

Building Web Applications FOR RESEARCHERS AND RESEARCH SOFTWARE ENGINEERS USING jupyter notebooks

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Scientific Web Application

Researchers are increasingly **using web applications** to promote their work in an accessible and engaging format within the scientific community via **interactive visualizations** and intuitive interfaces. RSEs may be interested in working with researchers to build web applications that have the potential **to improve code and data reuse**. Despite the value of these communication tools, **maintaining them eventually falls to the researchers** who are not incentivized to learn new tools and technologies.

Our Use Case

Dataset:

- 7000 handpicked articles showcasing the versatility and impact of agent-based modeling
- Spans diverse domains such as historical, economics, agriculture, etc.

We need a method in which we are able to **explore and analyze code sharing and model documentation practices** via visualization and properties of the dataset.

Why Jupyter Notebooks?

- We present a network analysis visualization tool we built which is able to **stay within the existing research workflow** and **achieve insightful information about the dataset in a dynamic manner**.
- This tool allows users to explore the properties of and **relationships among the dataset, in multiple views**.

Network Analysis Visualization Tool

BEFORE:

```
# Create Export tab content
export_tab_content = widgets.VBox([
    widgets.Dropdown(options=['.zip', 'Excel (XLSX)', 'CSV'], value=''),
    widgets.Button(description='Download', layout=widgets.Layout(width='100px'))
])
# Add the Export tab to the Tabs widget
tabs.children = [list(tabs.children) + [export_tab]]
tabs.set_title(2, 'Export') # Set the title of the new tab
```

AFTER:

VOILA

JUPYTER WIDGETS (IPYWIDGETS)

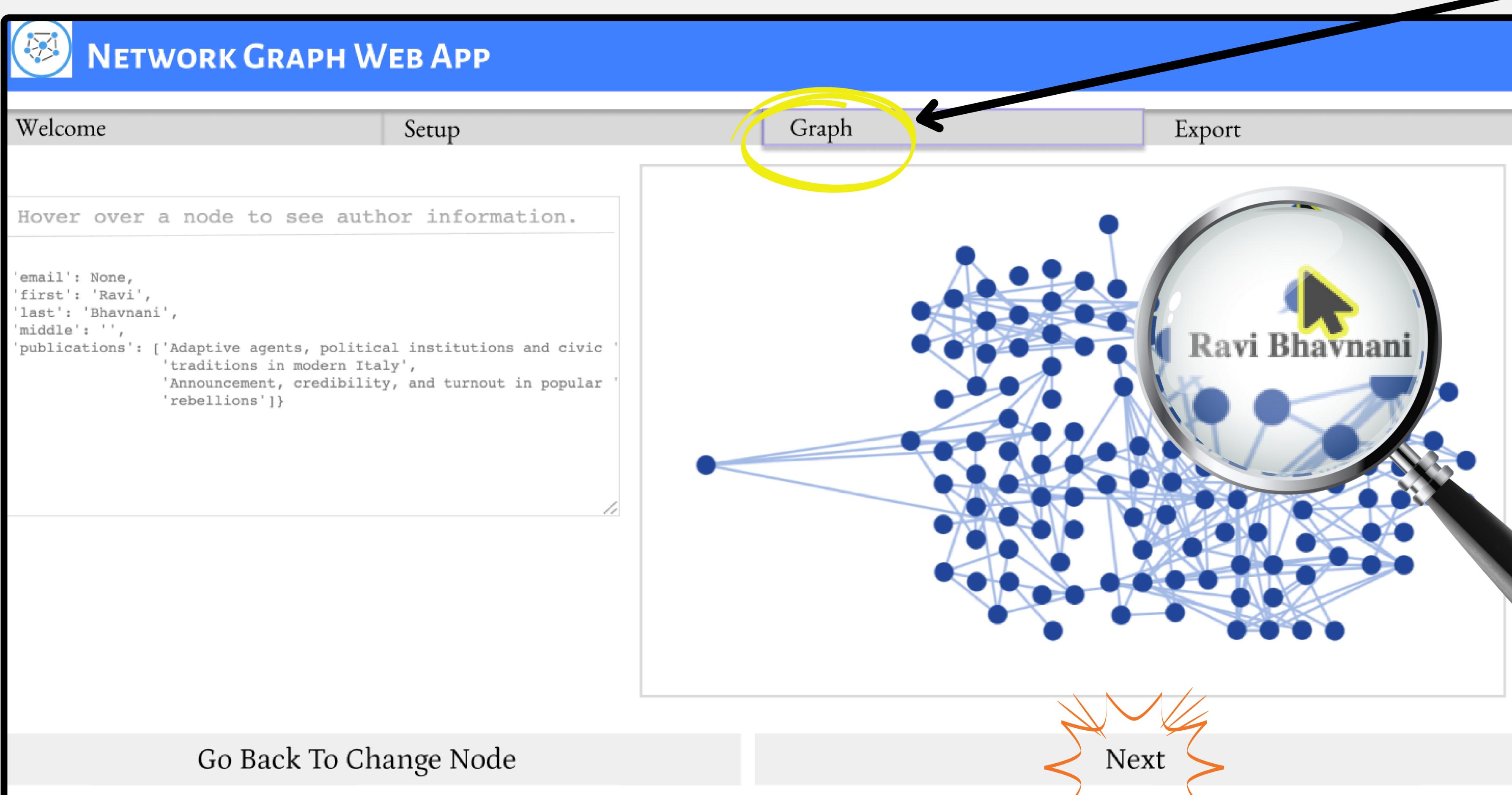
- Sliders
- Dropdown menus
- Dataframe table visualization
- A network visualization widget (**ipycytoscape**) to visually explore and analyze a large citation network.

NETWORK GRAPH WEB APP

key	first	middle	last	publications
0	W	A	Abdullah	Emergence of heterogeneity in an agent-based model
1	G		Abrami	Agent-based facilitation of water allocation: Case study in the Drome River Valley
2	Iqbal		Adjali	Agent-based modelling - intelligent customer relationship management
3	Michael		Agar	Agents in living color: Towards emic agent-based models
4	Caroline		Ahillen	Agent-based modeling of the spread of the 1918-1919 Spanish flu in three Canadian f...
5	Li		An	Impacts of demographic and socioeconomic factors on spatio-temporal dynamics of p...
6	J	V	Ander...	Modelling financial markets with agents competing on different time scales and with dif...
7	Peter		Andras	Uncertainty and Cooperation: Analytical Results and a Simulated Agent Society
8	Takaya		Arita	Evolution of linguistic diversity in a simple communication system

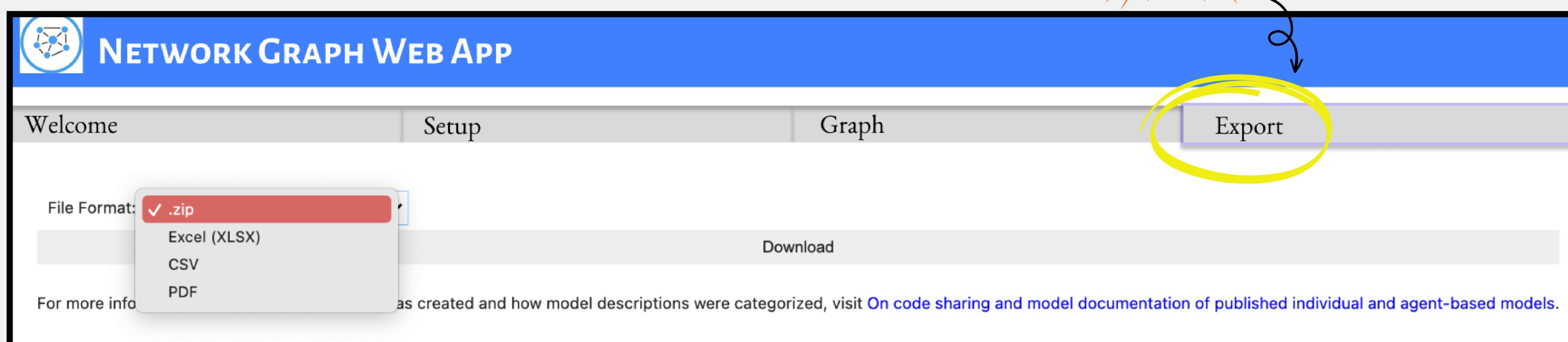


Voila strips away code cells, leaving behind only interactive browser components, resulting in a fully-fledged user interface.



Conclusion

- Based on our experience, we recommend the **adoption of Jupyter Notebook and Jupyter widgets** to transform existing workflows into intuitive, interactive, and aesthetic web applications that can effectively communicate their research findings
- JupyterLab offers many such widgets and extensions that **allow you to adapt your workflow**, just as we did.
- By adapting existing workflows, researchers working with RSEs can benefit from the **familiarity of the codebase and the development environment**. This helps them **maintain** the application **beyond the period of collaboration**.



EXPORT

The **export** feature promotes code and data usage and reuse amongst researchers.

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better scientific software