Impactful Scholar Map Based on Citation Network and Influence Numbers

Chen Lin, Cheng Zhang, Haoting Chen, Haojun Song, Zhaoyu Sun

MOTIVATION

The purpose of having a impactful scholar map is to provide insight for scholars into the educational potential of a university. It is a well-established fact that students tend to look for highly cited globally recognized researchers in their field. Therefore an novel author citation based visualization map is needed urgently for them.

APPROACH

MATHEMATICAL MODEL & ALGORITHM

Citation network - author influence index equation

$$I = \sum \left(\frac{D_{c_i}}{D_{max}} \sum \lambda_i \right)$$

I: the new influence number for the author
D_{c_i}: the max path between the author's node and a node in references
D_{max}: the max path of one node to another node
λ_i: 0.5 if there exits self-citation in the references for the ith article, 1 if otherwise

Analytical hierarchy process (AHP) - journal influence number

$$W_i = \alpha_0 X_i + \alpha_1 Y_i + \alpha_2 Z_i + S_i$$

W_i: the new influence number of a journal i
X_i: the initial value number of the journal
S_i: the sum of SNIP and SJR scores
Y_i: the score if the journal is cited by journal from higher group
Z_i: the score if the journal is cited by journal from lower group
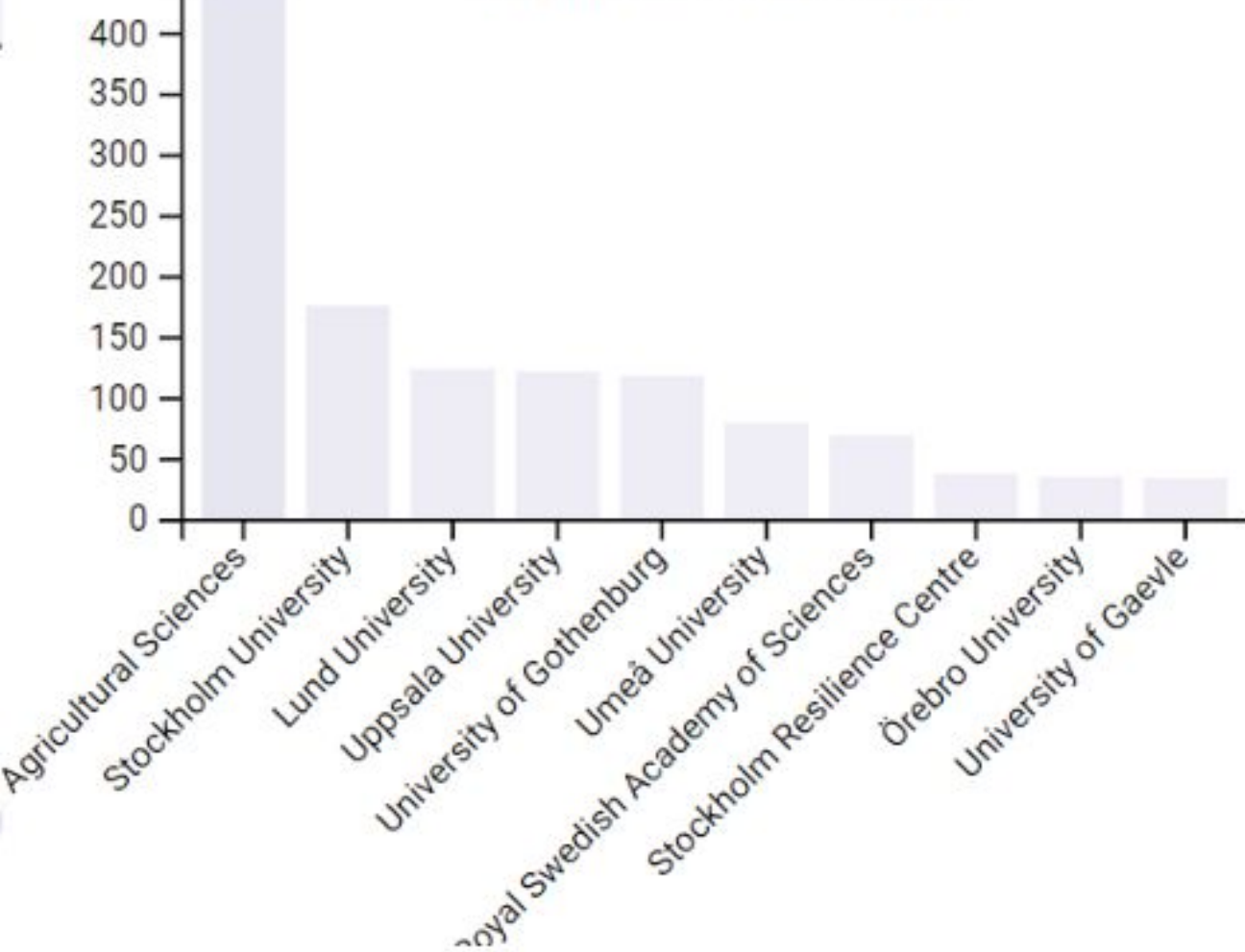
Interactive Visualization

A dropdown list of academic subfield is provided for users to explore and provided the carefully calculated country scores and visually encoded by the scale of the scores, darker color indicates a higher score, and users are able to view the top institution info in a bar chart ranked by the institution score when they click the country. To reveal more detailed info in the institution, the users can access to top 100 scholars in the institution by clicking the bar in the bar chart.

Academic Field: Ecology

World Map with citation impact

Sweden: 1277.28125

0.0
2500.0
5000.0
7500.0
10000.0
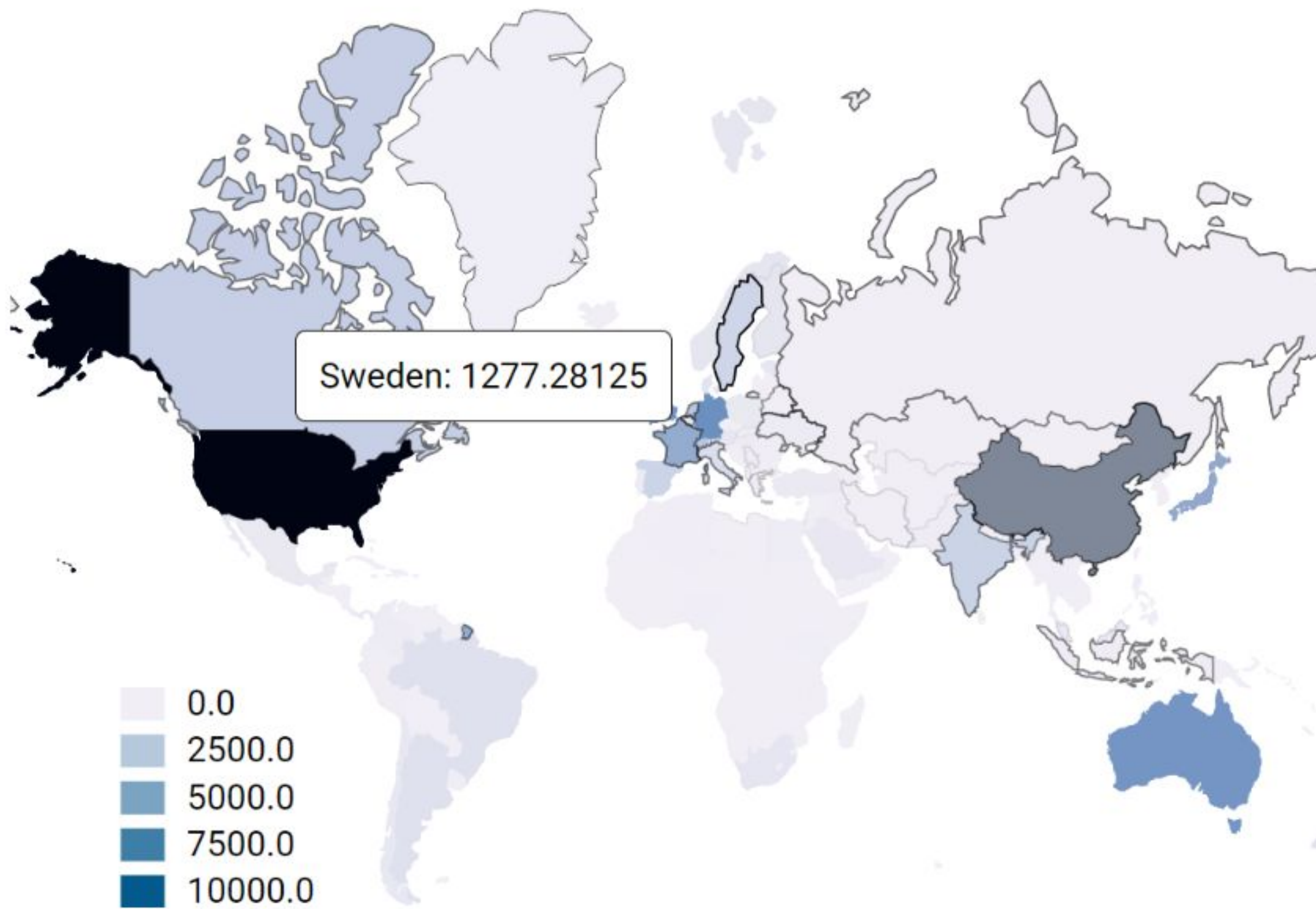
Top Institution in Sweden

Top 100 scholars in the Field of Ecology in Your Query Institute(id=grid.10548.38).

DATA

Springer and Semantics Scholar Academic Graph datasets are open-source database including information of journal, people, institution, citation etc. We downloaded full datasets from the database.
Characteristics
> 200 GB datasets 157 subfields > 2840 journals over 1960 years
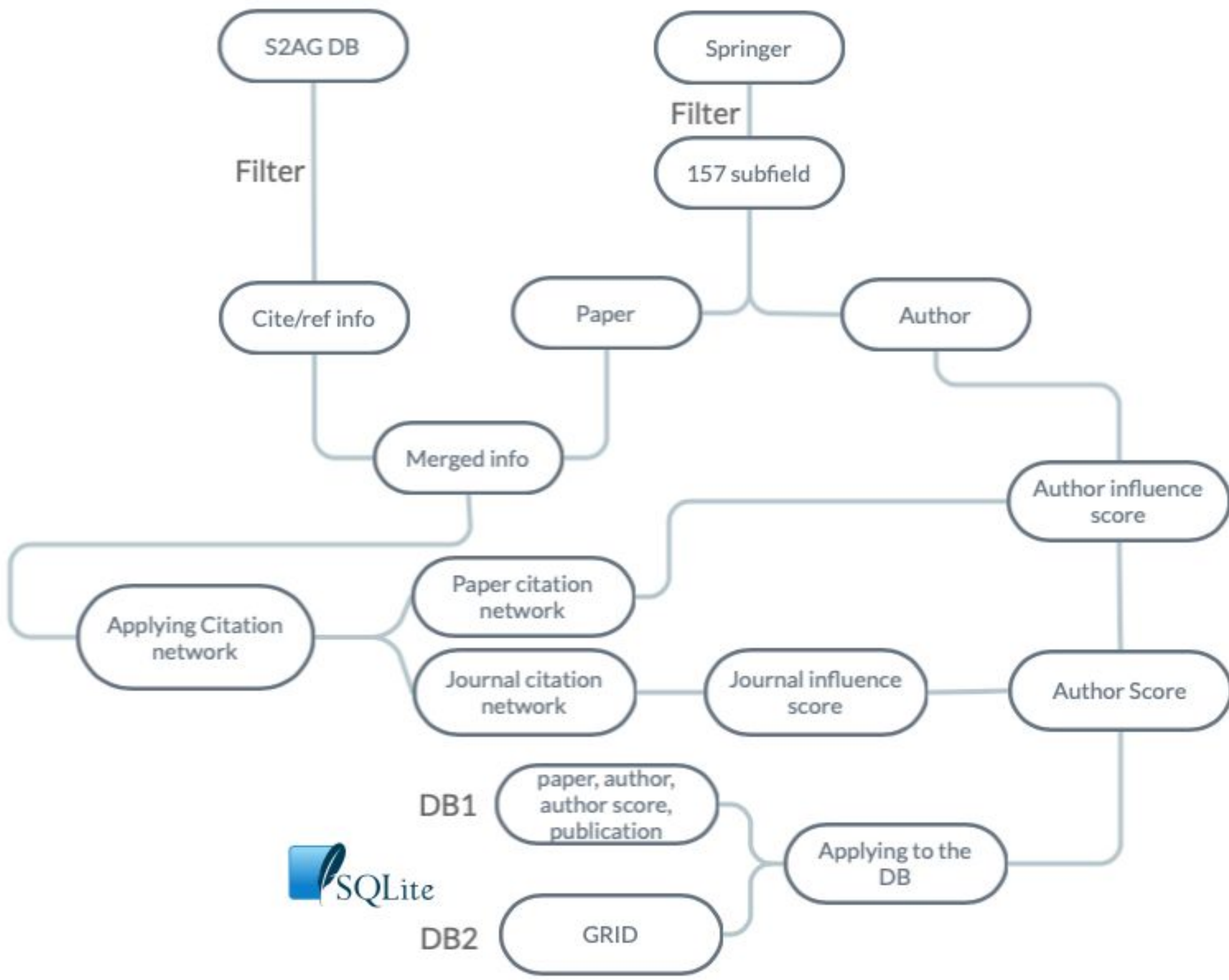
EXPERIMENTS AND RESULTS

Model Evaluation

We took top 8 authors from *Pure Mathematics* (from Mathematical Physics) as a example. Calculate the author's influence score(AIS) and journal influence score(JIS) compare with the citation numbers from the Semantics Scholar(CN-SS) and Google Scholar(CN-GS).
The result showing that our author's influence score take account not only the citation number, such as the author's influence across collaborators, research field and new ranking of the journals, etc.

Authors Ranked by Our Models

	AIS	JIS	CN-SS	CN-GS
N.Seiberg	395.47	614.09	49,209	71,970
E.Witten	259.12	444.88	143,905	230,548
A.Sen	167.34	302.21	24,156	35,457
M.R.Douglas	144.51	245.26	21,194	29,695
A.Connes	122.62	232.47	25,631	45,479
A.Strominger	117.37	222.43	37,099	58,380
S.Minwalla	122.07	209.13	10,792	
J.M.Maldacena	119.17	199.46	68,390	85,885

User test

To evaluate our UI design and feature, we employed our survey to our participants. Our study had a total of 11 participants and evaluated on UI design, usage and functions. Below is a survey in a rank of 10 in UI interface,

User Survey by 11 Users