Interactive, web-based visualization of scientific collaboration networks

Ben Leone, Ryuichi Ohhata, Lukas Rosario
Jinyu Tian, Angela Vellante

Mentors:

- Eric Kolaczyk (Hariri Institute, Director)
- Arezoo Sadeghi (SAIL)
- Margot Menestrot from Red Hat UX team
- Joe Farmer (BU Office of Research, Program Manager & Data Analyst)
- Jonathan Chamberlin (Teaching Fellow)

BOSTON UNIVERSITY

Hariri Institute for Computing and Computational Science and Engineering

→ Initiates, catalyzes, propels collaborative research and training initiatives

HARIRI FACULTY AFFILIATE PROGRAM

The Hariri Institute for Computing community consists of 257 Faculty Affiliates from 59 units, across 17 Boston University Schools and Colleges including departments in the College of Arts & Sciences, College of Engineering, Questrom School of Business, College of Communication, College of General Studies, Metropolitan College, School of Medicine, School of Public Health, School of Dental Medicine, School of Social Work, and Sargent College.

The Faculty Affiliate Program is open to all BU faculty members pursuing research projects, or leading teaching or training initiatives in computing or computational sciences. Faculty Affiliates are eligible to tap into Institute resources. To help promote highly-collaborative interdisciplinary research culture, our Faculty Affiliates are connected and interact through more focused activities and programs that are managed through Institute centers and initiatives, each reflecting a distinct intellectual research scope and culture, shared by faculty and students spanning multiple computing disciplines.

In addition to participation in the intellectual endeavors of the Institute, Faculty Affiliates enjoy many tangible benefits, including:

- Eligibility for research incubation awards
- Access to Institute facilities, including event and meeting spaces
- Support for event planning and organization
- Pre/post-award grant administration for Institute-based projects
- Inclusion in Institute directory of faculty profiles and interests
- Dissemination of noteworthy achievements through Institute portals and social media
- Serendipitous networking with BU colleagues, fueled by endless, free espresso at the Institute

Faculty Affiliate Application

Directory of Affiliated Faculty

Search in the bar below to filter affiliates by common interests, department, or name.

Search table...

Full Name	Department	College	BU Email	Interests	Domains
Bin Gu	Information Systems	Questrom School of Business	bgu@bu.edu	Distributed Systems, and Cloud Computing; Big Data Knowledge	Digital Arts and Humanities Digital Health and Rehabilitation

Problem

- https://www.bu.edu/hic/people-2/faculty-affiliates/
- 250 faculty affiliates
- Represented in **table** format with limited search capabilities
- Difficult to see everyone involved and the collaborations between them

Solution

- Interactive visualization of a network collaboration

BOSTON UNIVERSITY

Project Goals

1. Create a cleaner view of the affiliates than the current spreadsheet design which uses only raw HTML code

2. Provide an intuitive user experience that allows for easier navigation of the connections between collaborators using a network visualization

3. Provide researchers with tools to find similar collaborators based on fields of interest, past work and articles, etc.

4. May serve as a base prototype for other departments to implement a visualization of academic collaboration

BOSTON UNIVERSITY

Users

- Faculty affiliates of the Hariri Institute for Computing
- Potential collaborators and researchers looking for assistance in their work
- BU faculty members and non-members who are conducting teaching/training initiatives in computing or computational science
- Anyone interested in how the BU departments and colleges work together and what work is done in the fields of computing and computational science

BOSTON UNIVERSITY

MVP

- A clean and intuitive visualization of the collaboration network between affiliates within the Hariri Institute
  - Nodes in the visualization are the affiliates
  - Edges that connect the nodes are primarily the number of collaborations
  - A search/filter function to allow more granularity
  - The network visualization will be dynamic (i.e. clicking on a node displays its connections clearly to the user)
  - Links to academic works will be included, when possible
- The size of the network will be ~250 affiliates
  - Not all affiliates will be presented at the initial landing on the visualization
  - Possible breakdown by department to then show affiliates within selected department

BOSTON UNIVERSITY

Database

- PostgreSQL
- Python scripts that scrape Affiliate list and SciVal papers and upload to Database
- Name matching algorithm
- Easy to maintain and change

BOSTON UNIVERSITY

Database

Three tables:

- affiliate_info – each Hariri affiliate's information
- affiliate – papers the affiliates published
- relation – how many papers an affiliate collaborated with other affiliates

BOSTON UNIVERSITY

Database

Query Editor | Query History

```
SELECT * FROM public.affiliate_info
ORDER BY id ASC
```

Data Output | Explain | Messages | Notifications

	id [PK] integer	name character varying (50)	department character varying (100)	college character varying (50)	email character varying (50)	interests character varying (1000)	domains character varying (1000)
1	1	Rudolph, Abby	Epidemiology	School of Public Health	arudolph@bu.edu	NaN	NaN
2	2	Matta, Abraham	Computer Science	College of Arts and Sciences	matta@bu.edu	Computational Optimization, D...	Computational Geo/Environme...
3	3	Guren, Adam	Economics	College of Arts and Sciences	guren@bu.edu	High-Performance Scientific Co...	Computational Social and Politi...
4	4	Smith, Adam	Computer Science	College of Arts and Sciences	ads22@bu.edu	Computability and Computatio...	Computational Social and Politi...
5	5	Joshi, Ajay	Electrical and Computer Engin...	College of Engineering	joshi@bu.edu	Computer Architectures, Langu...	Computational Neuro, Brain, an...
6	6	Marscher, Alan	Astronomy	College of Arts and Sciences	marscher@bu.edu	Big Data Knowledge Discovery, ...	Computational Physics, Chemis...
7	7	Becker, Alexander	Administrative Sciences	Metropolitan College	apbecker@bu.edu	Computational Logic and Form...	Computational Finance and Ec...
8	8	Cronin-Golomb, Alice	Psychological and Brain Scien...	College of Arts and Sciences	alicecg@bu.edu	Machine Learning and Artificial ...	Digital Health and Rehabilitatio...
9	9	Ene, Alina	Computer Science	College of Arts and Sciences	aene@bu.edu	Theoretic and Algorithmic Foun...	Computational Finance and Ec...
10	10	Stoughton, Alley	Computer Science	College of Arts and Sciences	stough@bu.edu	Computational Logic and Form...	Cyber Society, Ethics, and Law
11	11	Sgro, Allyson	Biomedical Engineering	College of Engineering	asgro@bu.edu	Computational Optimization, D...	Computational Physics, Chemis...
12	12	Polkovnikov, Anatoli	Physics	College of Arts and Sciences	asp@bu.edu	Computational Optimization, D...	Computational Physics, Chemis...
13	13	Temkin, Anatoly	Computer Science	Metropolitan College	temkin@bu.edu	Big Data Knowledge Discovery, ...	Computational Neuro, Brain, an...
14	14	Emili, Andrew	Biochemistry (BUSM) and Biol...	School of Medicine	aemili@bu.edu	Big Data Knowledge Discovery, ...	Computational Medicine, Bioinf...
15	15	Fitzpatrick, Andrew	Physics	College of Arts and Sciences	fitzpatr@bu.edu	Machine Learning and Artificial ...	Computational Physics, Chemis...
16	16	Lyasoff, Andrew	Finance	School of Management	alyasoff@bu.edu	Theoretic and Algorithmic Foun...	Computational Finance and Ec...
17	17	Sellars, Andrew	Technology Law Clinic	School of Law	sellars@bu.edu	Big Data Knowledge Discovery, ...	Digital Arts and Humanities
18	18	Fradkin, Andrey	Marketing	Questrom School of Business	fradkin@bu.edu	Theoretic and Algorithmic Foun...	Computational Finance and Ec...
19	19	Destefano, Anita	Biostatistics	School of Public Health	adestef@bu.edu	NaN	NaN
20	20	Tucker, Anita	Operations & Technology Man...	Questrom School of Business	altucker@bu.edu	Big Data Knowledge Discovery, ...	Digital Health and Rehabilitatio...
21	21	Hohler, Anna	Neurology	School of Medicine	hohlera@bu.edu	NaN	NaN
22	22	Rosellini, Anthony	Psychological and Brain Scien...	College of Arts and Sciences	ajrosell@bu.edu	Theoretic and Algorithmic Foun...	Digital Health and Rehabilitatio...
23	23	Rosellini, Anthony	Psychological and Brain Scien...	College of Arts and Sciences	ajrosell@bu.edu	Big Data Knowledge Discovery, ...	Digital Health and Rehabilitatio...
24	24	Trachtenberg, Ari	Electrical and Computer Engin...	College of Engineering	trachten@bu.edu	Theoretic and Algorithmic Foun...	Robotics and Autonomous Syst...
25	25	Coskun, Ayse	Electrical and Computer Engin...	College of Engineering	acoskun@bu.edu	High-Performance Scientific Co...	Robotics and Autonomous Syst...

BOSTON UNIVERSITY

API

- Python Flask, Blueprint, and RESTful to construct API
- Applies credentials to DB and retrieves data

Three endpoints:

- /api/v1/info – information about each affiliates
- /api/v1/members – affiliates' published papers
- /api/v1/relations – Lists affiliates under "nodes" and their co-authorships under "links"

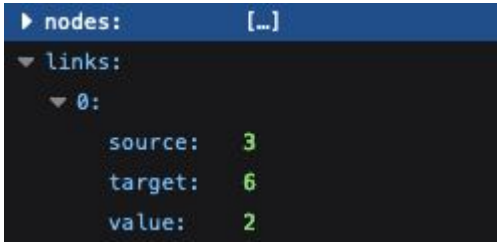
BOSTON UNIVERSITY

API

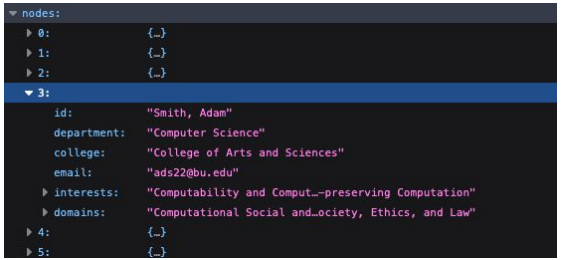
- Dockerfile to containerize the API application
- Hosted on OpenShift
- http://api-flask-ece-528-interactive-web-visualization.k-apps.osh.massopen.cloud/api/v1/relations

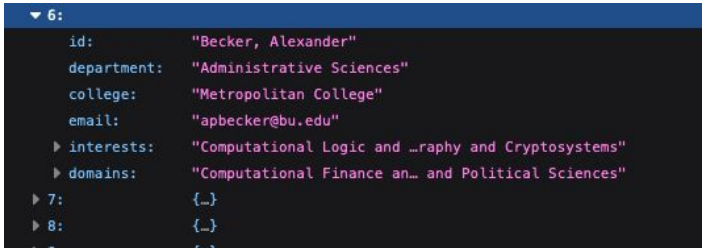
BOSTON UNIVERSITY

API

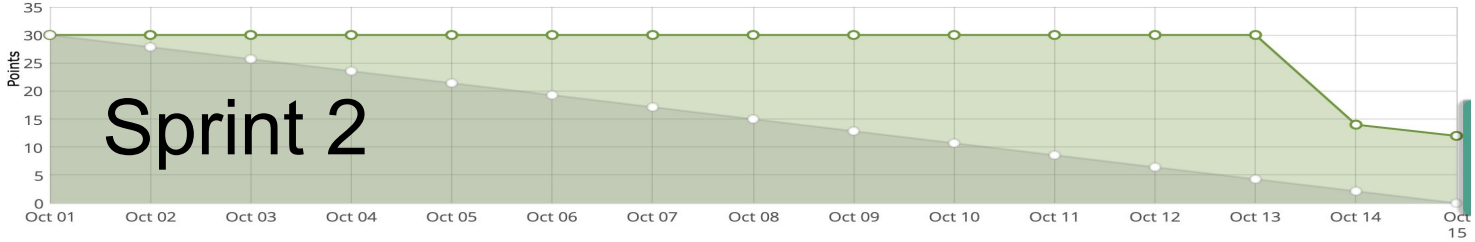


Source: Affiliate 1
Target: Affiliate 2
Value: How many collaborated papers

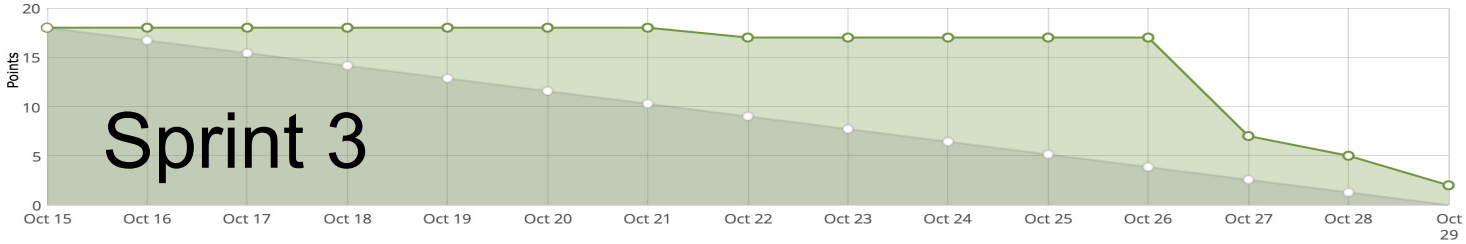




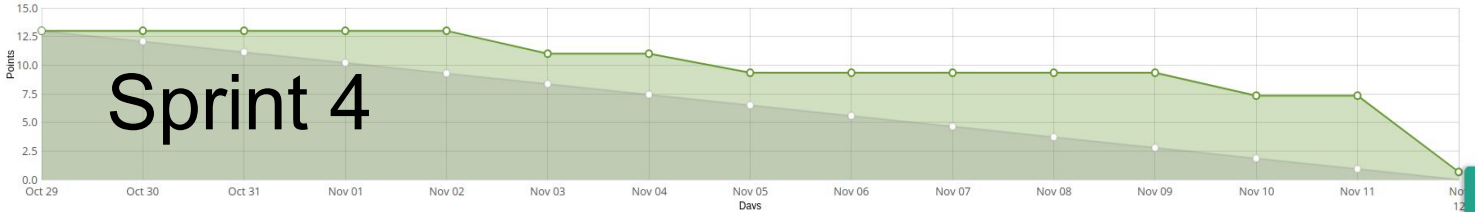
BOSTON UNIVERSITY



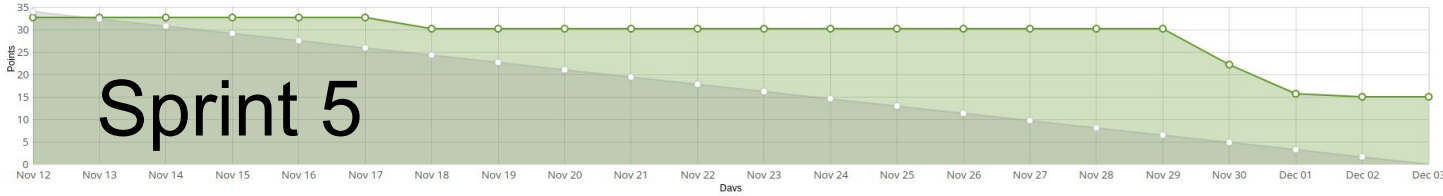
Sprint 2



Sprint 3



Sprint 4



Sprint 5

Lessons Learned

- WordPress is an unfriendly environment to do web development outside of basic features
- OpenShift databases only directly communicate with other resources inside the same container
- Working in an agile way with Taiga was difficult at first, but proved to be useful for keeping us on track

BOSTON UNIVERSITY

Project Limitations and Future Improvements

- Displaying name of publication when link is clicked on
- Functional
  - Search Bar
  - Isolated Button
    - Option for displaying only the nodes without links
  - Extended Button
    - Option for displaying only nodes with links
- UI/UX clean up
- Key/Legend
- Zoom Scale

BOSTON UNIVERSITY

Thank you!
Questions?

BOSTON UNIVERSITY