

SOCIAL AND ECONOMIC NETWORK ANALYSIS

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Problem Statement:

In modern society, Goods can be traded from one country to another through transportation. A country's economy depends highly on trade. So the analysis of the data on trade plays a crucial role to understand world trade. It also provides insight into the country's production performance and its significance in the world.

This project aims to visualize and analyze the international imports and exports between the years 2013 to 2019. It also ranks countries based on the import and export of various products.

Visualizing the connectedness of the countries through import and exports as graphs provides a better vision on understanding world trade.

Dataset Description:

The dataset for this project is obtained from the world trade organization ^[1] in CSV format 29131 rows and 8 columns. It contains information about countries involved in the import and export of various products along with the products that they import or export. This data is noted for the year between 2013 - 2019. The data contains the transactions (in US\$) through the exports and imports of products for each year between 2013-2019.

	B	C	D	E	F	G	H	I	J
1	Bilateral imports by MTN product category (US\$)								
2									
3	Product/Sector	Partner Economy	2013	2014	2015	2016	2017	2018	2019
4	MT2 - 01 - Animal products	World	100280097	104134431	94582547	75255359	92433609	94651457	
5	MT2 - 01 - Animal products	Argentina	120837	118526	11079	35517	3929		
6	MT2 - 01 - Animal products	Australia				46046	103453		
7	MT2 - 01 - Animal products	Austria	518221	688198	612356	695913	851641		
8	MT2 - 01 - Animal products	Azerbaijan					52757		
9	MT2 - 01 - Animal products	Belgium	406277	595100	911049	1122955	1058501		
10	MT2 - 01 - Animal products	Bosnia and Herzegovina	1010404	590361	285764	469466	351120		
11	MT2 - 01 - Animal products	Brazil	11051411	20407222	13579418	16340540	16700624		
12	MT2 - 01 - Animal products	Bulgaria	7424603	2861021	9761	1209789	3507091		
13	MT2 - 01 - Animal products	Canada	5263626	816826	4420639	998629	3513513		
14	MT2 - 01 - Animal products	Chile	54345						
15	MT2 - 01 - Animal products	China		126727		45			
16	MT2 - 01 - Animal products	Comoros			1250				
17	MT2 - 01 - Animal products	Côte d'Ivoire			254				
18	MT2 - 01 - Animal products	Croatia	381452	347641	450702	202683	95593		
19	MT2 - 01 - Animal products	Cyprus		43317	81255	15668	61510		
20	MT2 - 01 - Animal products	Czech Republic		85039		7851	5725		
21	MT2 - 01 - Animal products	Denmark	35691	109910	32335	18553	2766313		
22	MT2 - 01 - Animal products	Ecuador	309821	396471	230276	62066	221621		

Tools Used:

The tools used for visualization and analysis of data are:

- **Pandas** ^[5] - for pre-processing of data from CSV file.

Pandas is a fast, powerful, flexible and easy to use open-source data analysis and manipulation tool, built on top of the Python programming language.

- **Pyvis** ^[2] - for construction and visualization of the graph.

The pyvis library is meant for the quick generation of visual network graphs with minimal python code. It is designed as a wrapper around the popular Javascript visJS library.

- **NetworkX** ^[3] - formed a graph for triadic closure.

NetworkX is a Python package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks.

Challenges Faced:

1. Since the number of nodes (countries) in the dataset is large, the graph looks congested so nodes need to be scaled.
2. Since there is no inbuilt function in pyvis to traverse the graph, the user-defined function needs to be explicitly for traversing.
3. Since the dataset is huge, the CPU required more time for the processing which delayed the progress.
4. Limited documentation is available for the pyvis library.

Contribution of Team Members:

Name	Contribution
Narmatha R (18z233)	Dataset selection and Analysis of Product Distribution of imports and Exports.
Sharadha K (18z247)	Worked on Visualization of Graph
Sri Nagul G (18z256)	Analysis of Maximum, Minimum exports, Best relationship between the countries
Thamil Vani S (18z259)	Pyvis visualization and Analysis of Triadic Closure
Tharani Ganesh M (18z260)	Defining the traversal function for the pyvis graph, Analysis of Maximum Minimum exports.

* All of us joined in a virtual G-meet and worked together most of the time so that we could achieve the target quicker and easier

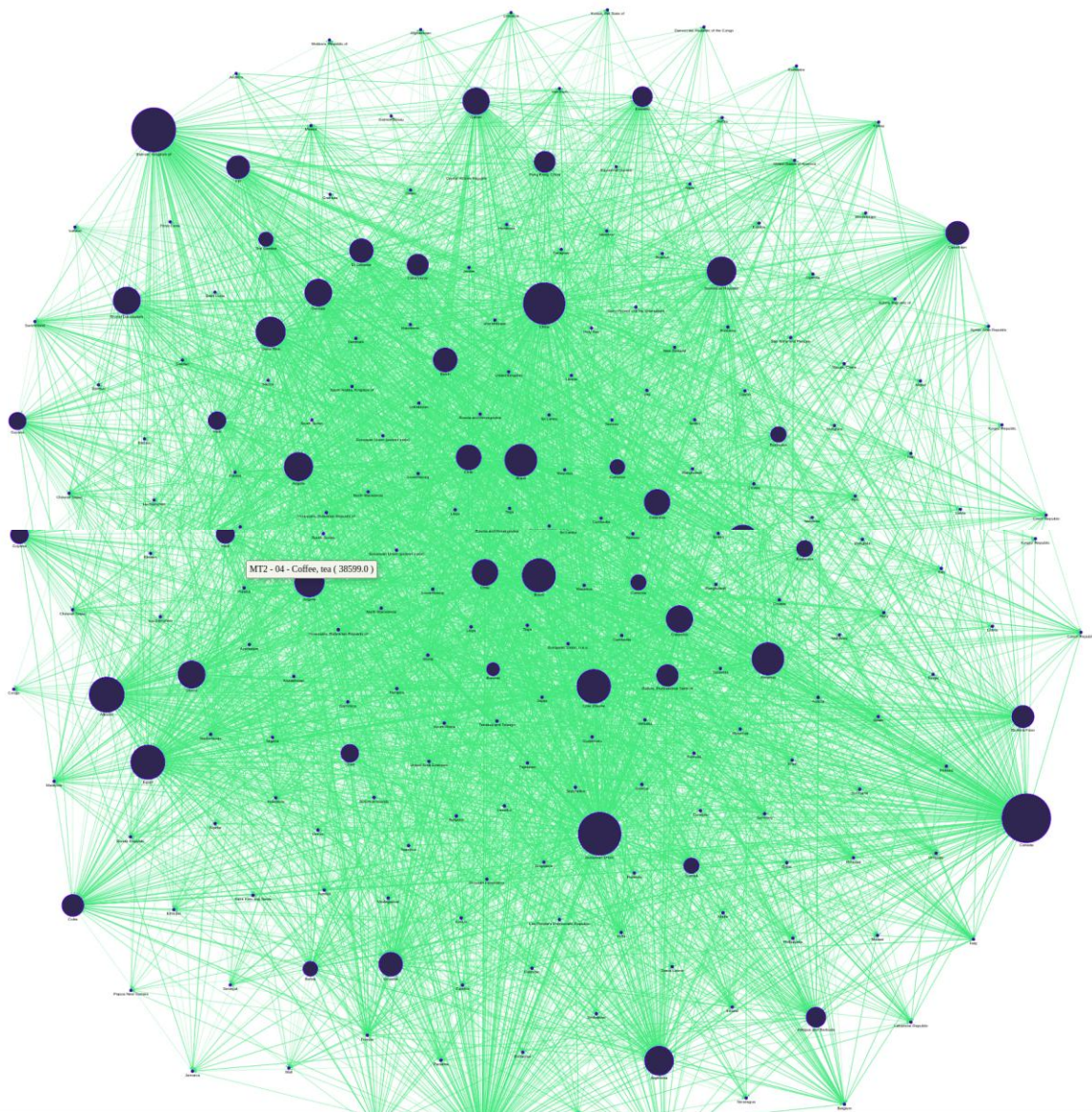
Annexure-I:

CODE:

https://github.com/TharaniGanesh431/Trade_Analysis_SENA

Annexure-II:

OUTPUT^[8] :



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Maximum Export:
Canada - 183

Minimum Export:
Central African Republic - 1

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Maximum Import:
India - 41

Minimum Import:
European Union (partner code) , South Sudan - 1

*****

Best Product Exporters:

MT2 - 01 - Animal products : China - 104883195695.0
MT2 - 02 - Dairy products : China - 56530805801.0
MT2 - 03 - Fruits, vegetables, plants : European Union - 413044064964.0
MT2 - 04 - Coffee, tea : European Union - 219068832664.0

*****

Best relationship with other countries:
European Union to World - 359508305312.0

Best bond between two countries:
Canada to United States of America - 56963112216.0

*****

Countries which imports certain product from large number of distributors

MT2 - 01 - Animal products : United States of America
MT2 - 02 - Dairy products : France
MT2 - 03 - Fruits, vegetables, plants : India
MT2 - 04 - Coffee, tea : United States of America

*****

Largest Distributor of the products to other countries

MT2 - 01 - Animal products : European Union
MT2 - 02 - Dairy products : European Union
MT2 - 03 - Fruits, vegetables, plants : Canada
MT2 - 04 - Coffee, tea : Canada

*****

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The possible new edges according to Triadic closure are:

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--> European Union,World,Timor-Leste
--> European Union,Afghanistan,Timor-Leste
--> European Union,Albania,Timor-Leste
--> European Union,Algeria,Timor-Leste
--> European Union,Andorra,Timor-Leste
--> European Union,Angola,Timor-Leste
--> European Union,Antigua and Barbuda,Timor-Leste
--> European Union,Argentina,Timor-Leste
--> European Union,Armenia,Timor-Leste
--> European Union,Azerbaijan,Timor-Leste
--> European Union,Bahamas,Timor-Leste
--> European Union,Bahrain, Kingdom of,Timor-Leste
--> European Union,Bangladesh,Timor-Leste
--> European Union,Barbados,Timor-Leste
--> European Union,Belarus,Timor-Leste
--> European Union,Belize,Timor-Leste
--> European Union,Benin,Timor-Leste
--> European Union,Bolivia, Plurinational State of,Timor-Leste
--> European Union,Bosnia and Herzegovina,Timor-Leste
--> European Union,Botswana,Timor-Leste
--> European Union,Brazil,Timor-Leste
--> European Union,Brunei Darussalam,Timor-Leste
--> European Union,Cambodia,Timor-Leste
--> European Union,Cameroon,Timor-Leste
--> European Union,Central African Republic,Timor-Leste
--> European Union,Chile,Timor-Leste

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References :

- [1] World Trade (dataset) - <https://data.wto.org/>
- [2] Pyvis - <https://pyvis.readthedocs.io/en/latest/documentation.html>
- [3] Networkx - <https://networkx.org/> <https://networkx.org/documentation/stable/tutorial.html>
- [4] Link Prediction - <https://www.analyticsvidhya.com/blog/2020/01/link-prediction-how-to-predict-your-future-connections-on-facebook/>
- [5] Pandas - https://pandas.pydata.org/pandas-docs/stable/user_guide/index.html
- [6] Pyvis - <https://medium.com/analytics-vidhya/interactive-visualisation-of-bitcoin-transactions-made-easy-with-python-and-pyvis-109dea06b86e>
- [7] Network Visualization With Pyvis And VisJS - <https://arxiv.org/pdf/2006.04951.pdf>
- [8] Visualizing Networks in Python - <https://towardsdatascience.com/visualizing-networks-in-python-d70f4cbeb259>