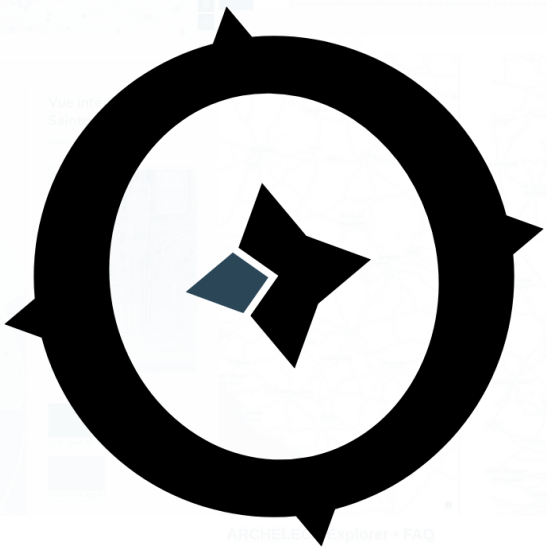
Developing Custom UIs to Explore Graph Databases Using Sigma.js

FOSDEM 2025, 1 February 2025

Data Analytics devroom



Alexis Jacomy
OuestWare

ouestware.com

github.com/jacomyal

vis.social/@jacomyal

let's start with

RICardo

RICardo

ricardo.medialab.sciences-po.fr

Research on International Commerce

goal:

crafting a **dataset** on **international trades** from ~1830 to ~1930 between **sovereign entities**

core data: **trades**

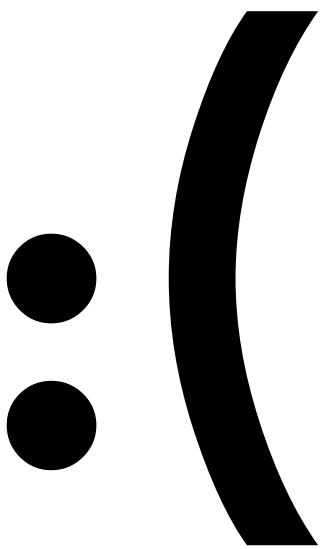
an **entity** reports a trade with another **entity**, with:

- direction (import/export)
- monetary value
- year

entities are as described in the raw reports

- France
- Southern France
- France & Monaco
- Western Europe
- Paris

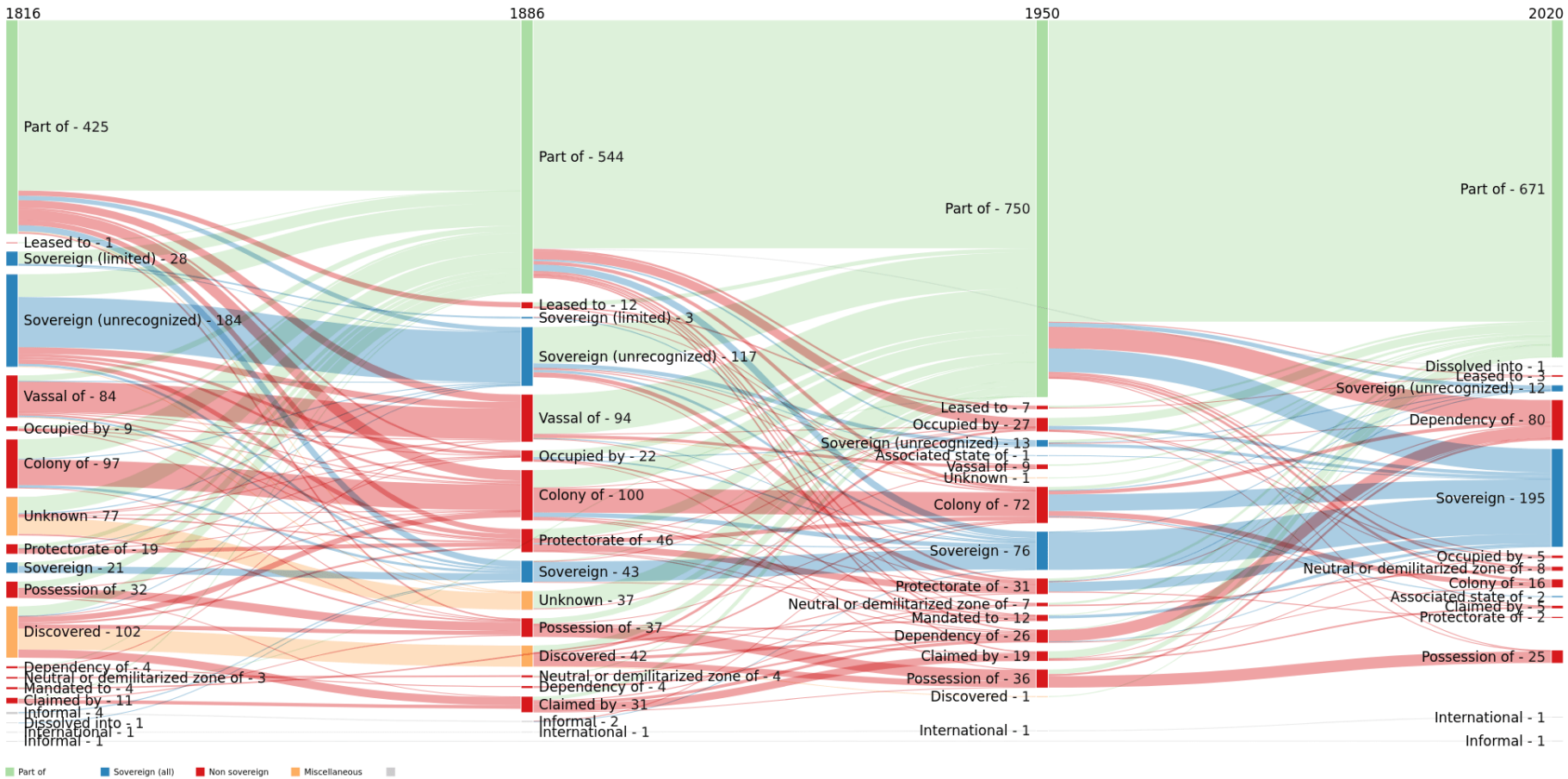
...



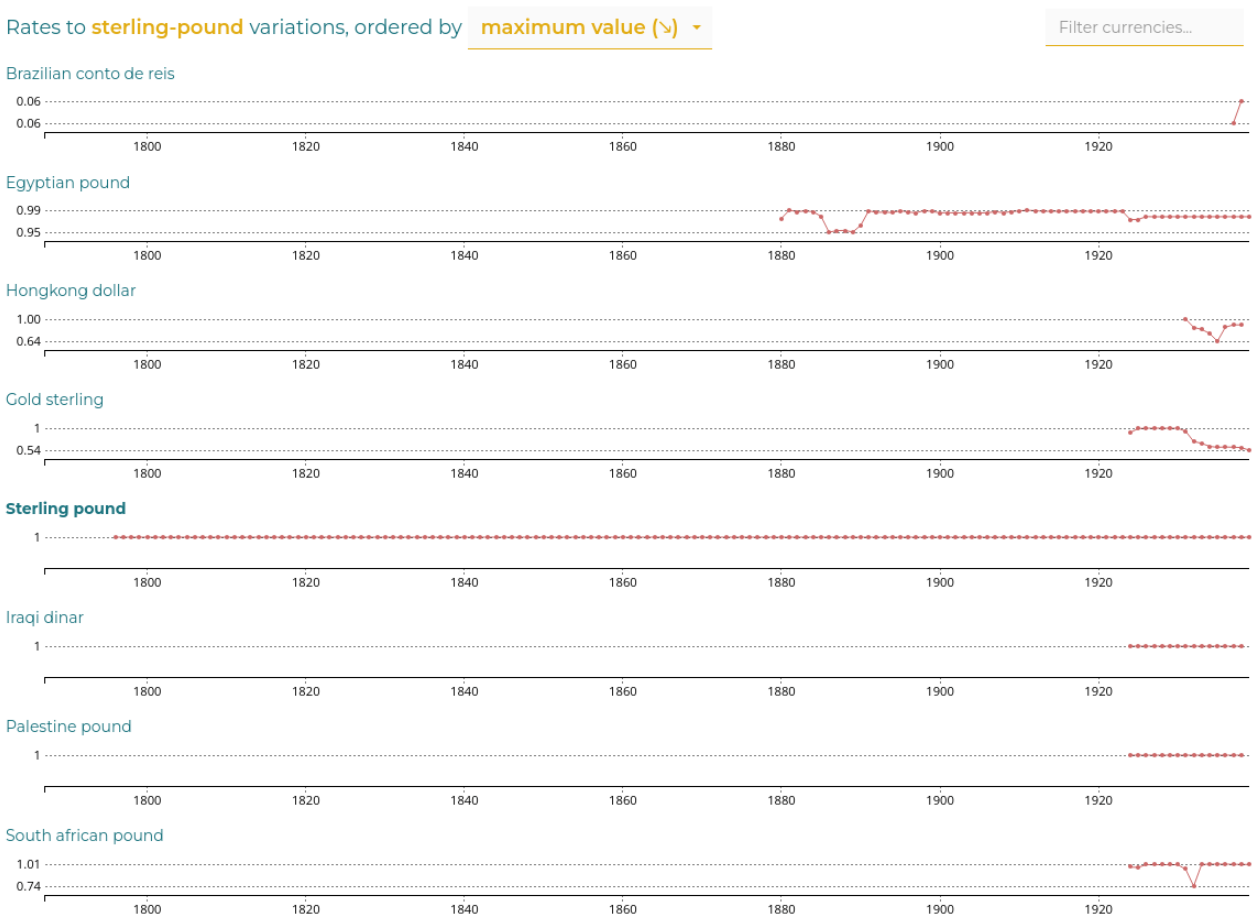
additional dataset:

GeoPolHist provides reference **sovereign entities** along time, and links them to entities from **RICardo**

medialab.github.io/GeoPolHist



last dataset:
exchange rates along time



today, let's focus on:

- raw yearly **trade reports**

  (with normalized monetary values)
- relations between **entities**

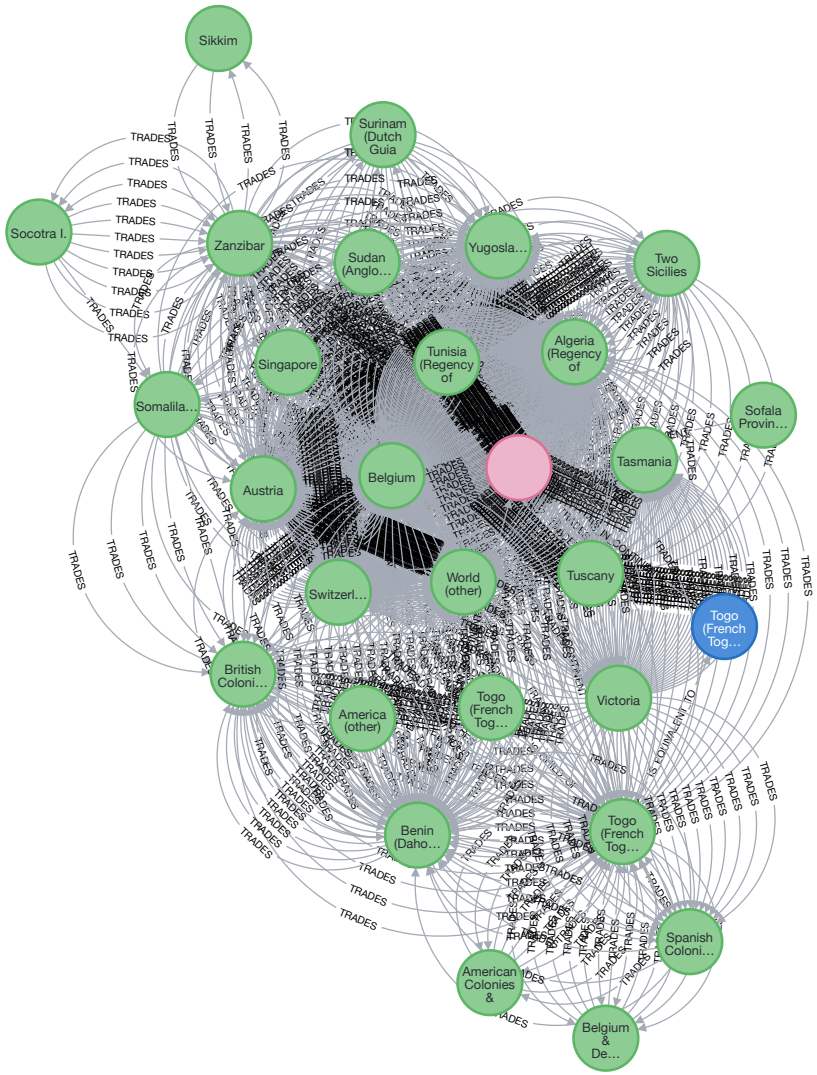
let's first put the data in **Neo4j** and use their **browser**

the Neo4j indexation scripts are available at

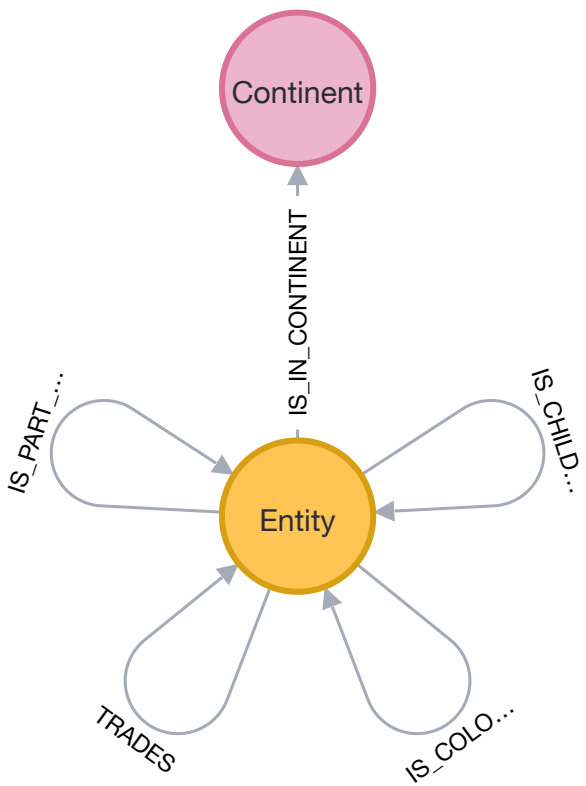
github.com/jacomyal/2025-fosdem

some observations

1. there are **many** relations



2. trades between sovereign entities is often **indirect**



- Colonies
- Groups
- Parts (cities, regions...)

...

3. there can be **mistakes** in the original reports interpretation

this dataset is
tricky to **explore**!

it's a good usecase
for some **custom UI**

here comes

sigma.js


sigma.js
sigmajs.org
vis.social/@sigmajs

built with **visual network analysis** in mind

graphology

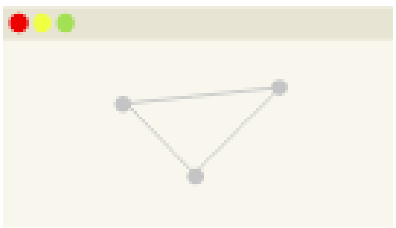
handles ***graph data model & algorithms***

+

sigma.js

handles ***graph rendering & interactions***

=



your ♥ web app

graphology

provides many

graph algorithms

- Metrics (pagerank...)
- Layouts (ForceAtlas2...)
- Traversal, clustering...

sigma

provides many

rendering helpers

- Nodes (images, borders...)
- Edges (curves, arrows...)
- Layers (maps, heatmaps...)

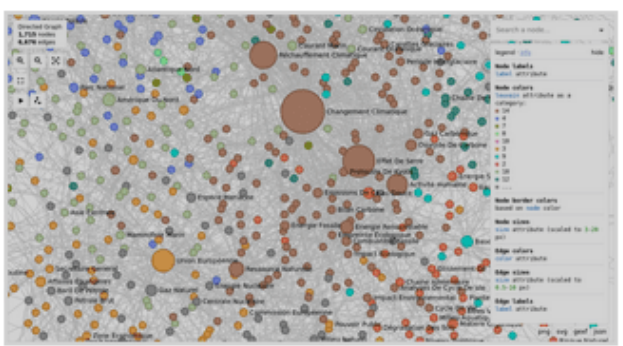
used in many **tools** already

Gephi Lite
a graph visualization and exploration web application

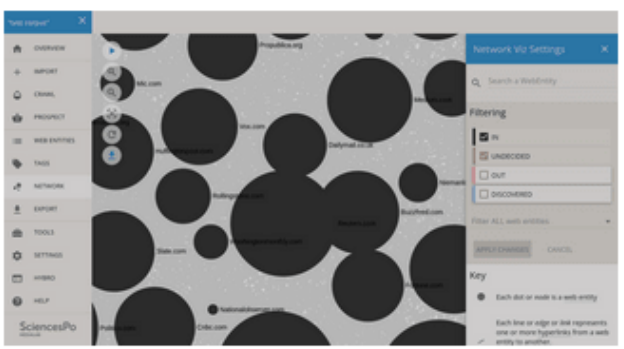
GraphCommons
a collaborative platform for mapping, analyzing, and sharing data-networks

Retina
a web application to help sharing graph visualizations online

G.V()
a software to write, debug, test and analyze Gremlin graph databases



ipysigma
a Jupyter widget to render networks in the result of a notebook cell



Hyphe
a web corpus curation tool featuring a research-driven web crawler

let's build our
exploration interface!

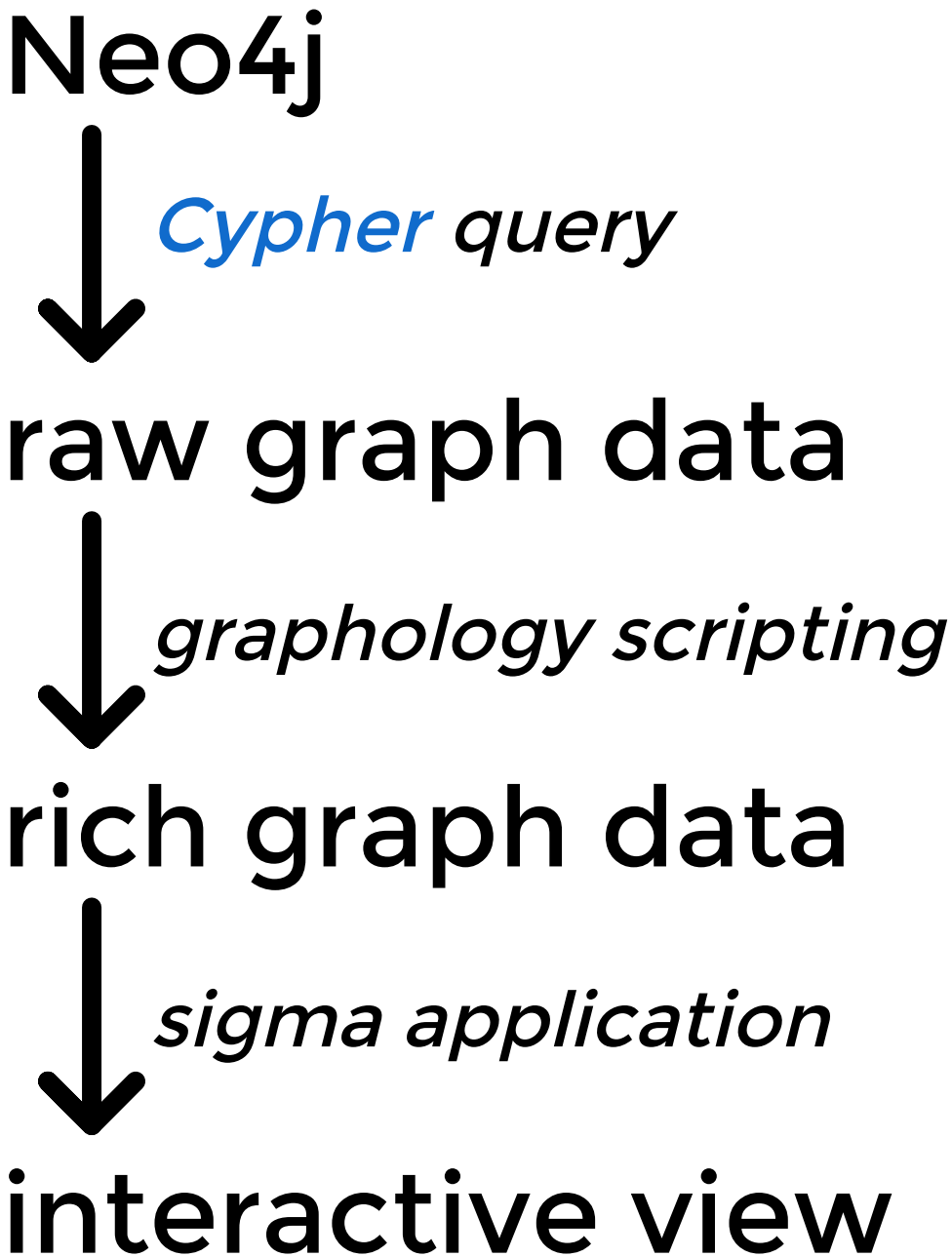
the web application is
also available at

github.com/jacomyal/2025-fosdem

the web application is built with **Vite + TypeScript**

```
"dependencies": {
  "@sigma/edge-curve": "^3.1.0",
  "graphology": "^0.26.0",
  "graphology-layout": "^0.6.1",
  "graphology-layout-forceatlas2": "^0.10.1",
  "neo4j-driver": "^5.27.0",
  "sigma": "^3.0.1"
},
```

1. **ego** networks


Neo4j
Cypher query
raw graph data
graphology scripting
rich graph data
sigma application
interactive view

Cypher query

For a given center **c**

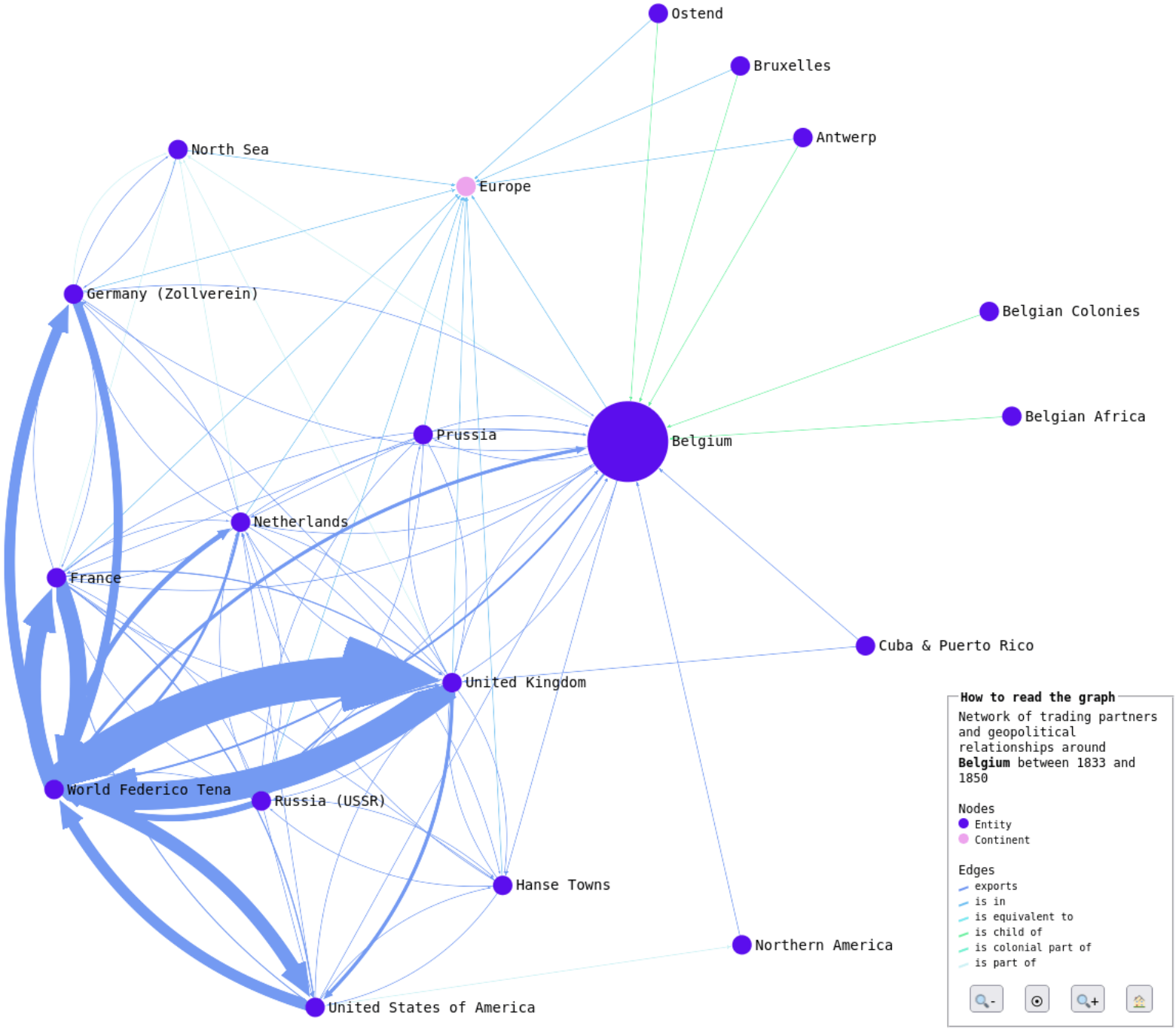
1. get neighbors: (c)-[**r1**]-(**n**)
2. for each unique neighbors pair, get relations: (n1)-[**r2**]-(n2)

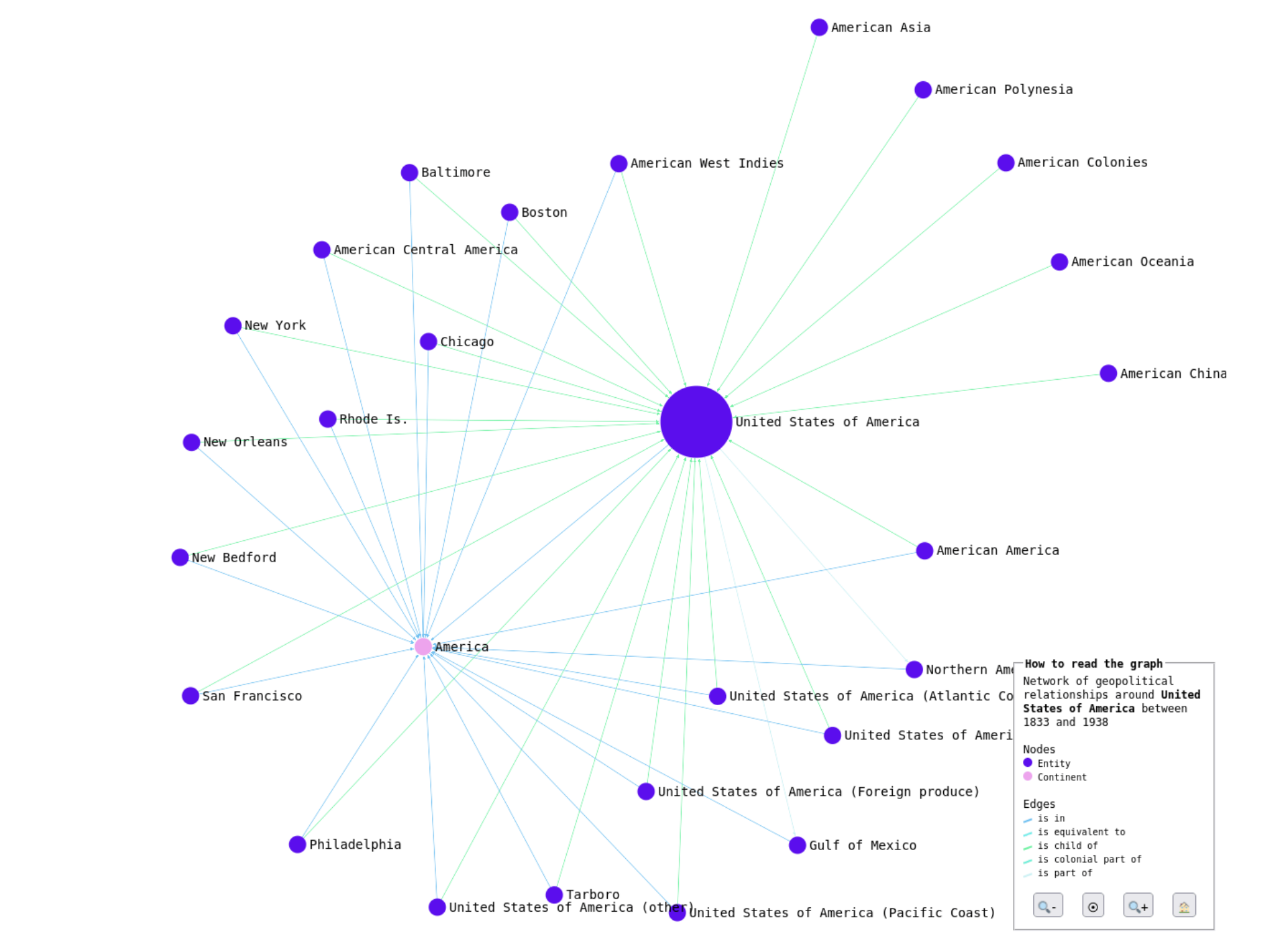
graphology scripting

1. aggregate all parallel trades
2. use **ForceAtlas2** to get better node positions
3. set **graphical** variables (sizes, colors, labels)

sigma application

1. make parallel edges **curved**
2. add zoom in/out/reset buttons
3. add caption
4. highlight neighbors on hover


Ostend
Bruxelles
Antwerp
North Sea
Europe
Germany (Zollverein)
Belgian Colonies
Belgian Africa
Prussia
Belgium
Netherlands
France
Cuba & Puerto Rico
United Kingdom
World Federico Tena
Russia (USSR)
Hanse Towns
Northern America
United States of America
How to read the graph
Network of trading partners and geopolitical relationships around Belgium between 1833 and 1850
Nodes
Entity
Continent
Edges
exports
is in
is equivalent to
is child of
is colonial part of
is part of


American Asia
American Polynesia
American West Indies
American Colonies
Baltimore
Boston
American Central America
American Oceania
New York
Chicago
American China
Rhode Is.
United States of America
New Orleans
American America
New Bedford
America
Northern Ame
San Francisco
United States of America (Atlantic Co
United States of Ameri
United States of America (Foreign produce)
Gulf of Mexico
Philadelphia
Tarboro
United States of America (other)
United States of America (Pacific Coast)
How to read the graph
Network of geopolitical relationships around United States of America between 1833 and 1938
Nodes
Entity
Continent
Edges
is in
is equivalent to
is child of
is colonial part of
is part of

2. how to see **indirect trades**

Cypher query

For two entities **e1** and **e2**

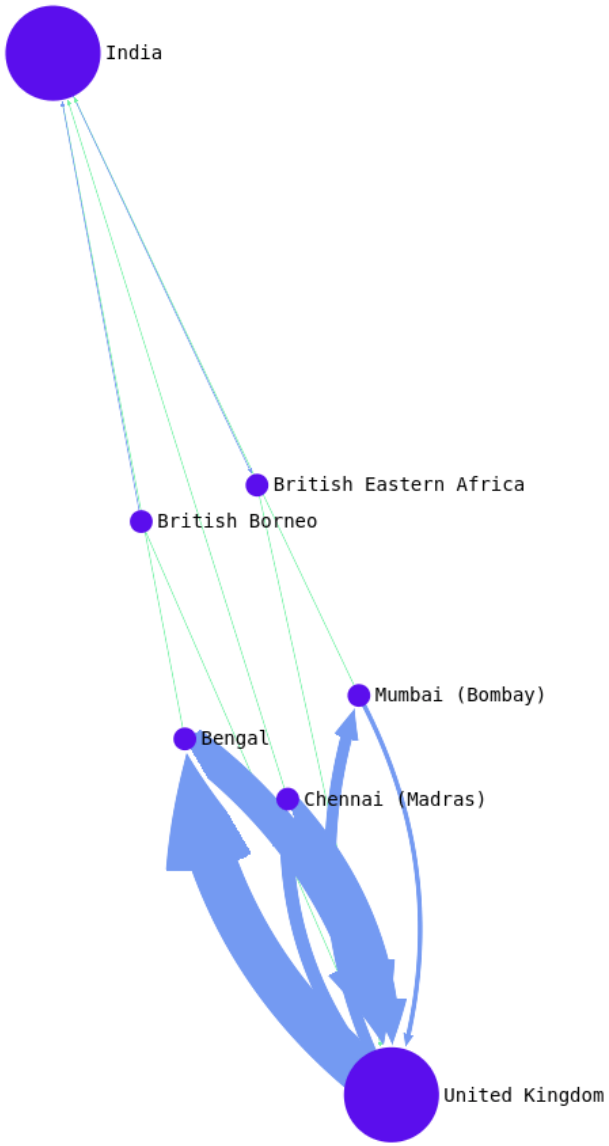
1. Get all paths with depth 2

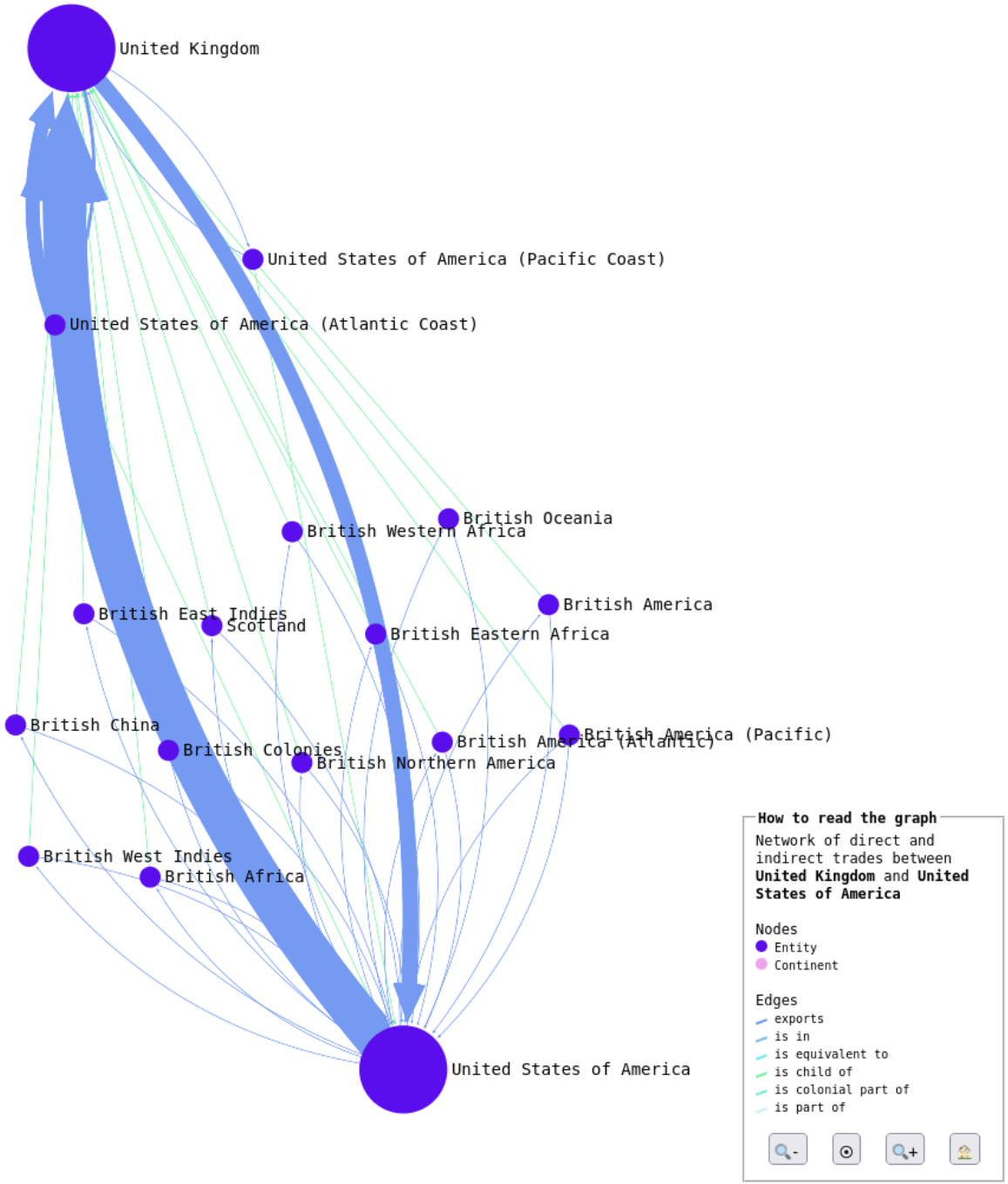
(e1)-[**r1**]-(**entA**)-[**r2:TRADES**]-(e2)

2. Get all paths with depth 3

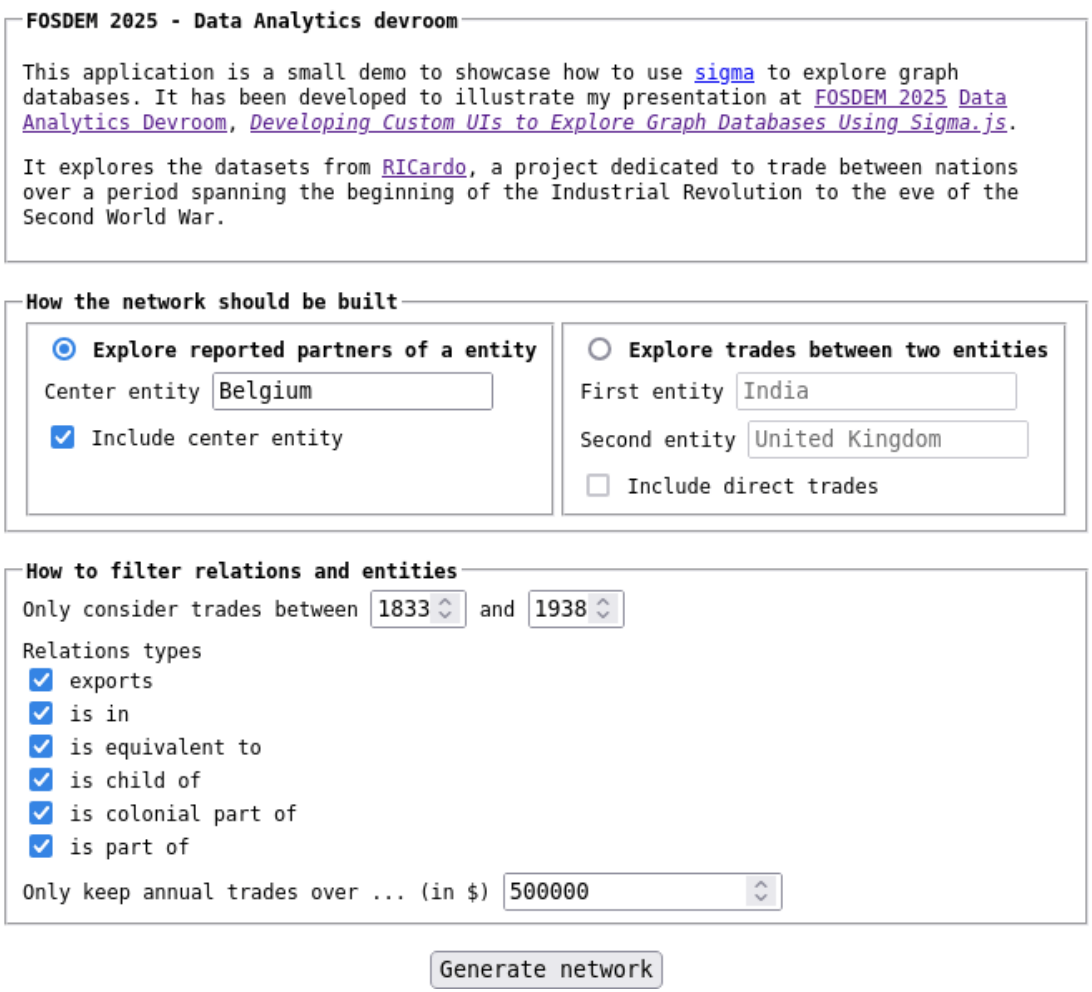
(e1)-[**r1**]-(**entA**)-[**r2:TRADES**]-(**entB**)-[r3]-(e2)

same
graphology and
sigma scripting


India
British Eastern Africa
British Borneo
Mumbai (Bombay)
Bengal
Chennai (Madras)
United Kingdom
How to read the graph
Network of indirect trades between India and United Kingdom between 1833 and 1938
Nodes
Entity
Continent
Edges
exports
is in
is equivalent to
is child of
is colonial part of
is part of


United Kingdom
United States of America (Pacific Coast)
United States of America (Atlantic Coast)
British Oceania
British Western Africa
British America
British East Indies
Scotland
British Eastern Africa
British China
British America (Pacific)
British America (Atlantic)
British Colonies
British Northern America
British West Indies
British Africa
United States of America
How to read the graph
Network of direct and indirect trades between United Kingdom and United States of America
Nodes
Entity
Continent
Edges
exports
is in
is equivalent to
is child of
is colonial part of
is part of

demo time \o/


FOSDEM 2025 - Data Analytics devroom
This application is a small demo to showcase how to use sigma to explore graph databases. It has been developed to illustrate my presentation at FOSDEM 2025 Data Analytics Devroom, Developing Custom UIs to Explore Graph Databases Using Sigma.js.
It explores the datasets from RICardo, a project dedicated to trade between nations over a period spanning the beginning of the Industrial Revolution to the eve of the Second World War.
How the network should be built
Explore reported partners of a entity
Center entity Belgium
Include center entity
Explore trades between two entities
First entity India
Second entity United Kingdom
Include direct trades
How to filter relations and entities
Only consider trades between 1833 and 1938
Relations types
exports
is in
is equivalent to
is child of
is colonial part of
is part of
Only keep annual trades over ... (in $) 500000
Generate network

some
insights

the **rendered network** does not need to be the **exact query result**

scripting
graphology is really
easy and comfortable

the separation between **graphology** and **sigma** makes the code stay quite simple

I couldn't find the pattern with depth 3

(e1)-[**r1**]-(**entA**)-[**r2:TRADES**]-(**entB**)-[r3]-(e2)

and it makes sense, since **reports** mostly come from **sovereign entities**

I wrote that query for nothing :'(

thanks
:)