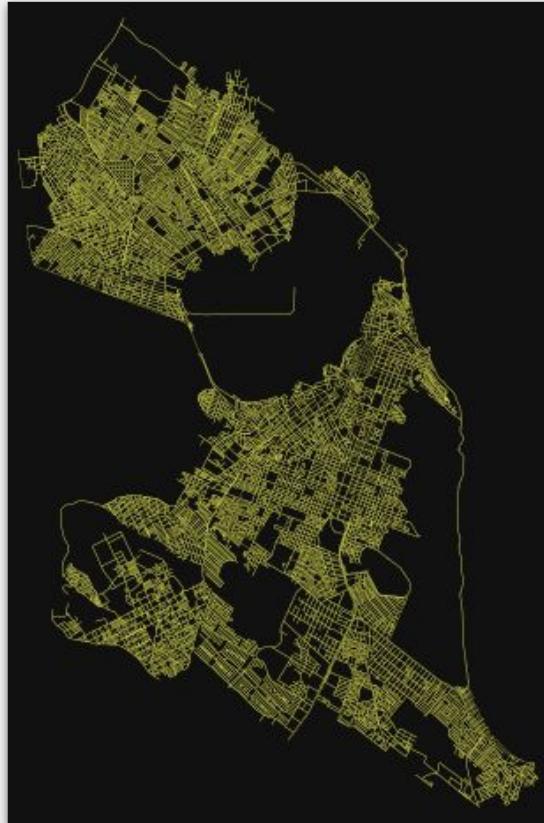


# Algorithms & Data Structures II

## DCA 0209

[ivanovitch.silva@ufrn.br](mailto:ivanovitch.silva@ufrn.br)  
@ivanovitchm

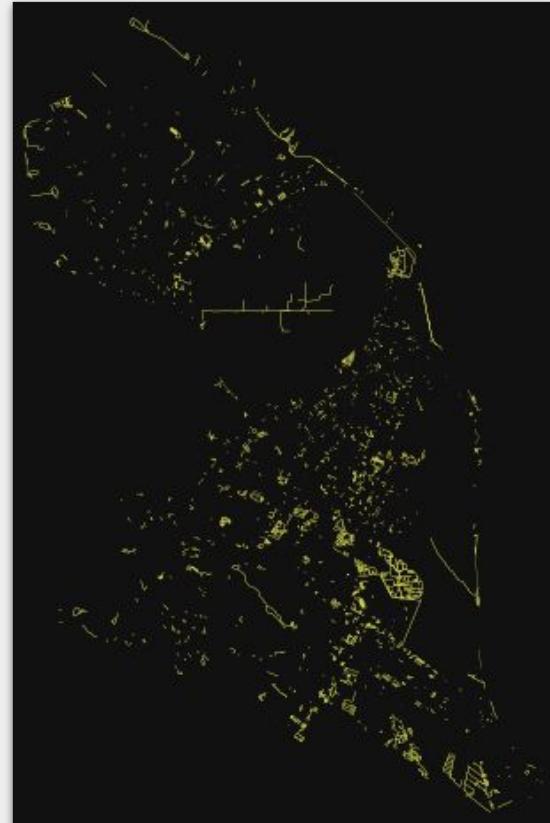




Drive



Bike



Bike - Drive

## 6º Nível

Estrutura Curricular	Natureza	
DCA0104 - ARQUITETURA DE COMPUTADORES - 60h	Obrigatória	
DCA0110 - MODELAGEM E ANALISE DE SISTEMAS DINAMICOS - 60h	Obrigatória	
DCA0115 - OTIMIZACAO DE SISTEMAS - 60h	Obrigatória	
DCA0130 - REDES DE COMPUTADORES - 60h	Obrigatória	
DCA0205 - PROJETO E ENGENHARIA DE SOFTWARE - 45h	Obrigatória	
DCA0207 - BANCO DE DADOS - 45h	Obrigatória	
DCA0208 - ALGORITMOS E ESTRUTURAS DE DADOS I - 60h	Obrigatória	

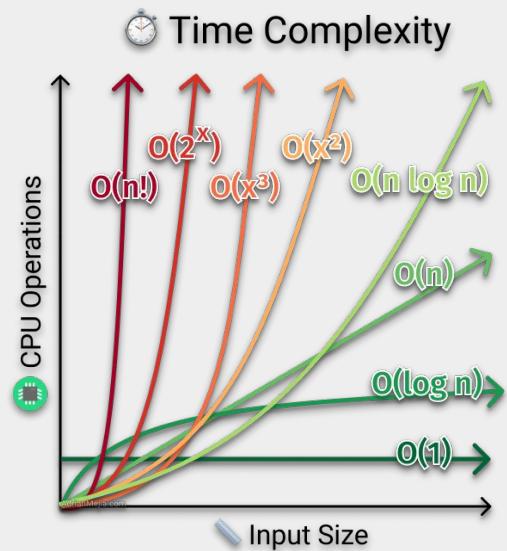
**CH Total:** 390h.

## 7º Nível

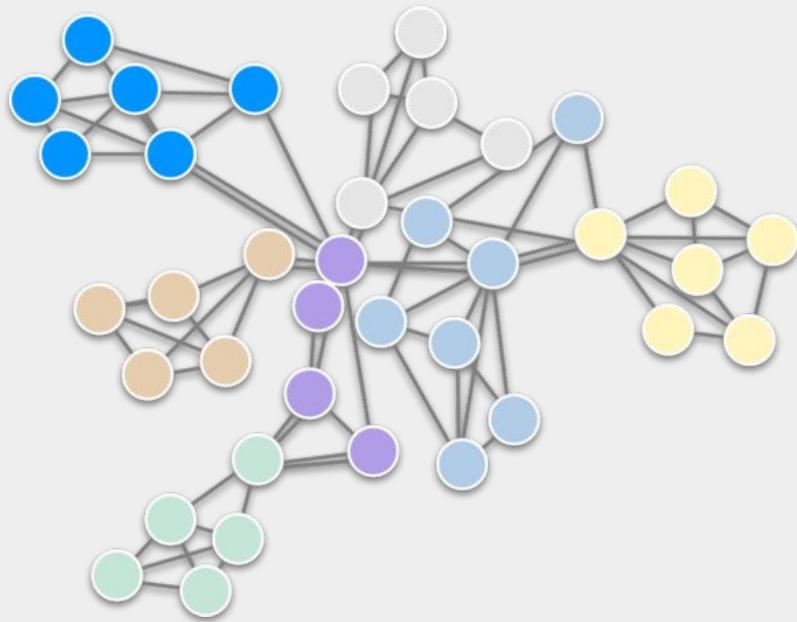
Estrutura Curricular	Natureza	
DCA0108 - SISTEMAS OPERACIONAIS - 60h	Obrigatória	
DCA0114 - COMPUTACAO GRAFICA - 60h	Obrigatória	
DCA0119 - SISTEMAS DIGITAIS - 60h	Obrigatória	
DCA0200 - INTELIGÊNCIA ARTIFICIAL - 60h	Obrigatória	
DCA0209 - ALGORITMOS E ESTRUTURAS DE DADOS II - 60h	Obrigatória	
DCA0210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

**CH Total:** 390h.

# Course Outline



Algorithm Complexity



Graph

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

n = 121

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

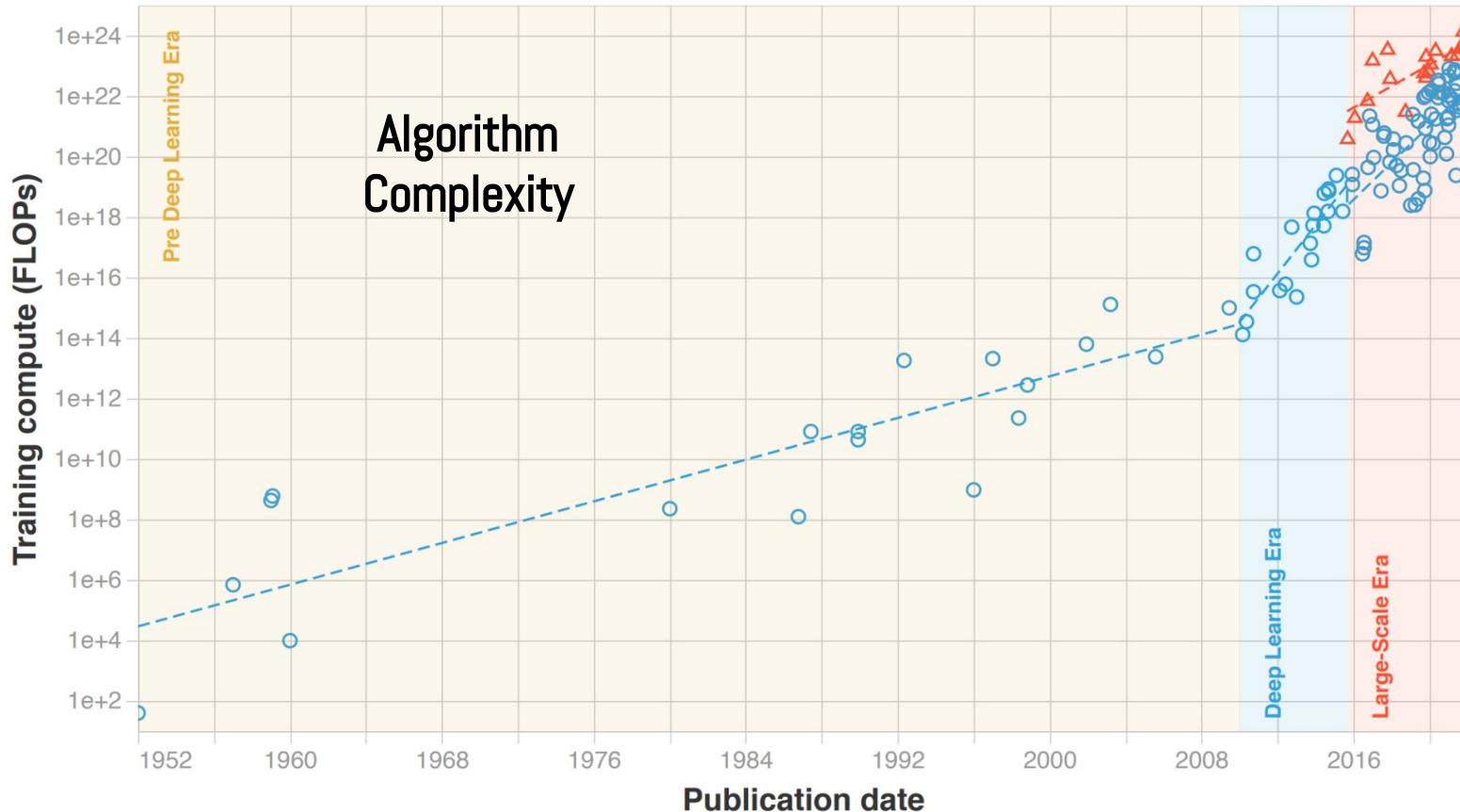
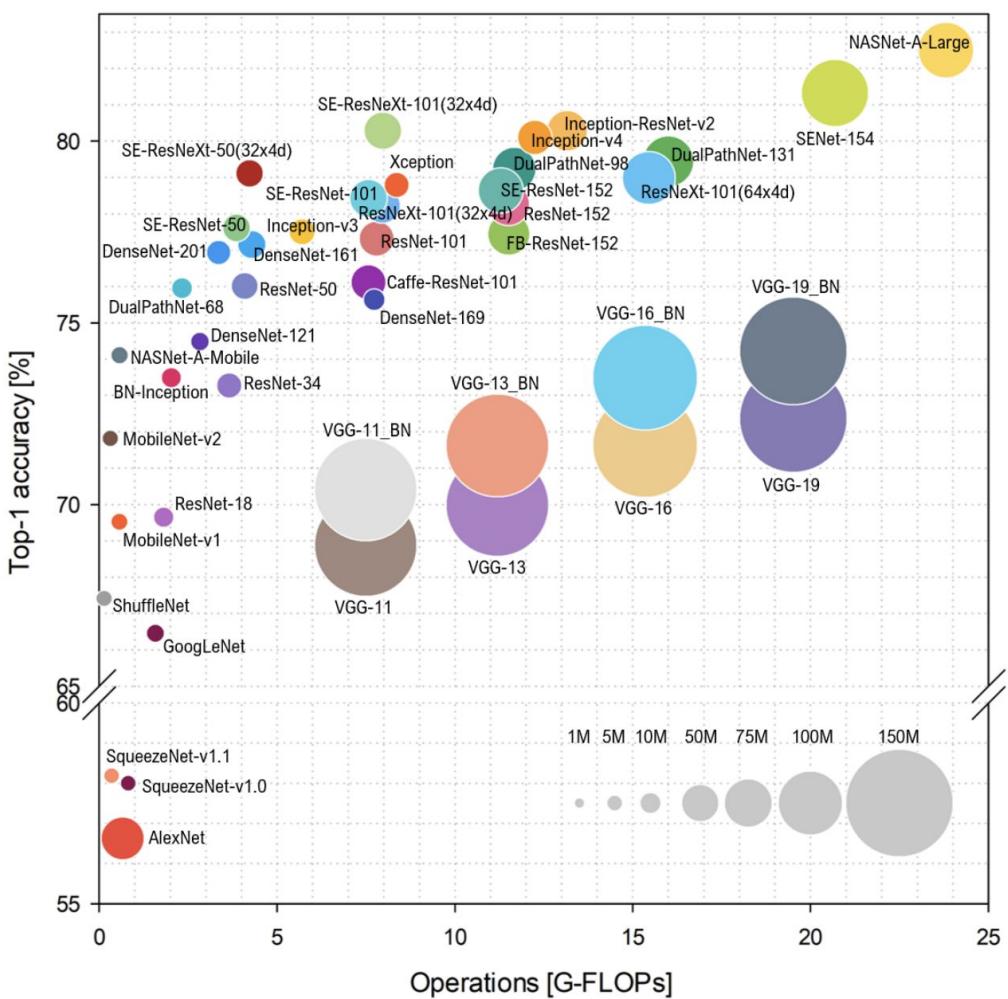


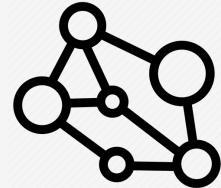
Figure 1: Trends in  $n = 121$  milestone ML models between 1952 and 2022. We distinguish three eras. Notice the change of slope circa 2010, matching the advent of Deep Learning; and the emergence of a new large-scale trend in late 2015.

# Algorithm Complexity

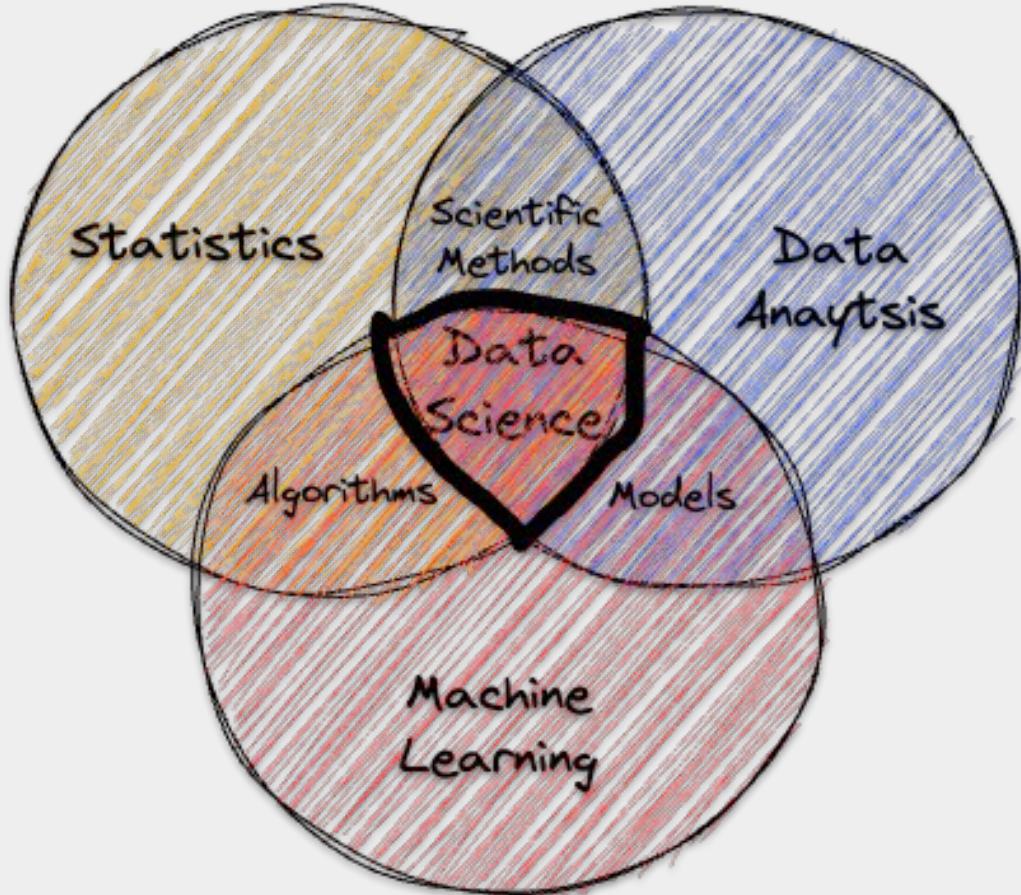


# ML Model Evolution ImageNet

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

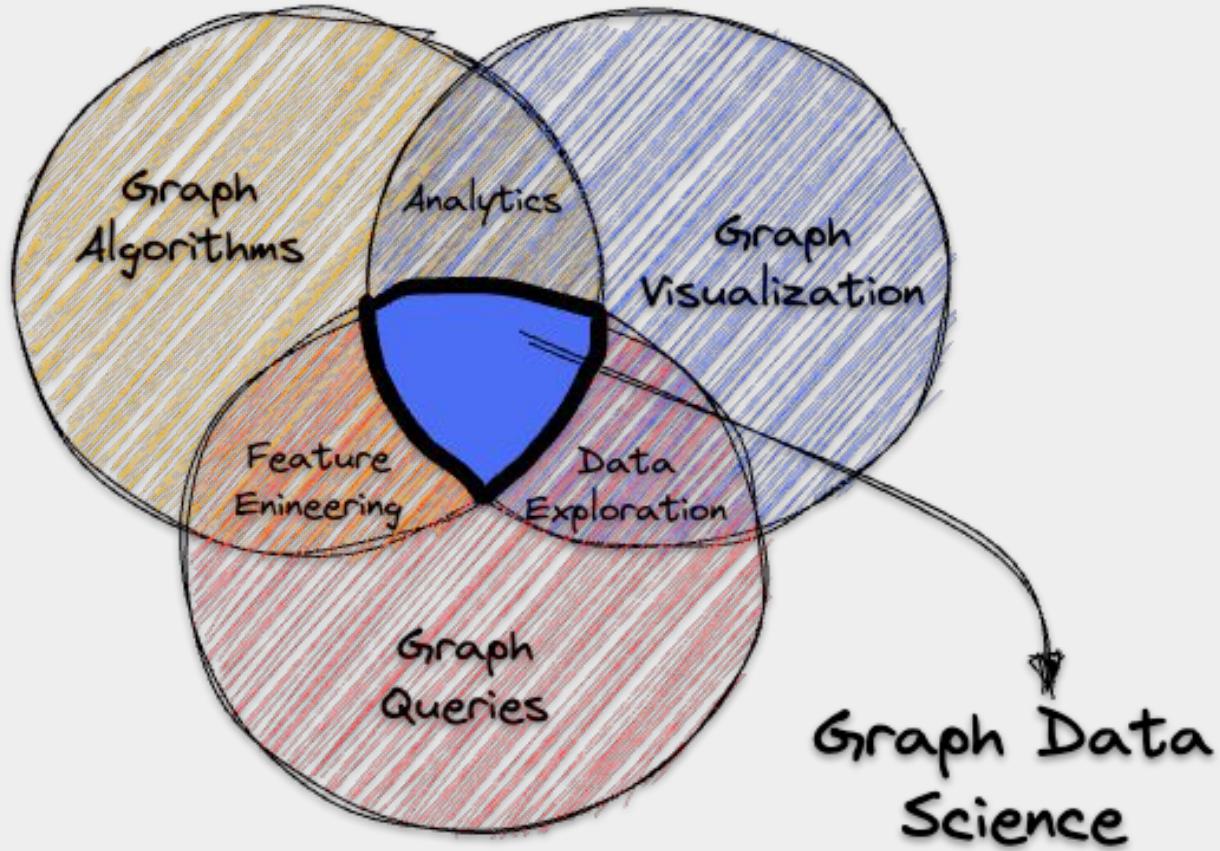


And about graph?  
Where and how use them?



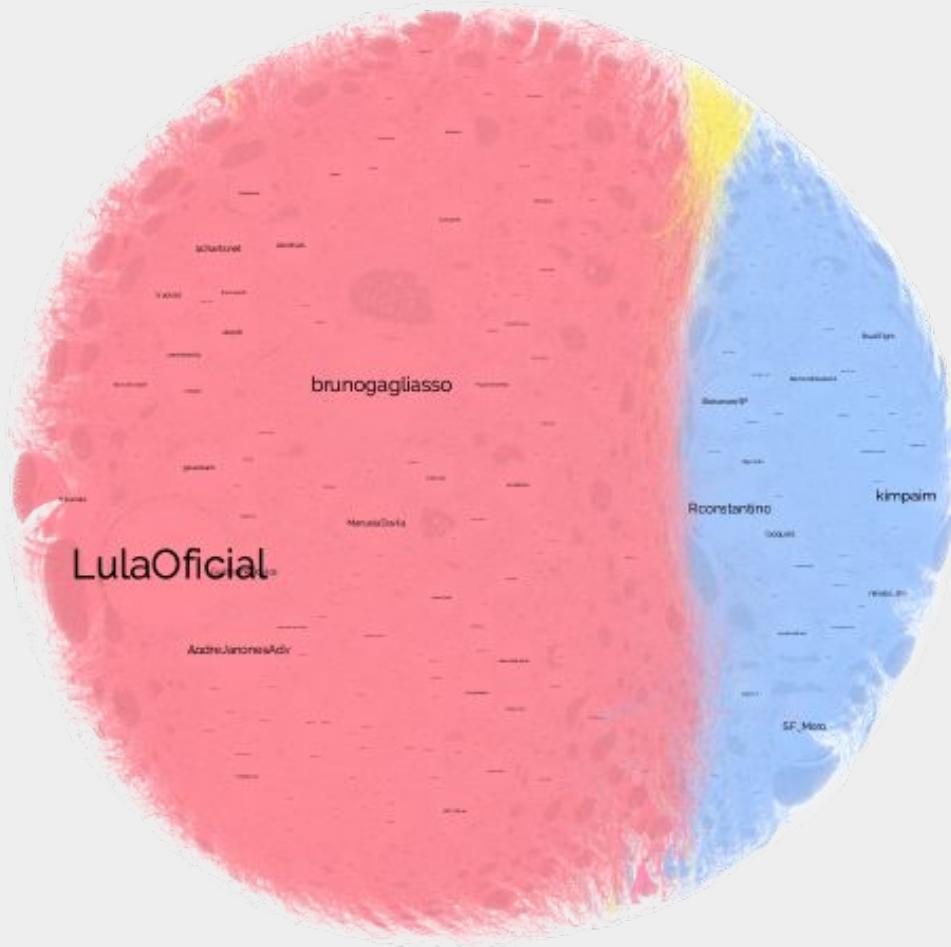
Data Science is an interdisciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data.

**Data Scientists use data to answer questions.**



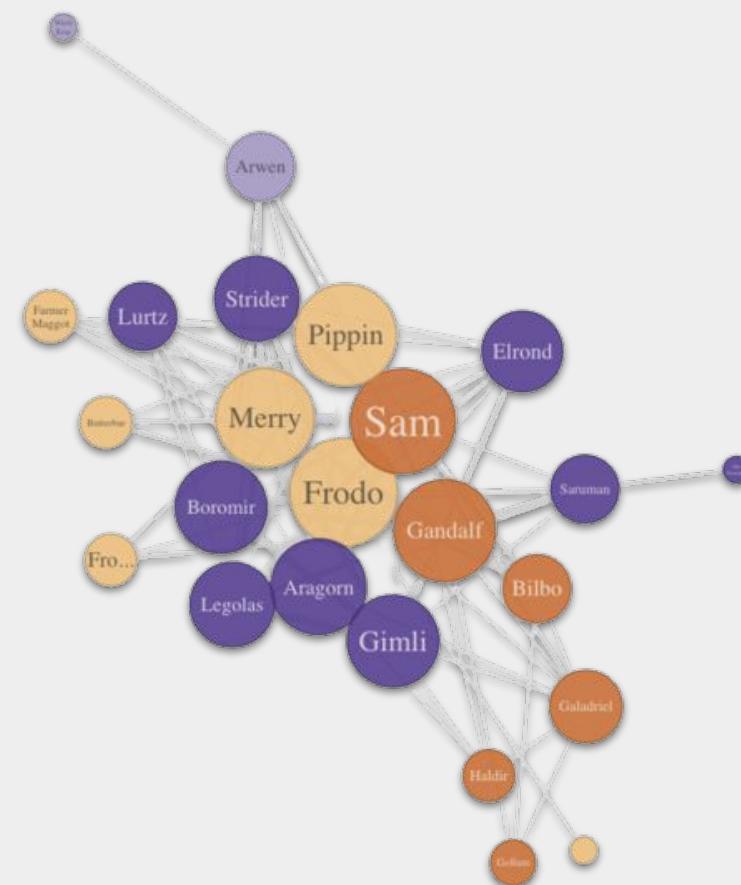
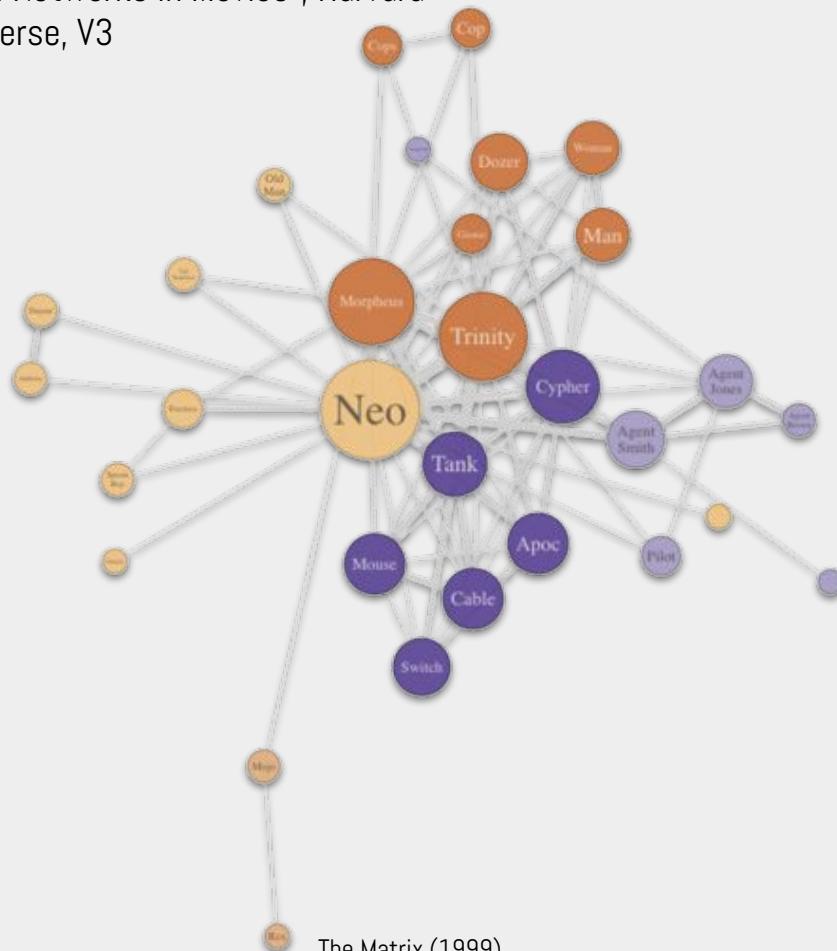
Graph Data Science is a science-driven approach to gain knowledge from the relationships and structures in data, typically to power predictions.

**Data Scientists use relationships to answer questions.**

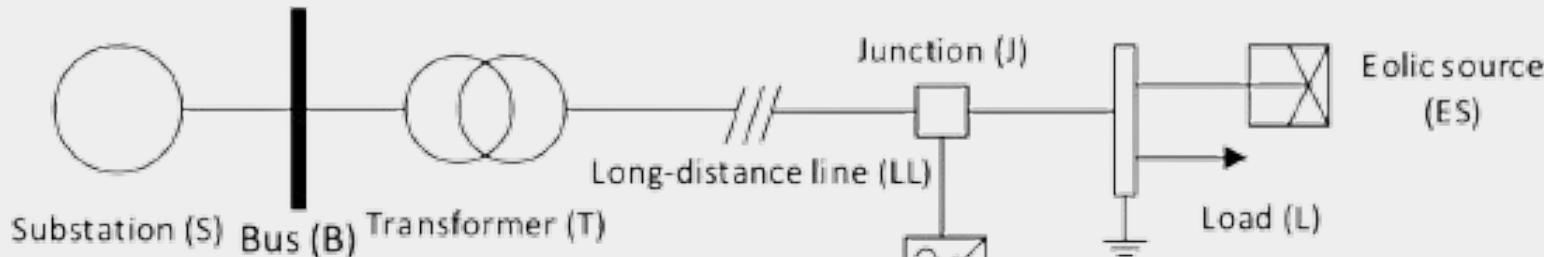


# Visualizing Elections Feedback

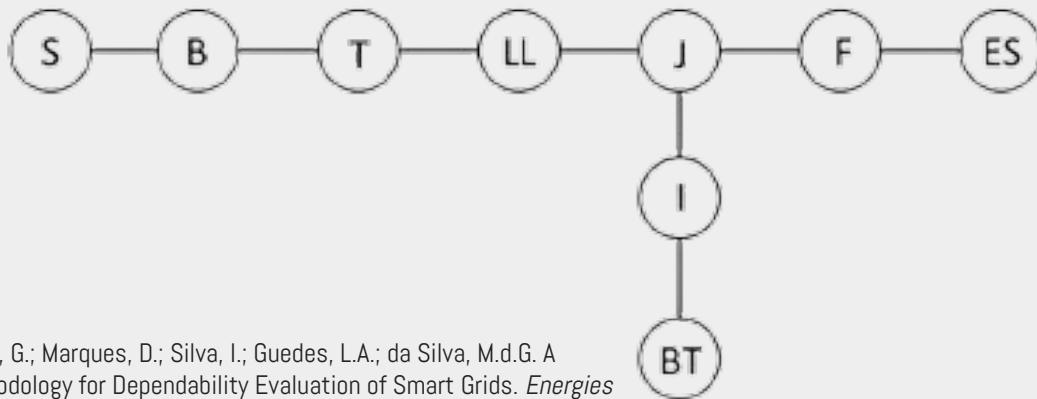
Clustering  
Community Detection  
Mention network



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

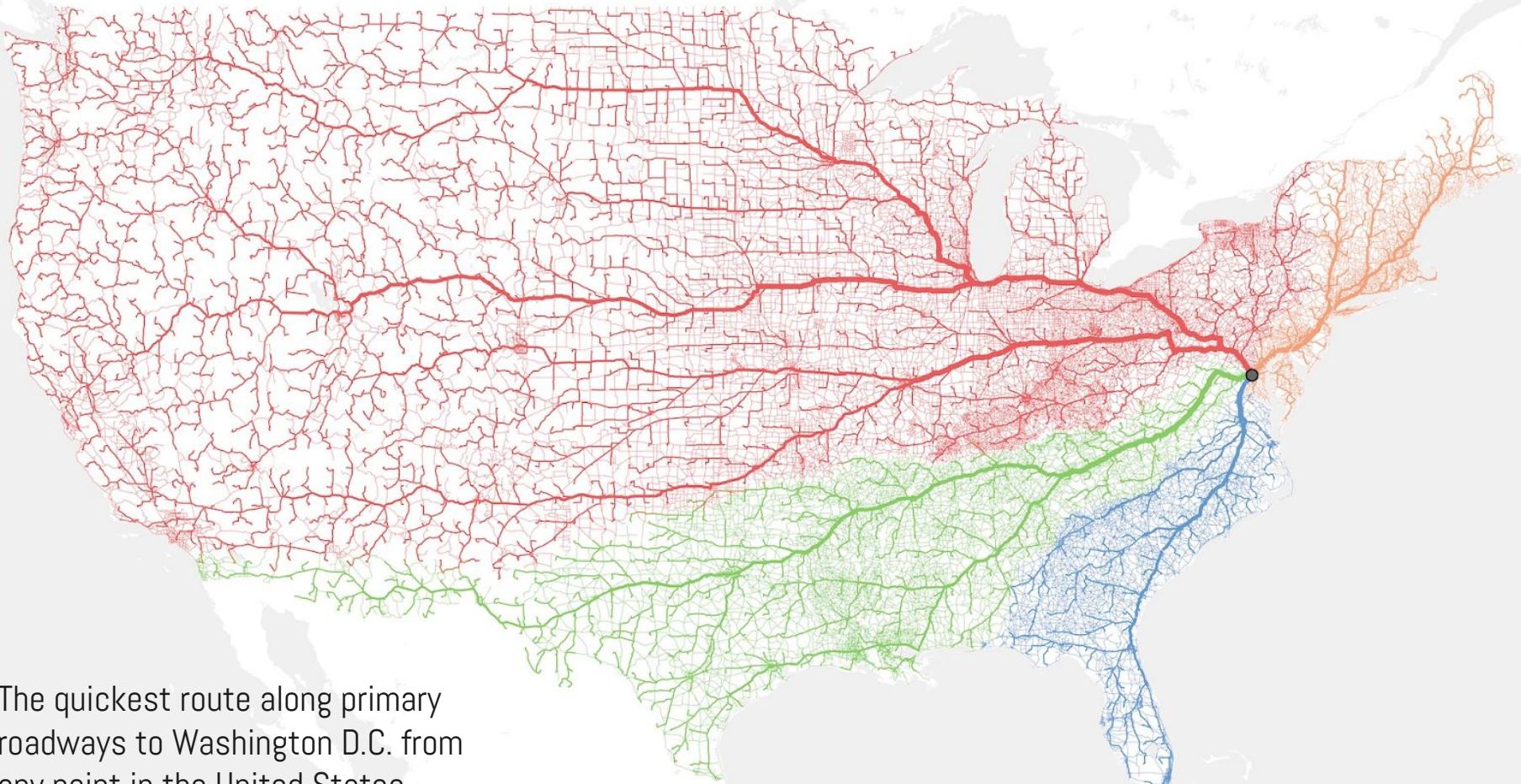


**One-line diagram  
to Graph**



**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



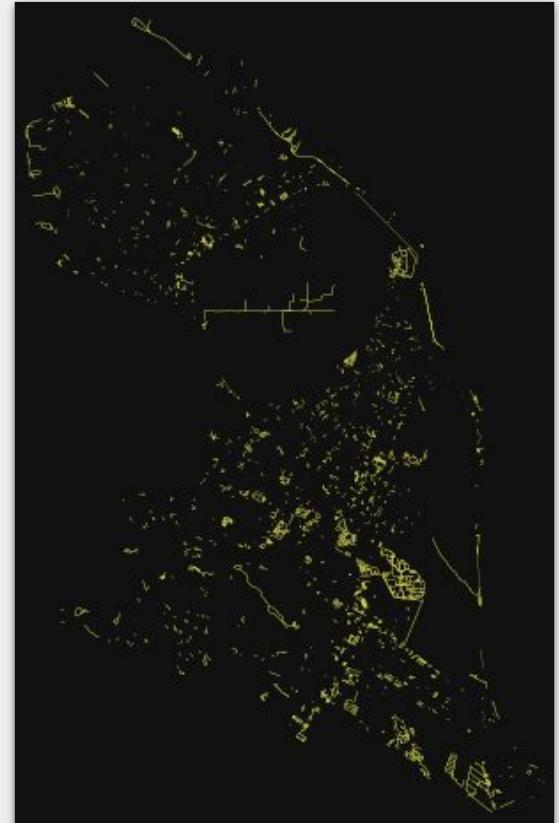
The quickest route along primary  
roadways to Washington D.C. from  
any point in the United States



Drive

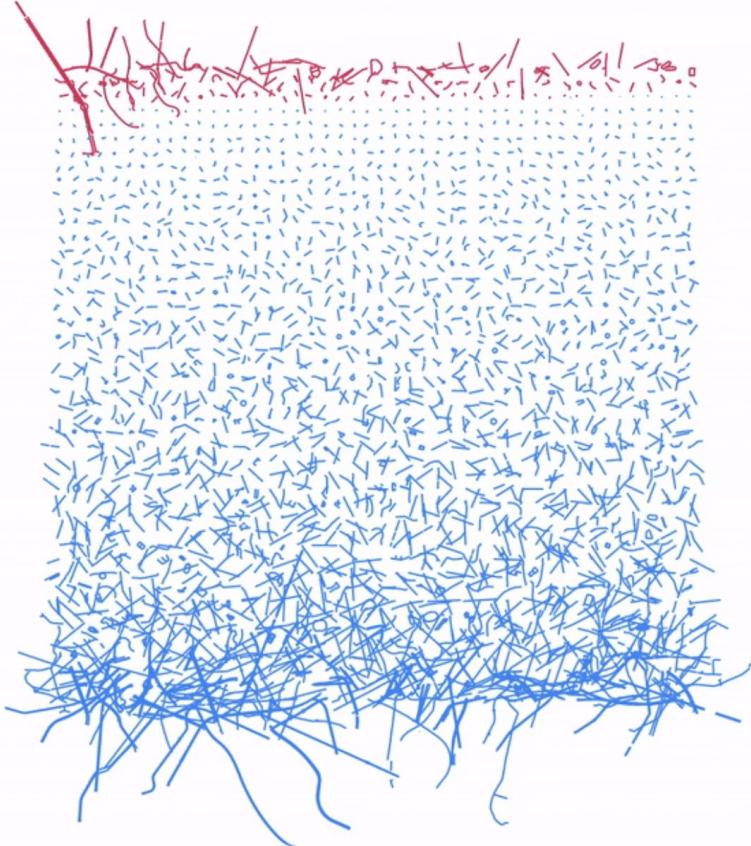


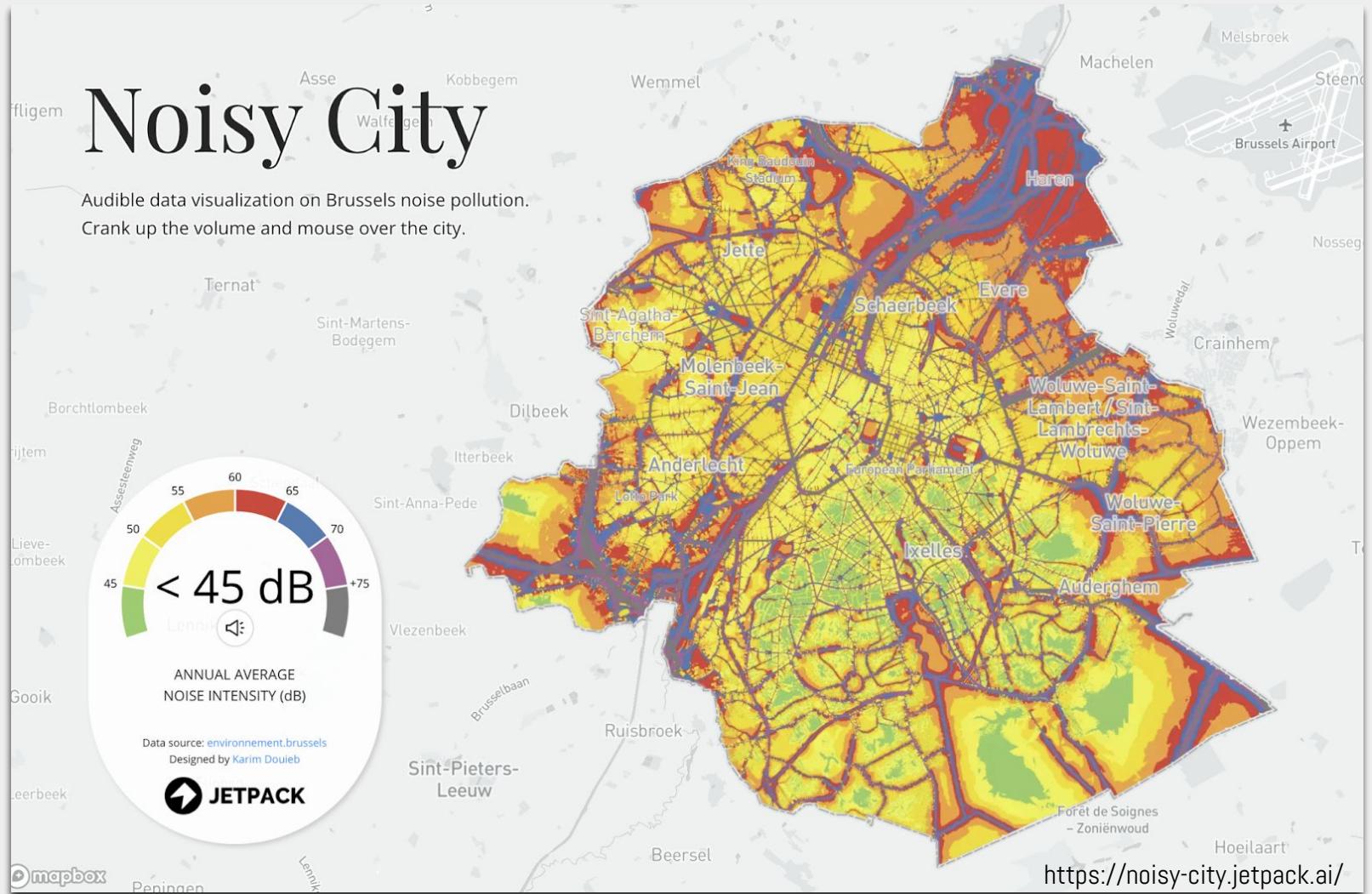
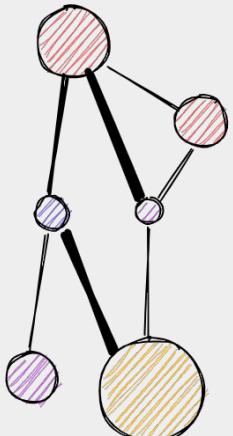
Bike

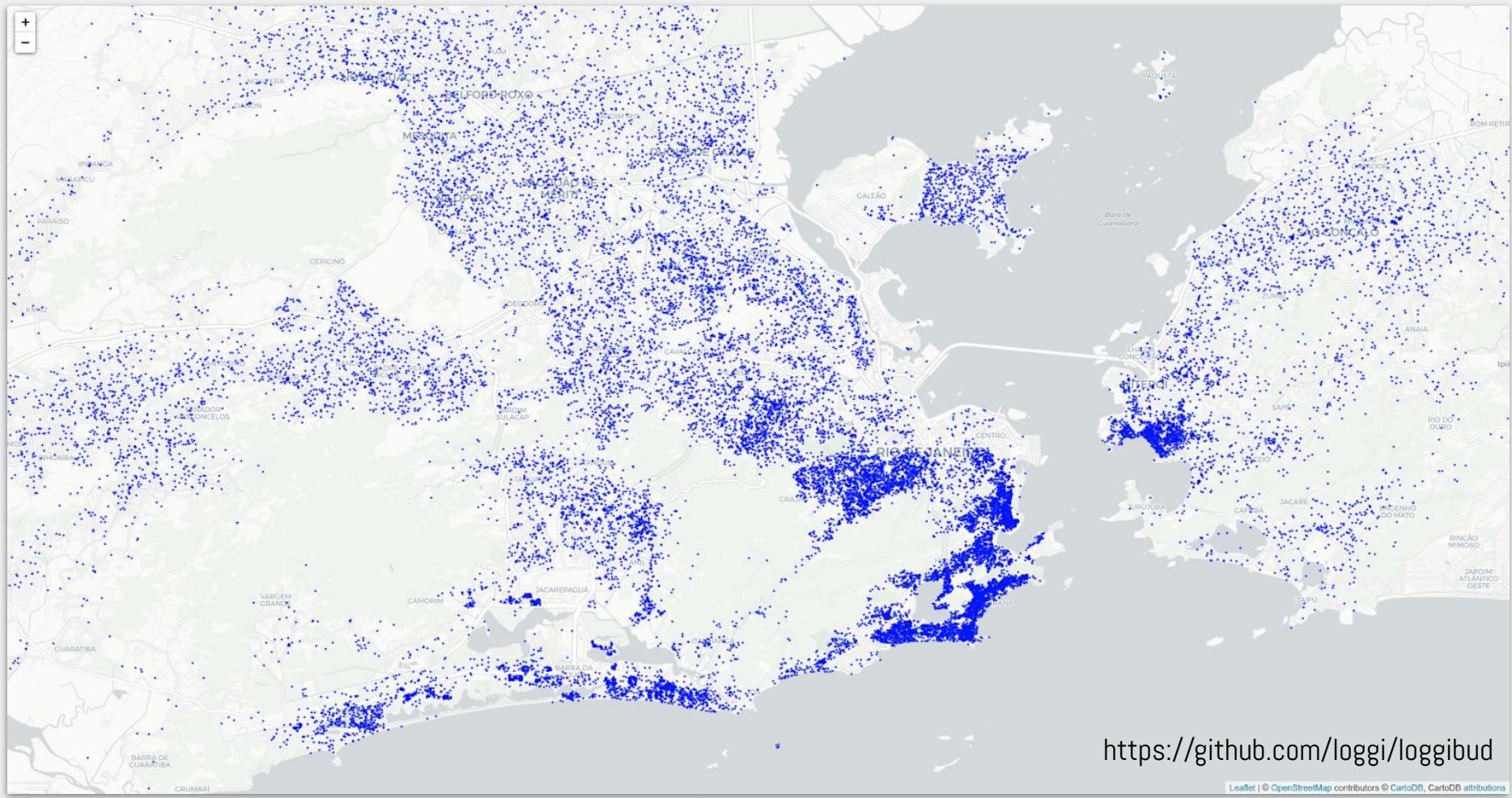


Bike - Drive

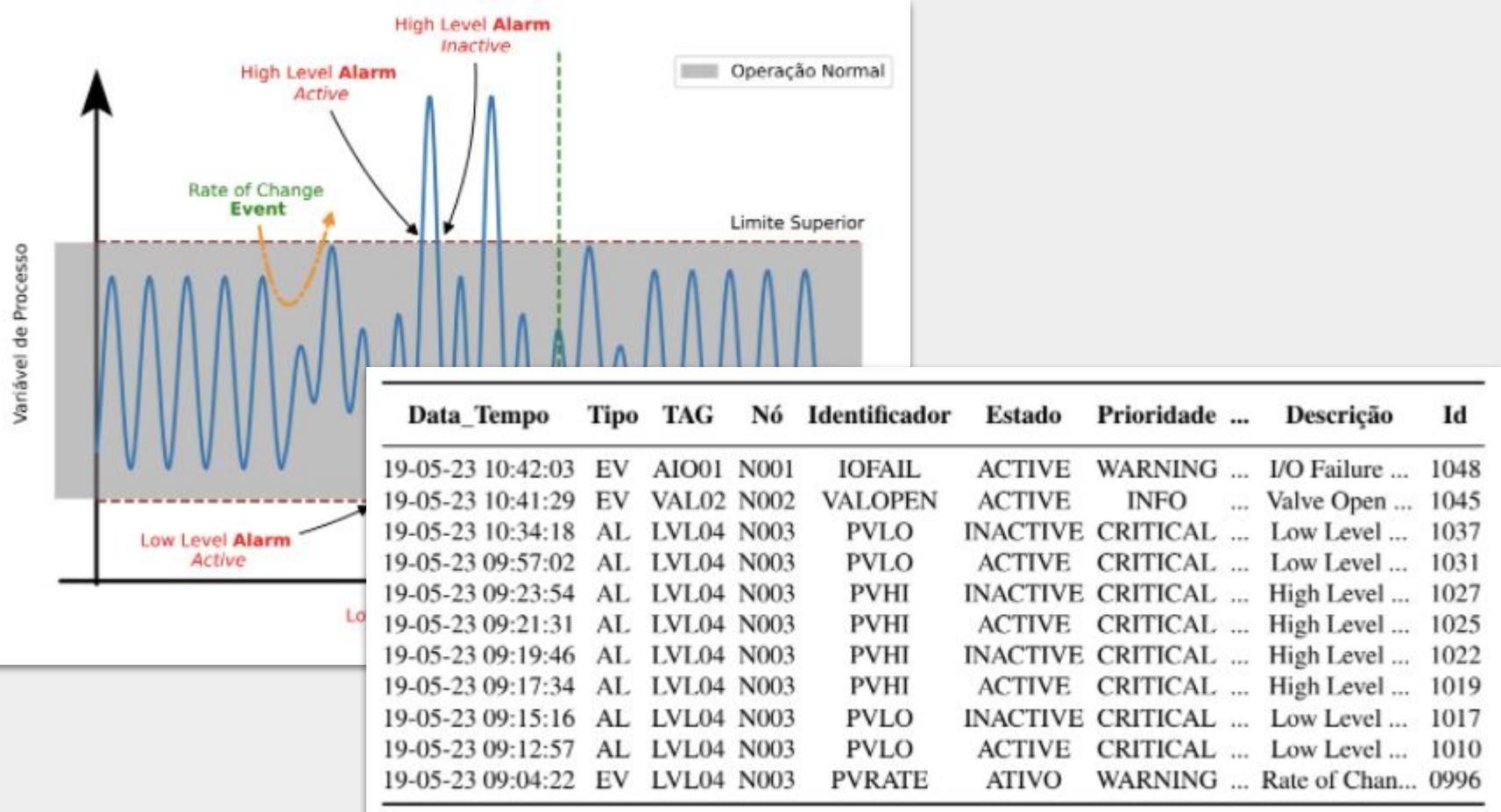
Only 6% of Brussels streets are named after women. [Open Knowledge BE](#) organized the production of these statistics with the help of 60 volunteers who tagged the gender of each street in Brussels.



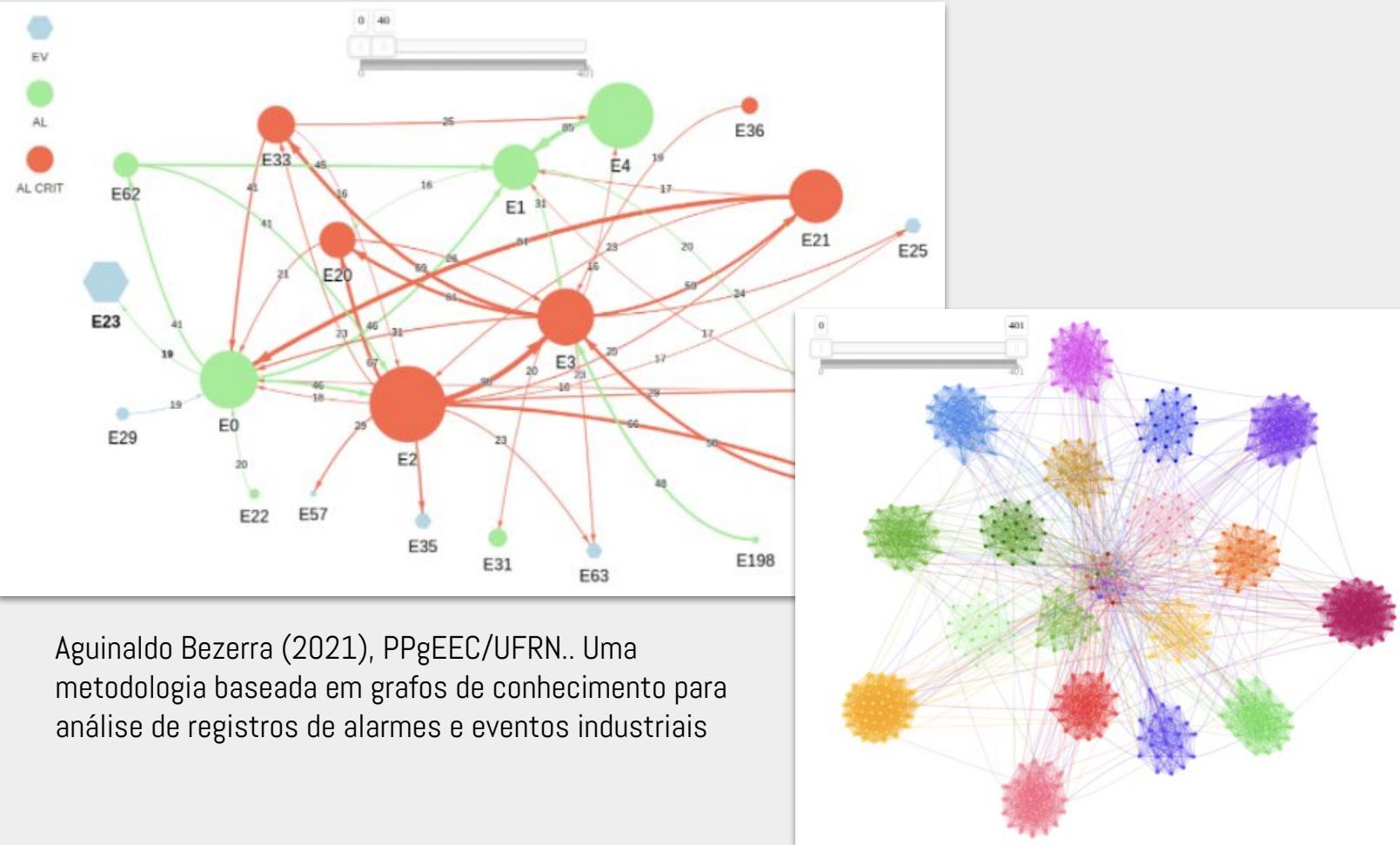




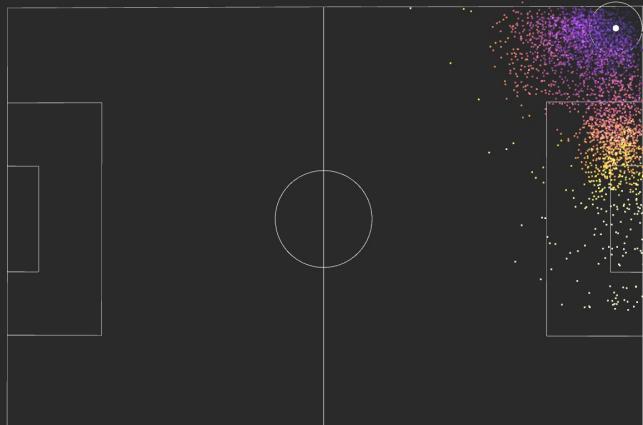
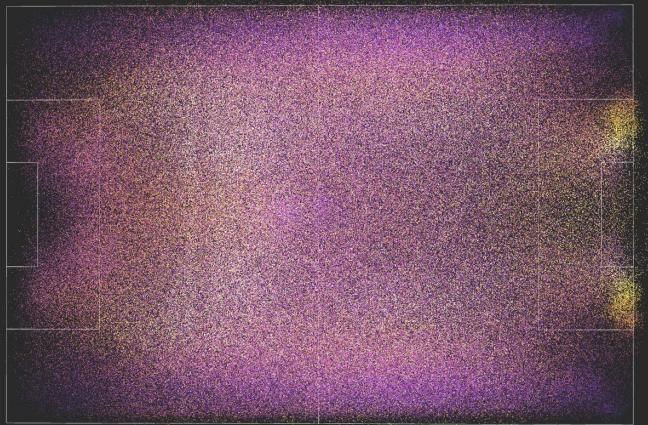
<https://github.com/loggi/loggibud>



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



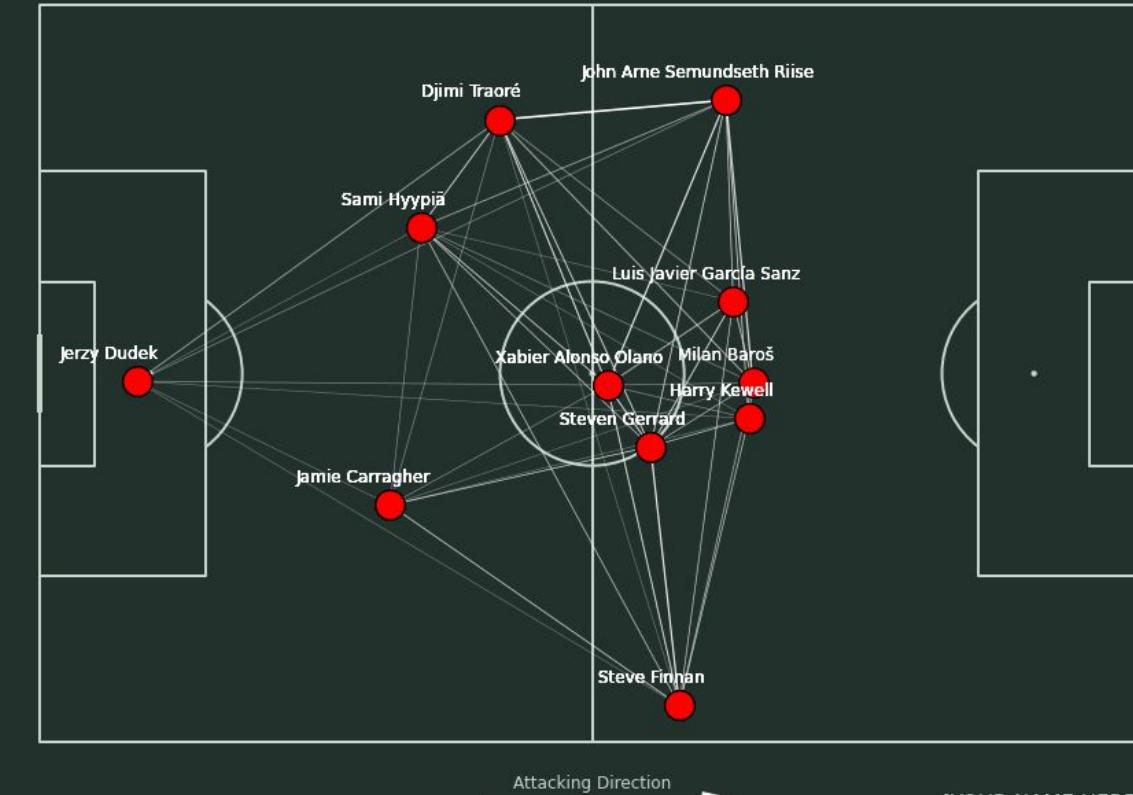
<https://statsbomb.com/>

<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

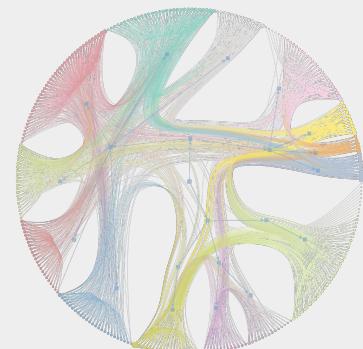
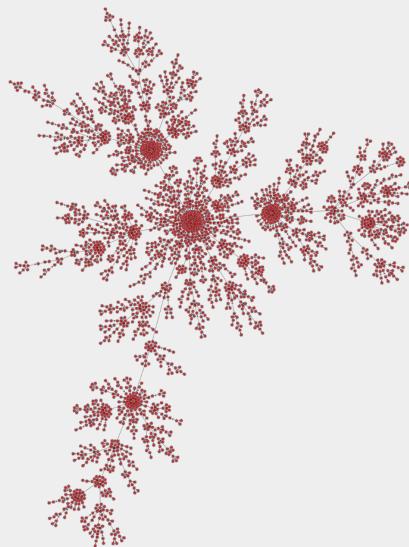
Recently, scholars have applied network science, which examines interconnected systems, to the study of food recipes. By examining the current literature, this review paper analyses the contribution of network science to recipes, and finds evidence of two main contributions. First, the pioneer studies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

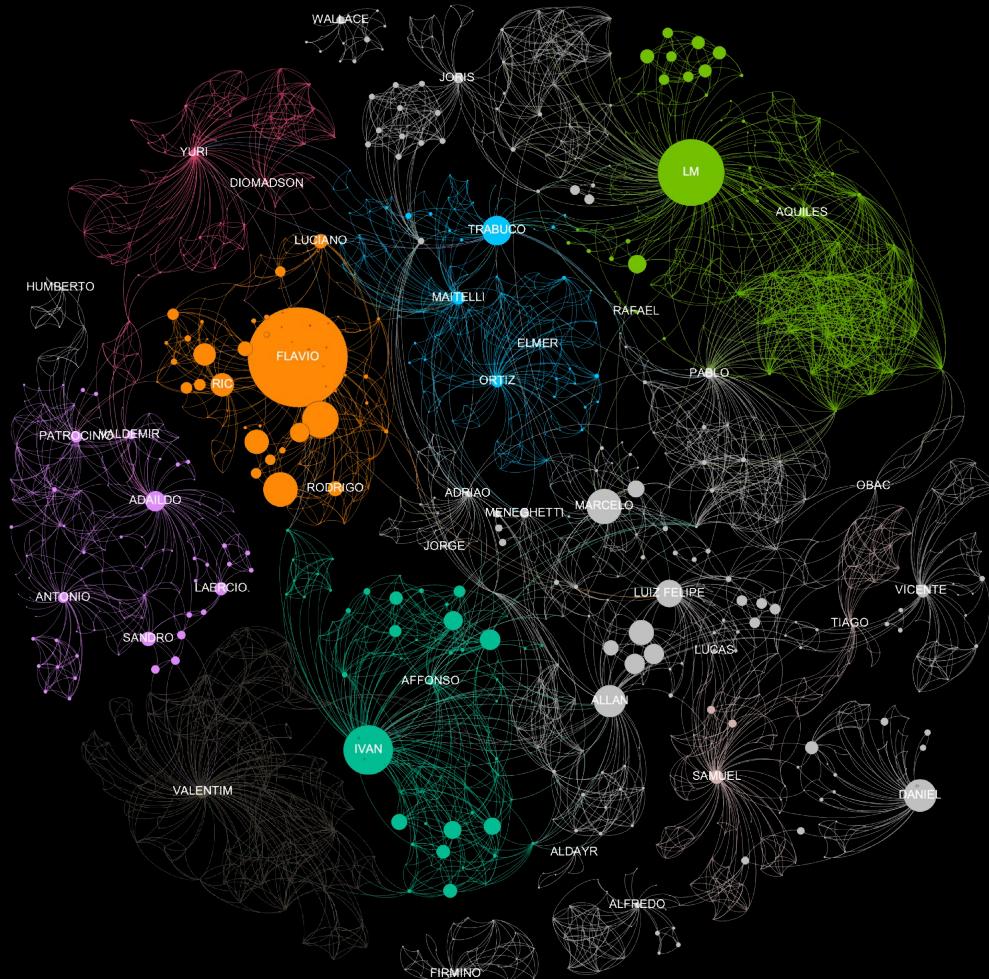
## 1. Introduction

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>

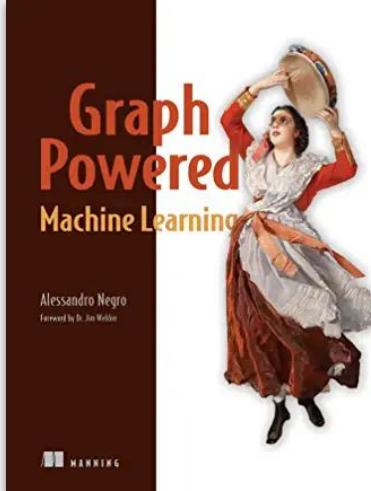
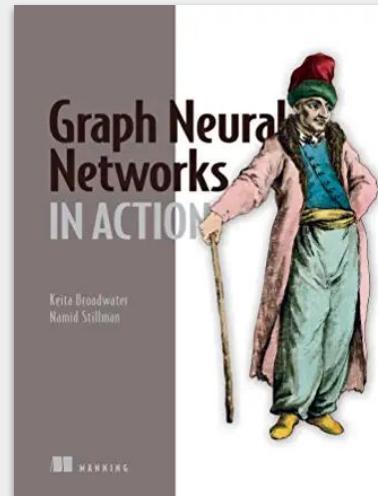
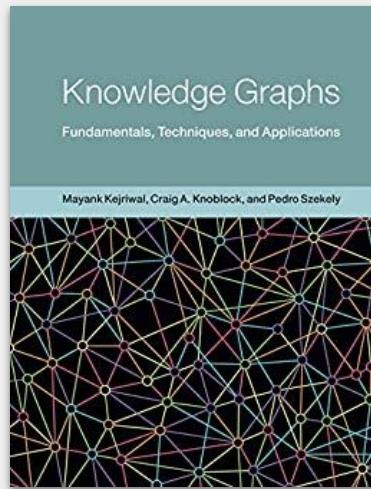
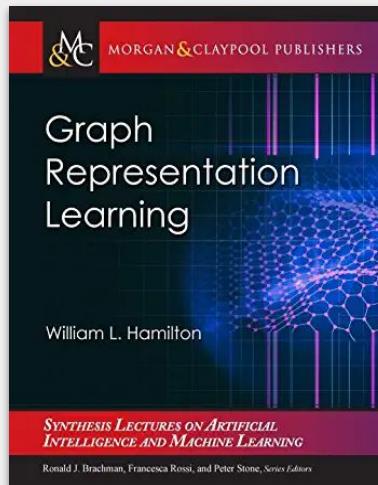
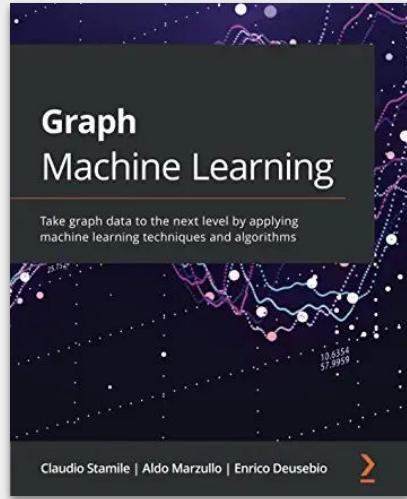
# State of AI Report 2023

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>

# Course Syllabus

1. Fundamentals of Python, Git
2. Data structure review
3. Algorithms complexity
4. Data Pipeline
5. Network elements, Small worlds, Hub, Communities
6. Directed Networks
7. Case Studies
  - a. Social Networks
  - b. Scientometrics
  - c. Data Visualization
  - d. Mobility
  - e. NLP

colab

graph-tool



Medium

YouTube

spaCy

Gephi

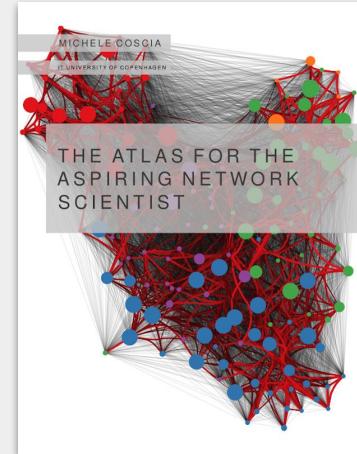
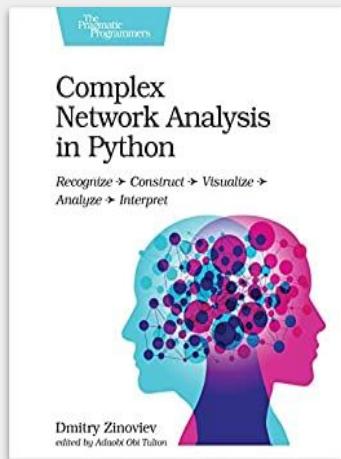
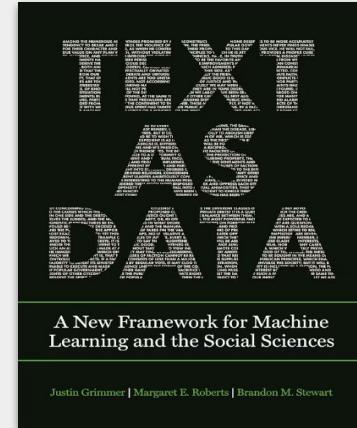
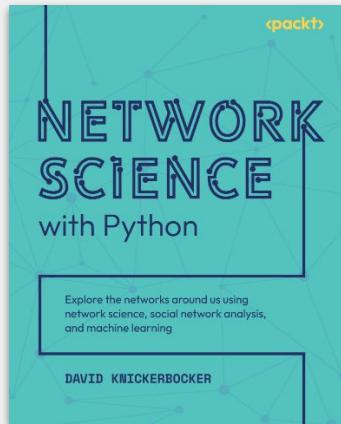
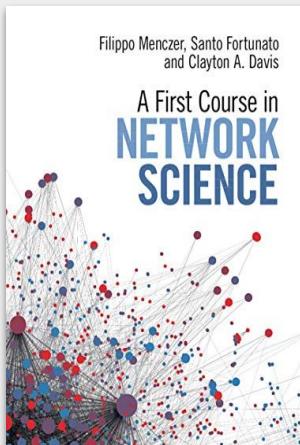
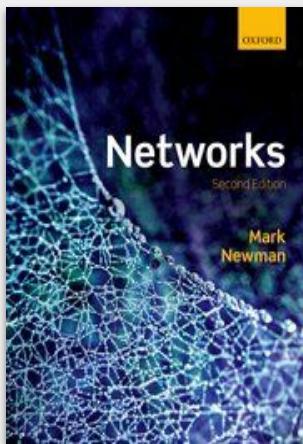
loom

GitHub

NetworkX  
Network Analysis in Python

python™

# References



# Clone me!!!!

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