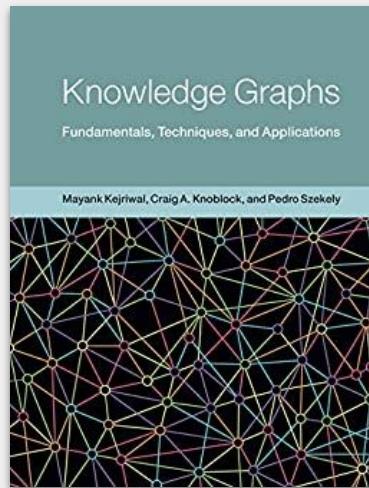
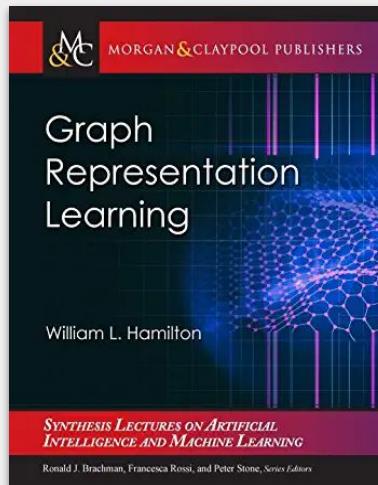
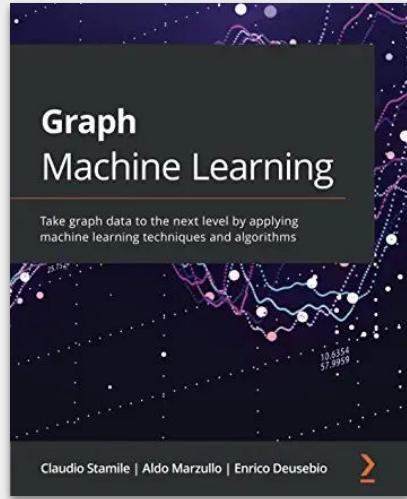
State of AI Report 2023

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 the **Air Street Capital** team.

State of AI Report

October 12, 2023

Nathan Benaich
Air Street Capital



SOTA Papers

<https://paperswithcode.com/area/graphs>

Setembro - 2024						
D	S	T	Q	Q	S	S
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					

Outubro - 2024						
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20	21	22	23	24	25	26
27	28	29	30	31		

Novembro - 2024						
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Dezembro - 2024						
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29	30	31				

Janeiro - 2025						
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

September

Week 01

16th and 18th - Planning

Week 02

23rd - Course Presentation
(Python)

25th - Network Elements I
(Networkx)

Week 03

30th - Network Elements II
2nd - Case Study (SDG)

Unit 01

30% small assignments
70% project

October & November

Week 04

7th - Homophily and Assortativity
9th - Paths, Distances, and Walks

Week 05

14th - Hubs
16th - Wikipedia

Week 06

21st - Assignment Description
23rd - Gephi

Weeks 07 and 08

28th, 30th, 4th, 6th - Unit 1 Assignment

Setembro - 2024						
D	S	T	Q	Q	S	S
1	2	3	4	5	6	7
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22	23	24	25	26	27	28
29	30					

Outubro - 2024						
D	S	T	Q	Q	S	S
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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		

Novembro - 2024						
D	S	T	Q	Q	S	S
			1	2		
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24	25	26	27	28	29	30

Dezembro - 2024						
D	S	T	Q	Q	S	S
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22	23	24	25	26	27	28
29	30	31				

Janeiro - 2025						
D	S	T	Q	Q	S	S
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

November

Week 08

11th - Dijkstra's algorithm
13th - Challenge

Week 09

18th - Kruskal's algorithm & Challenge

Week 10

25th - Prim's algorithm
27th - Challenge

Unit 02

30% challenges
70% project

December & January

Week 11

2nd - A* Algorithm I
4th - A* Algorithm II

Week 12

9th - Introduction to OSMnx and GeoGraph
11th - Implementing A* algorithm into OSMnx

Week 13, 14 and 15

16th - Assignment Description
18th to 06th January

Setembro - 2024

D	S	T	Q	Q	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
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22	23	24	25	26	27	28
29	30					

Outubro - 2024

D	S	T	Q	Q	S	S
			1	2	3	4
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		

Novembro - 2024

D	S	T	Q	Q	S	S
			1	2	3	4
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

Dezembro - 2024

D	S	T	Q	Q	S	S
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Janeiro - 2025

D	S	T	Q	Q	S	S
			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	

January

Week 16

08th - NLP & Network Analysis



OSMnx

Week 17

13th - Final Project

15th - Final Project



Medium

Week 18

20th - Final Project

22th - Final Project



spaCy

Week 19

27th - 29th Final Exam

Gephi



GitHub

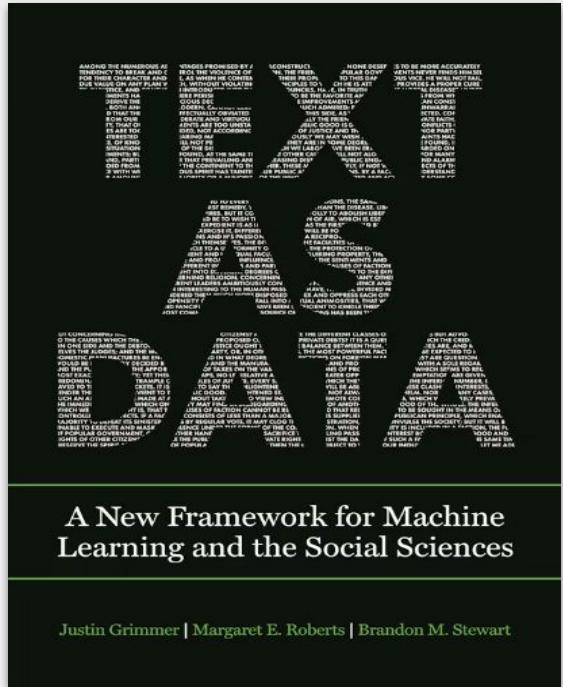
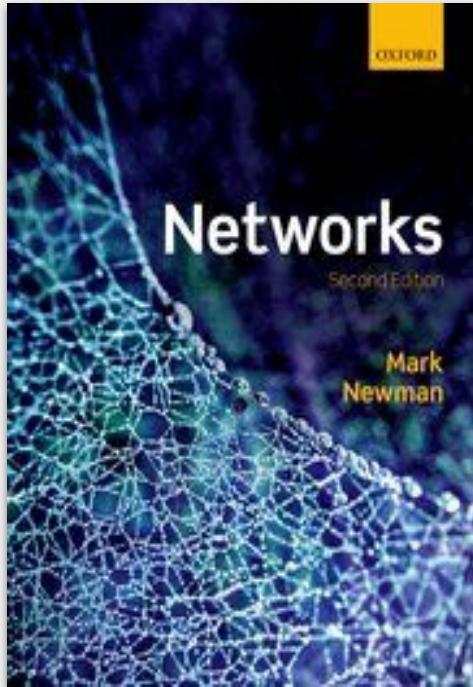
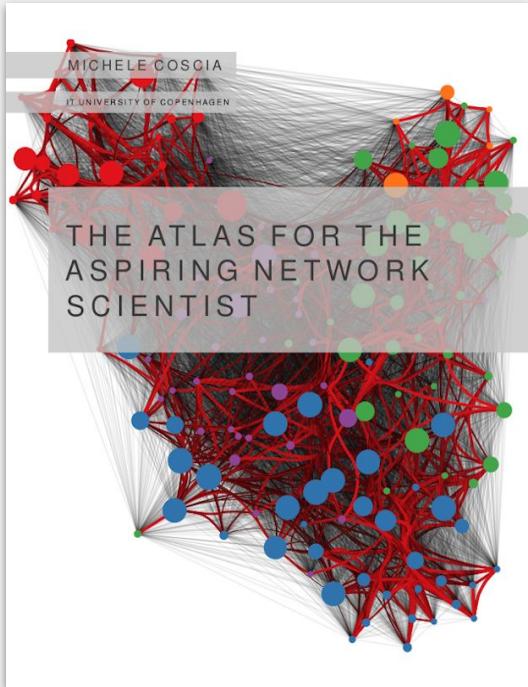
Unit 03

100% Final Project

 **NetworkX**
Network Analysis in Python

 python™

References



Clone me!!!!

<https://github.com/ivanovitchm/datastructure>