WUSTL Networks: Finding Student Communities

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Representing the Data

Student Responses

We gathered initial data by 1. **asking** students at dining halls around campus about where they just came from, and 2. sending out a **survey** asking for the same information

Potential issues with this method:

- All data was collected using fixed sources and dining halls as targets
- This was on purpose to verify our hypothesis that dining halls on campus are central nodes of student flows on campus.
- We combined halls into areas, and didn't ask about study spaces without dining
- In reality, student flow is not always through dining halls, and often happens like:
    - Study area -> study area
    - Study area -> dining area
    - Dining area -> study area
    - Dining area -> dining area

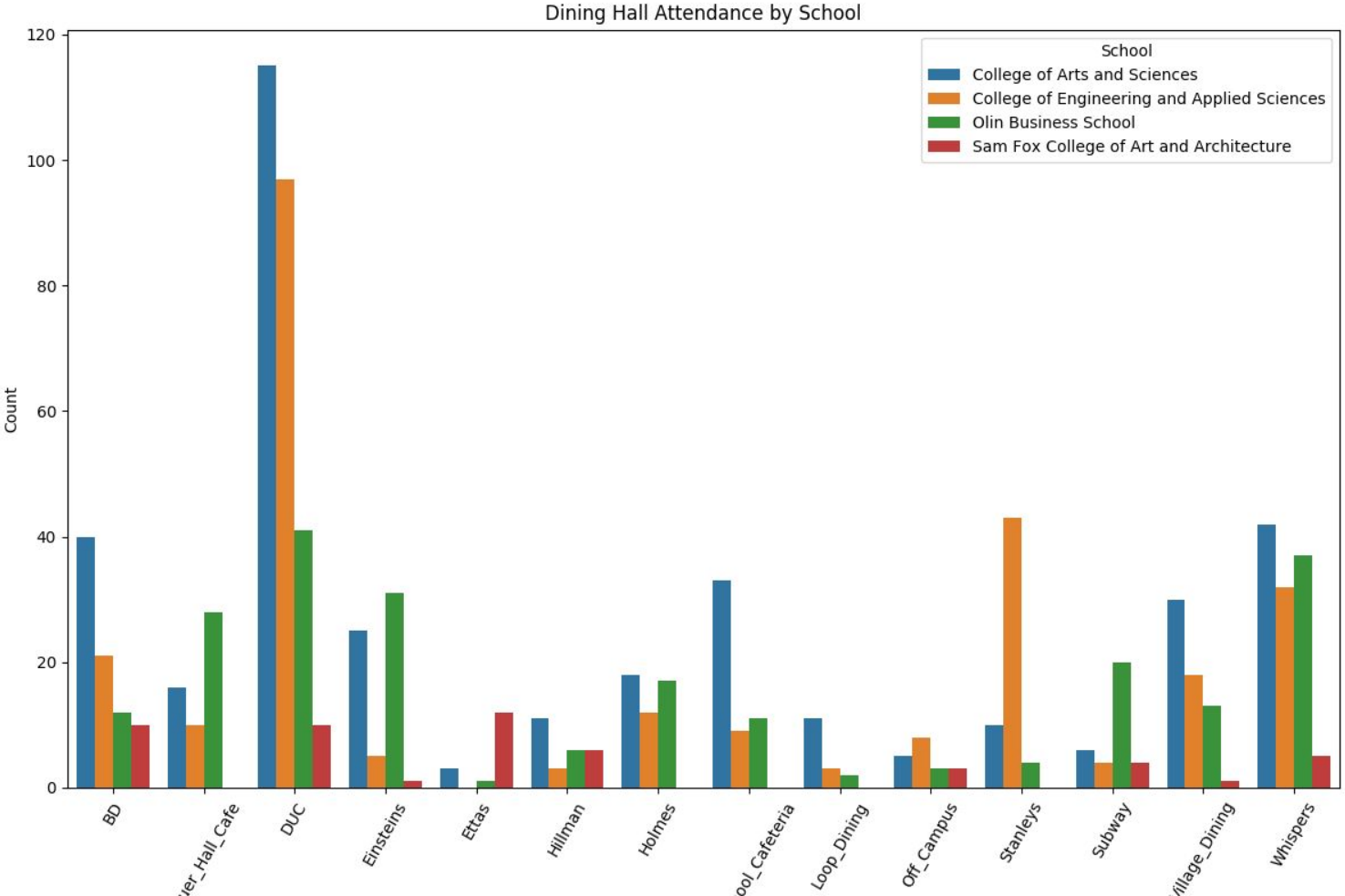
Creating files

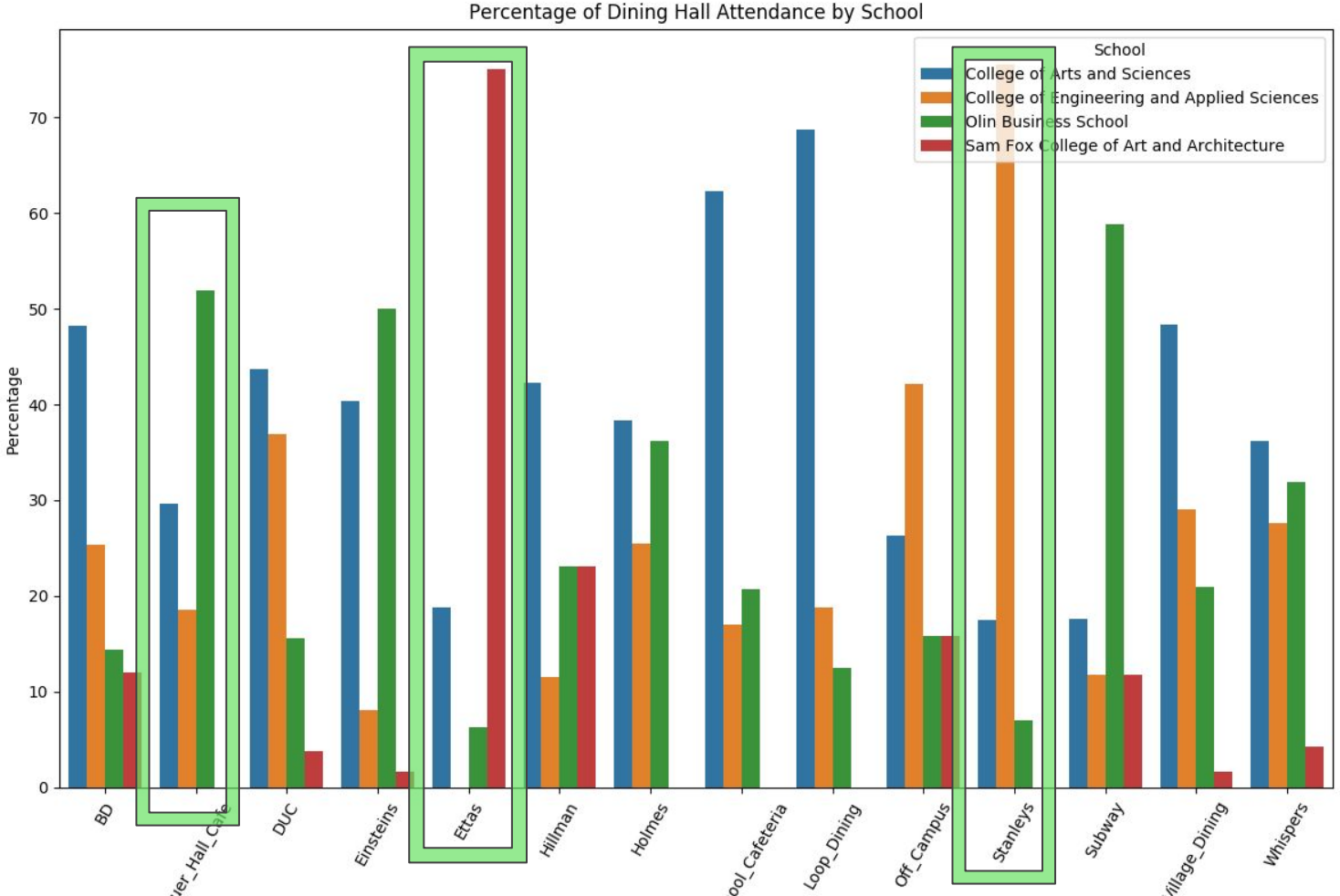
Pandas and CSVs were used to manipulate and store all of the data that was found

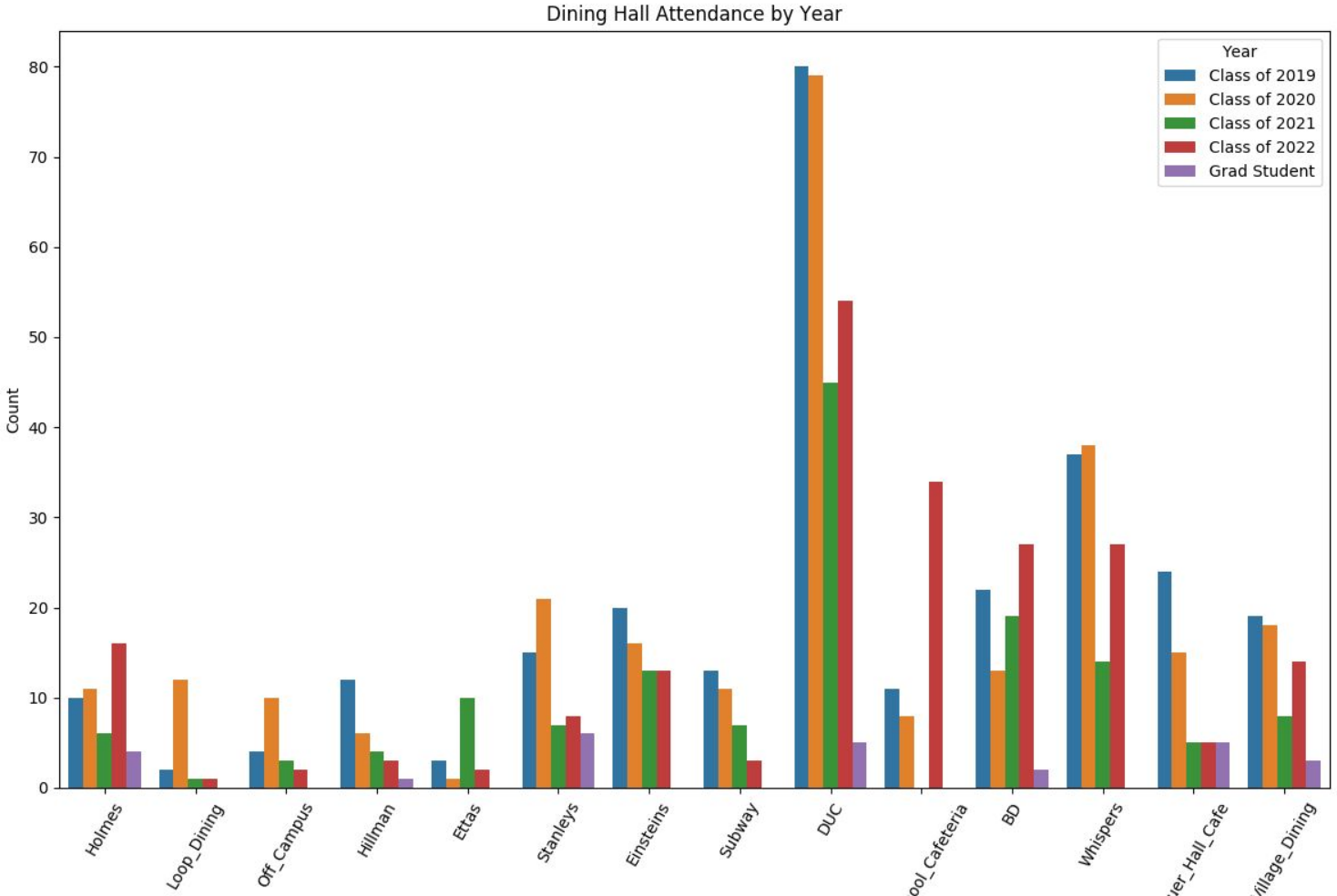
Allowed for several things:

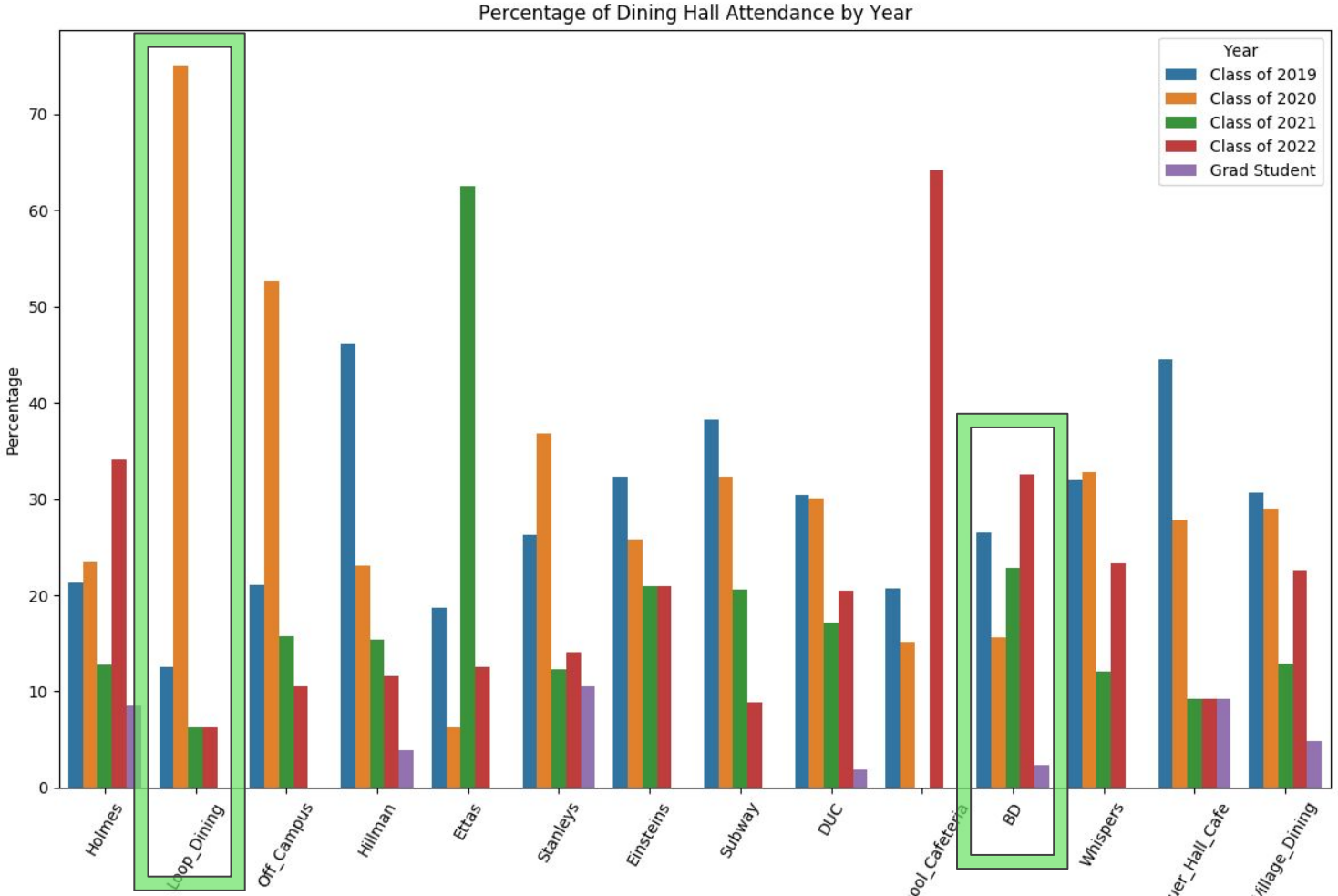
- Easy manipulation of groups/data points
- Removal of empty nodes/responses
- Easy transfer into graphing/network packages
- Familiarity through Python

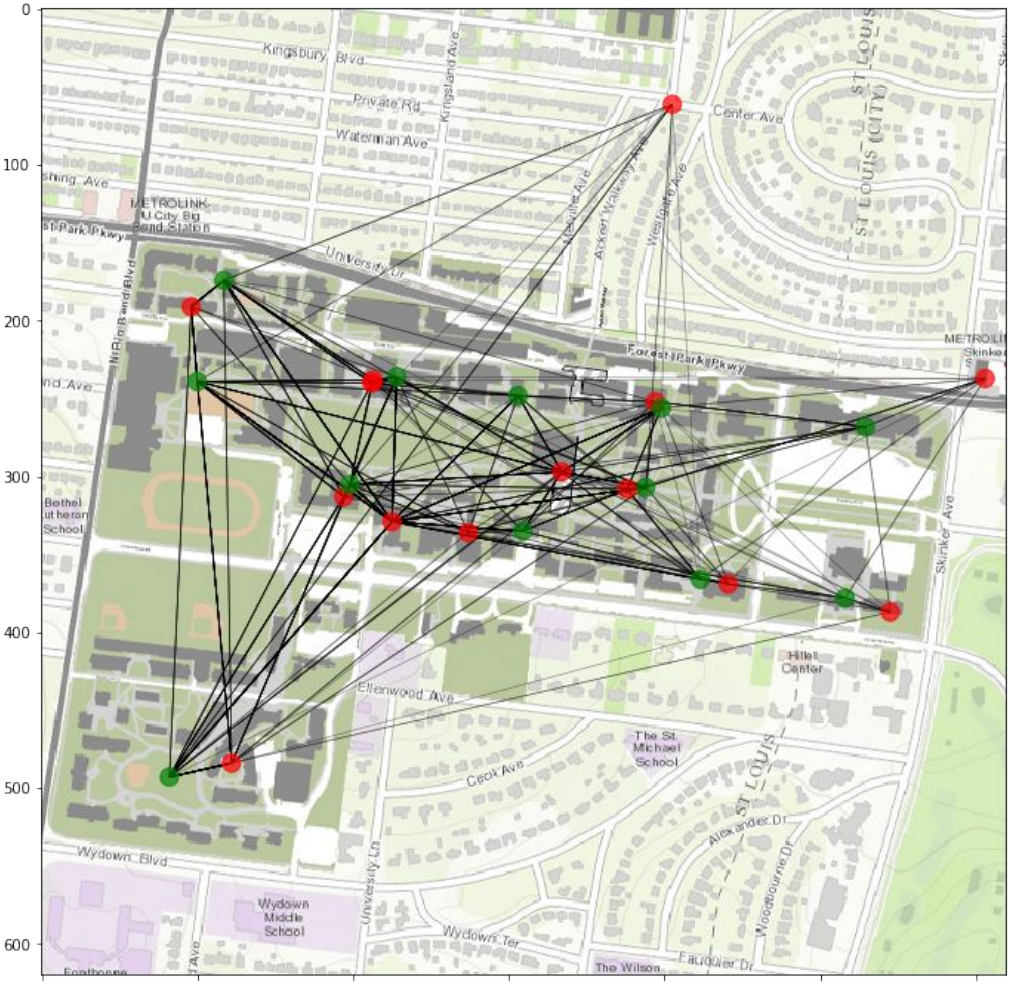
NetworkX was used due to the vast range of analysis possible


Dining Hall Attendance by School
School
College of Arts and Sciences
College of Engineering and Applied Sciences
Olin Business School
Sam Fox College of Art and Architecture
Count
0
20
40
60
80
100
120
BD
DUC
Einsteins
Ettas
Hillman
Holmes
Loop_Dining
Off_Campus
Stanleys
Subway
Whispers


Percentage of Dining Hall Attendance by School
School
College of Arts and Sciences
College of Engineering and Applied Sciences
Olin Business School
Sam Fox College of Art and Architecture
Percentage
0
10
20
30
40
50
60
70
BD
DUC
Einsteins
Ettas
Hillman
Holmes
Loop_Dining
Off_Campus
Stanleys
Subway
Whispers

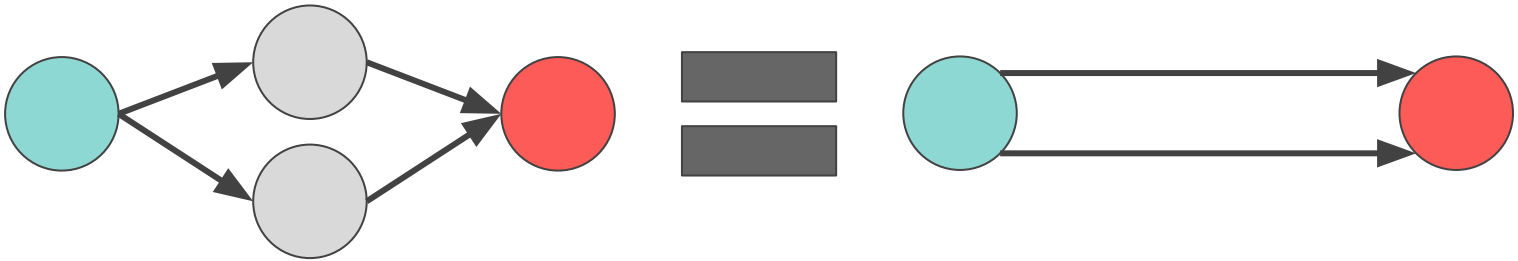

Dining Hall Attendance by Year
Year
Class of 2019
Class of 2020
Class of 2021
Class of 2022
Grad Student
Count
0
10
20
30
40
50
60
70
80
Holmes
Loop_Dining
Off_Campus
Hillman
Ettas
Stanleys
Einsteins
Subway
DUC
BD
Whispers


Percentage of Dining Hall Attendance by Year
Year
Class of 2019
Class of 2020
Class of 2021
Class of 2022
Grad Student
Percentage
0
10
20
30
40
50
60
70
Holmes
Off_Campus
Hillman
Ettas
Stanleys
Einsteins
Subway
DUC
BD
Whispers
Village_Dining


Kingsbury Blvd
Private Rd
Waterman Ave
Kingsland Ave
Center Ave
ST LOUIS (CITY)
METROLINK
University Dr
Forest Park Pkwy
Bethel
School
Skinker Ave
Hillel
Center
Ellenwood Ave
The St.
Michael
School
Cecil Ave
Alexander Dr
Wydown Blvd
Wydown
Middle
School
University Ln
Wydown Ter
The Wilson
Woodbourne Dr
0
100
200
300
400
500
600

Avoiding Edge Weights

Edge Weights are unnecessary

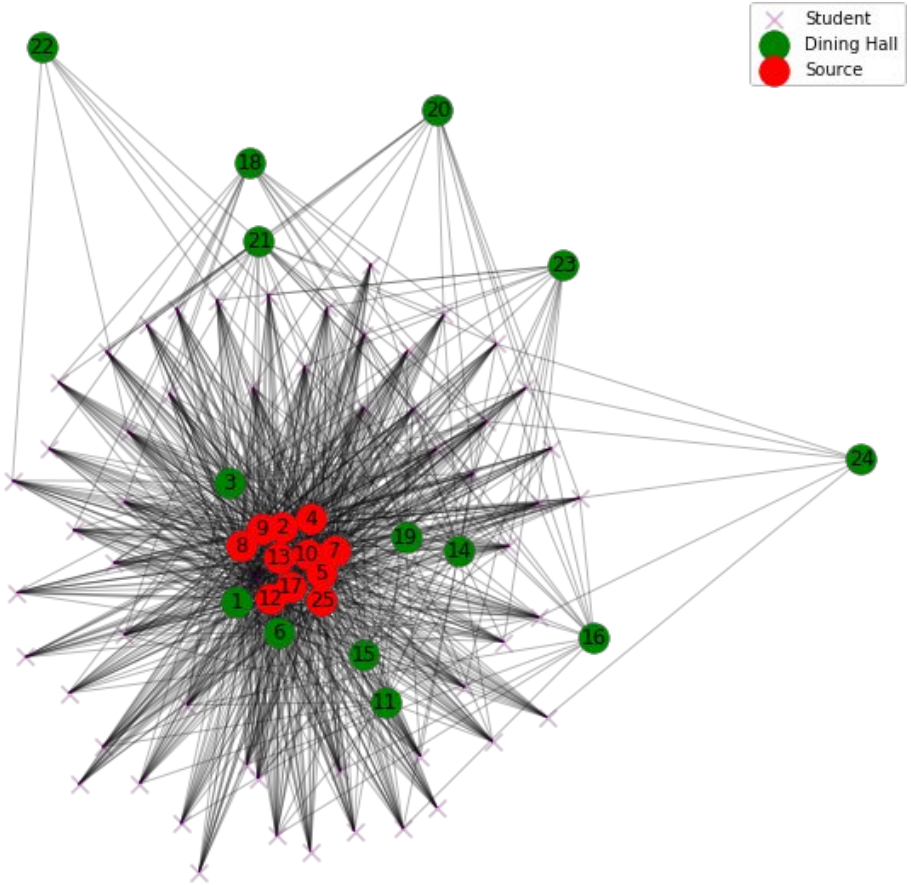


Graph Format

Three different formats utilized:

1. Pathways as nodes
2. Students as nodes
3. Students as edges (multigraph)

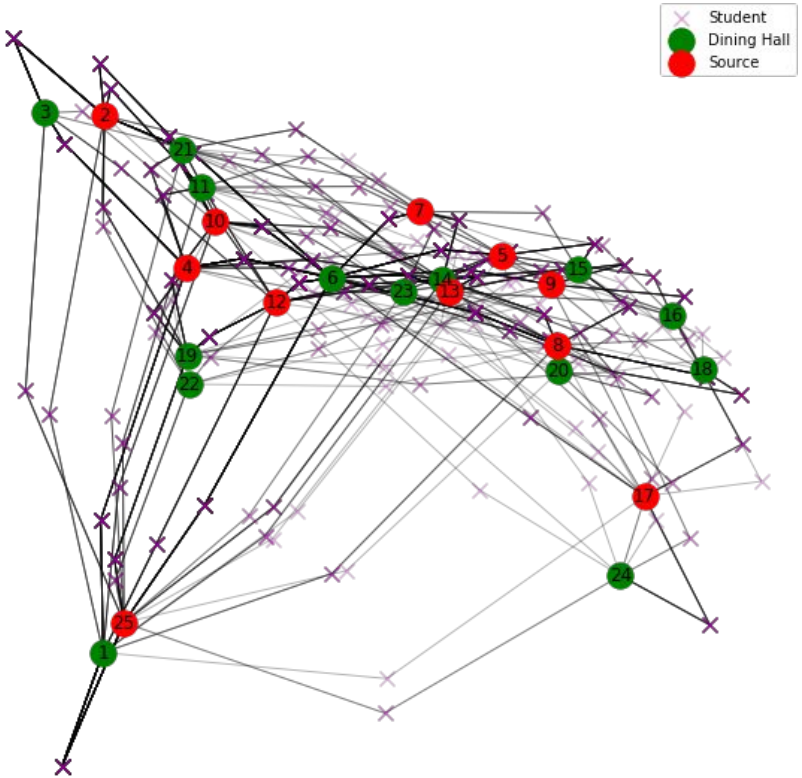
Student Nodes



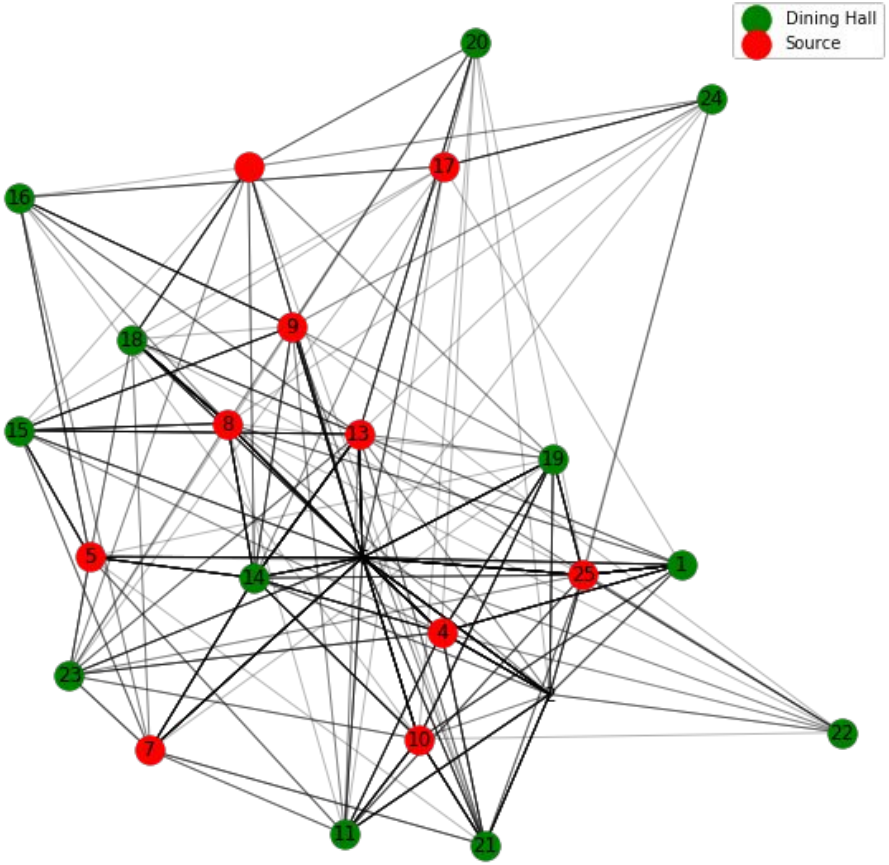
Pathway Nodes

Technically students are nodes, but multiple nodes per student

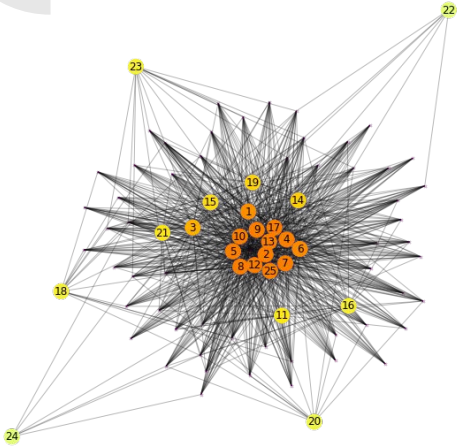
Each edge has a node, to avoid being a multigraph

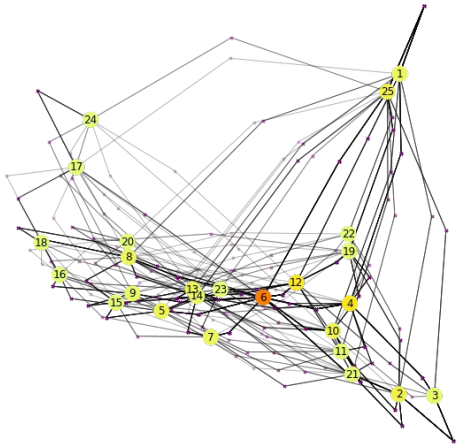


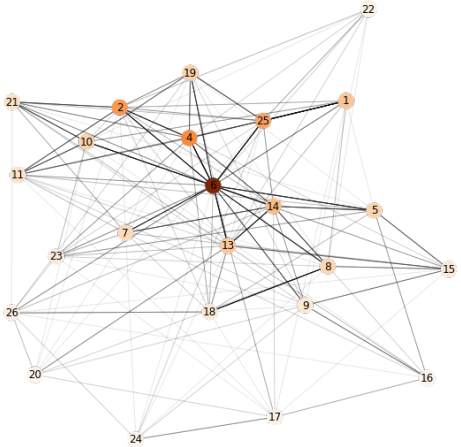
Multigraph


Dining Hall
Source
20
24
17
16
9
18
8
13
15
19
5
14
25
1
4
23
22
10
7
11
21

Eigenvector Centrality

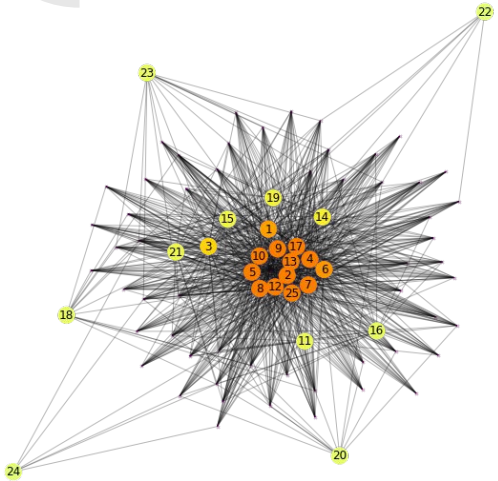


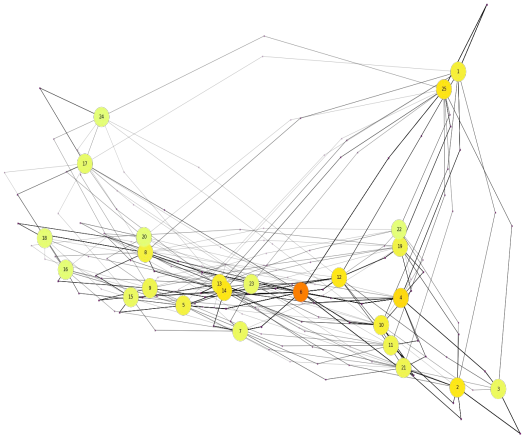


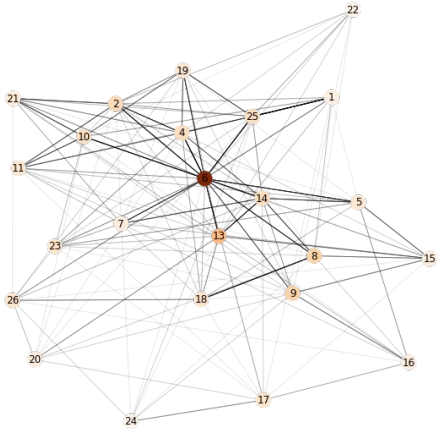


Student Nodes	Pathway Nodes	Multigraph
South 40: 0.182	DUC: 0.635	DUC: 0.650
Brookings: 0.182	AC & Frat Row: 0.162	AC & Frat Row: 0.337
Brown: 0.182	DUC Area: 0.151	Village: 0.302

Betweenness Centrality

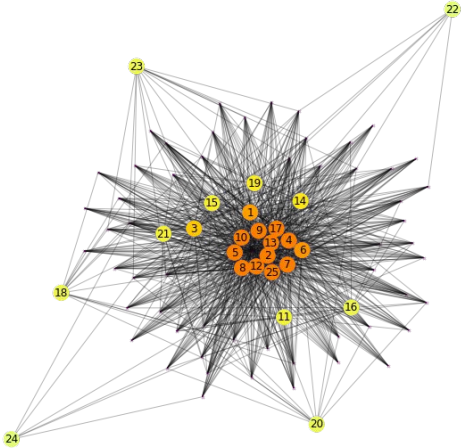


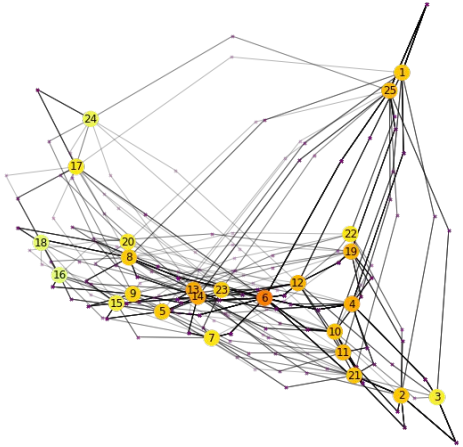


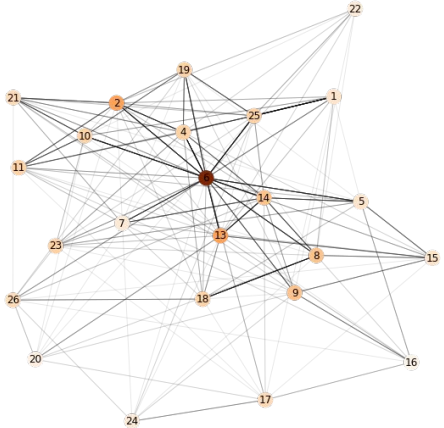


Student Nodes	Pathway Nodes	Multigraph
South 40: 0.0415	DUC: 0.390	DUC: 0.115
Village: 0.0415	AC & Frat Row: 0.135	Brookings: 0.042
DUC: 0.0415	South 40: 0.114	Engineering: 0.032

Closeness Centrality





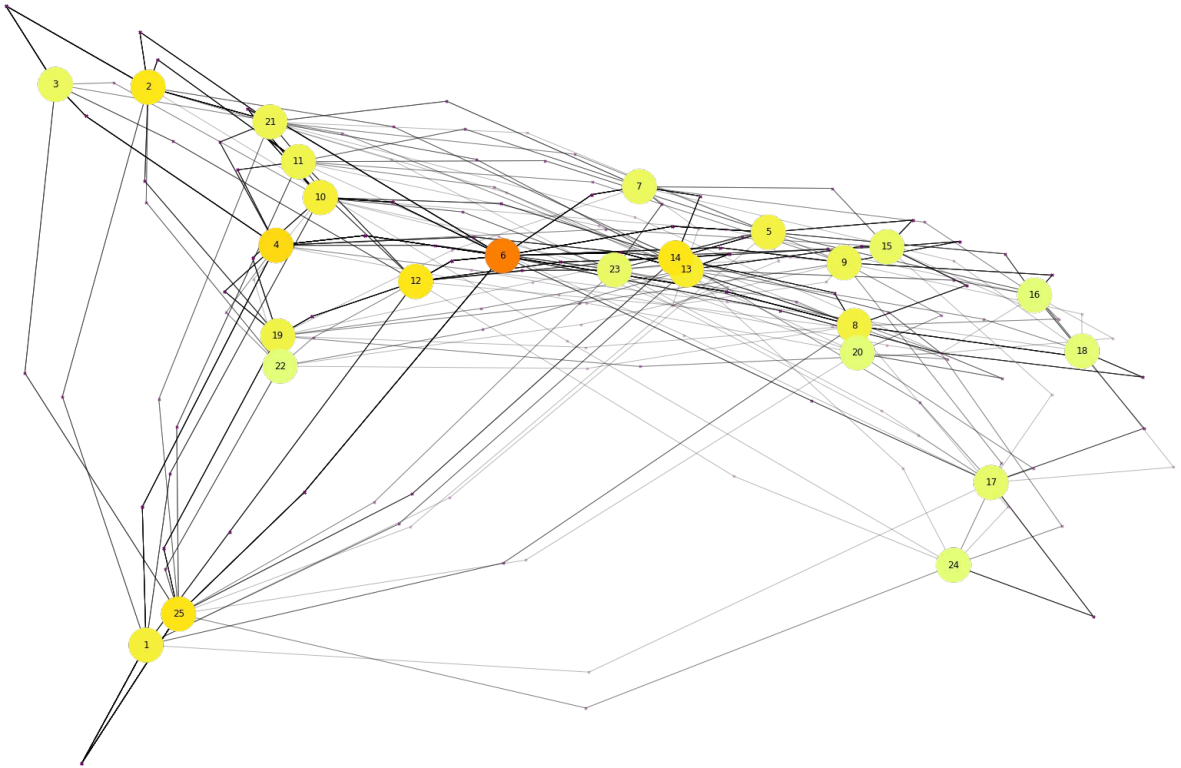


Student Nodes	Pathway Nodes	Multigraph
South 40: 0.762	DUC: 0.408	DUC: 0.92
Village: 0.762	Whispers: 0.357	Village: 0.719
DUC: 0.762	Brookings: 0.354	Brookings: 0.719

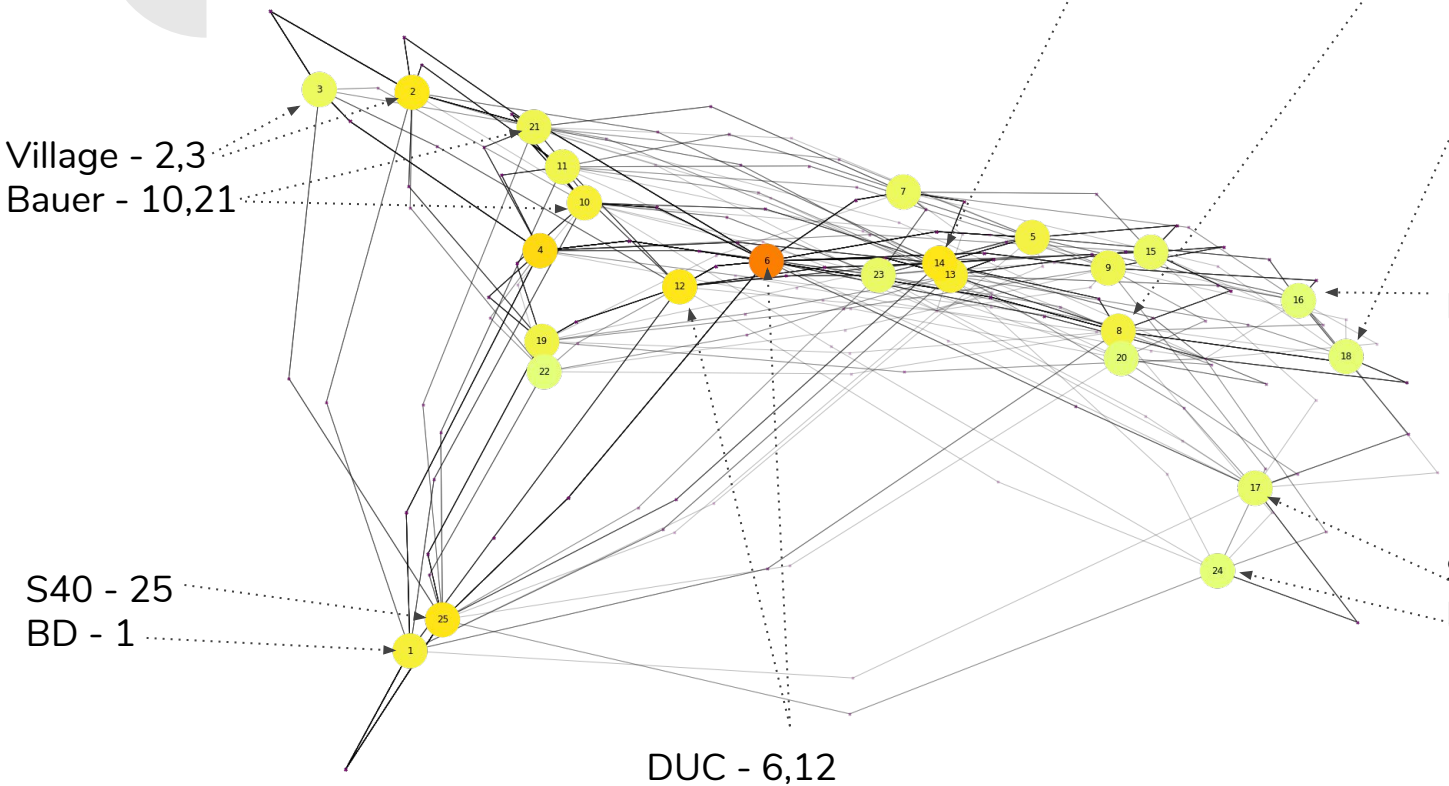
On the Student Nodes Graph

The DUC was always the Dining Hall with the highest centrality, regardless of calculation method

Pathways - Spectral Layout



Spectral Layout



Engineering Quad - 8
Stanley's - 18

Brooking Quad - 13
Whisper's - 14

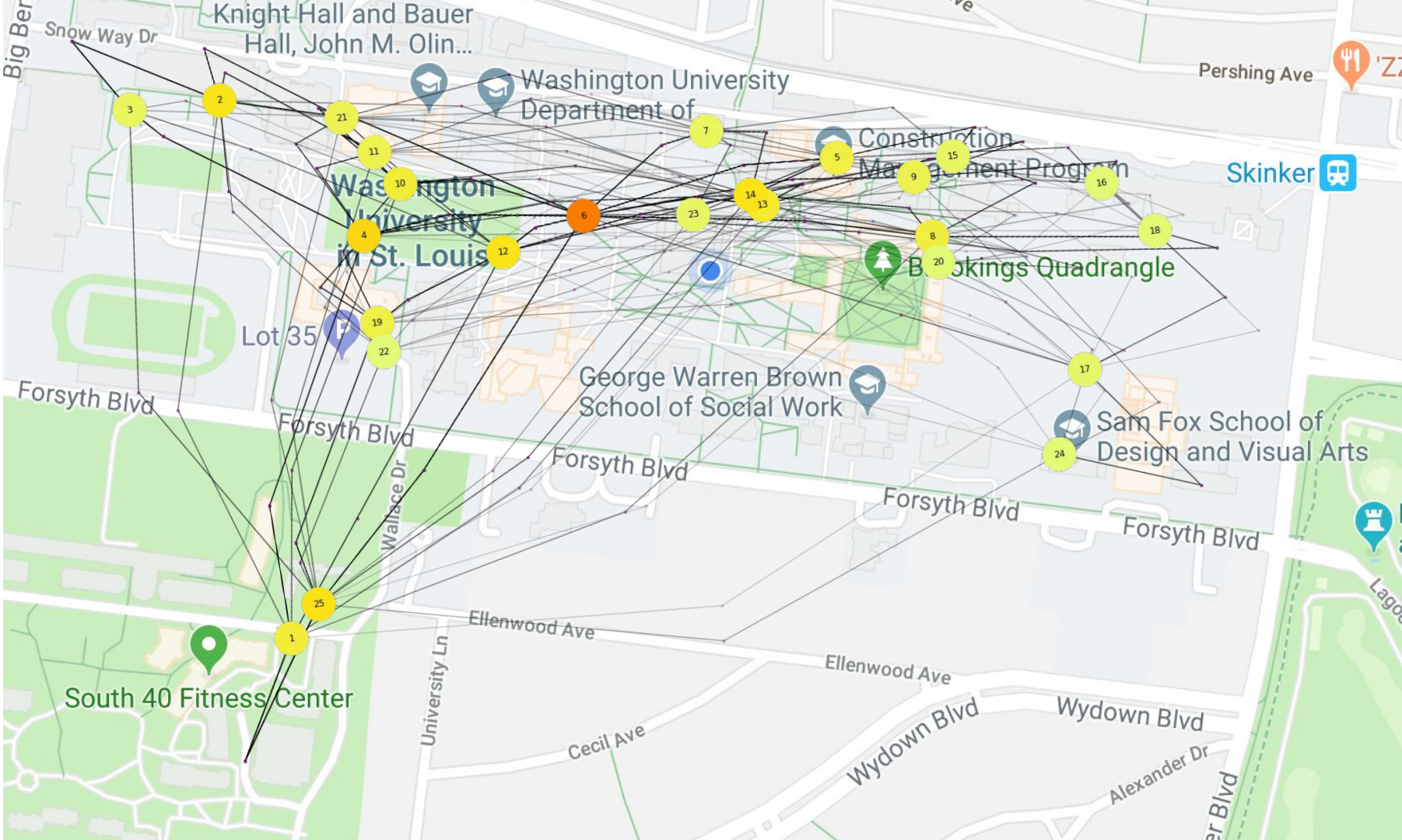
Village - 2,3
Bauer - 10,21

Hillman - 16

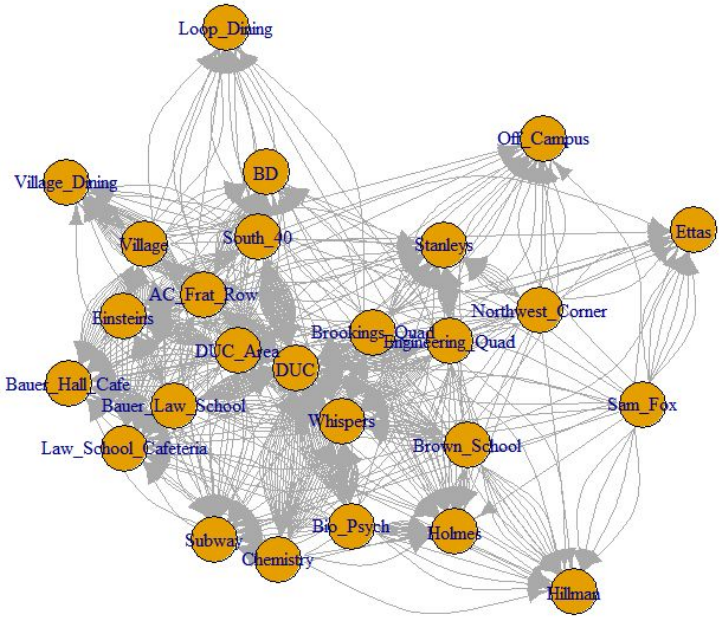
Sam Fox - 17
Etta's - 24

S40 - 25
BD - 1

DUC - 6,12


Knight Hall and Bauer Hall, John M. Olin...
Snow Way Dr
Washington University Department of
Pershing Ave
Skinker
Lot 35
George Warren Brown School of Social Work
Sam Fox School of Design and Visual Arts
Forsyth Blvd
Wallace Dr
Ellenwood Ave
University Ln
South 40 Fitness Center
Cecil Ave
Wydown Blvd
Alexander Dr

Community detection using R igraph library



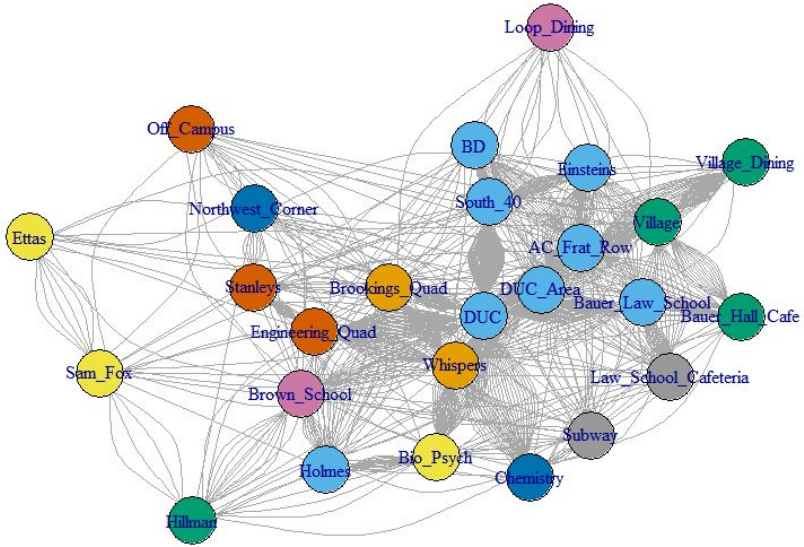
The igraph library in R gives some handy community detection and plotting tools

We have adopted 2 ways that we learned in class

- Betweenness-based clustering
- Modularity Maximization

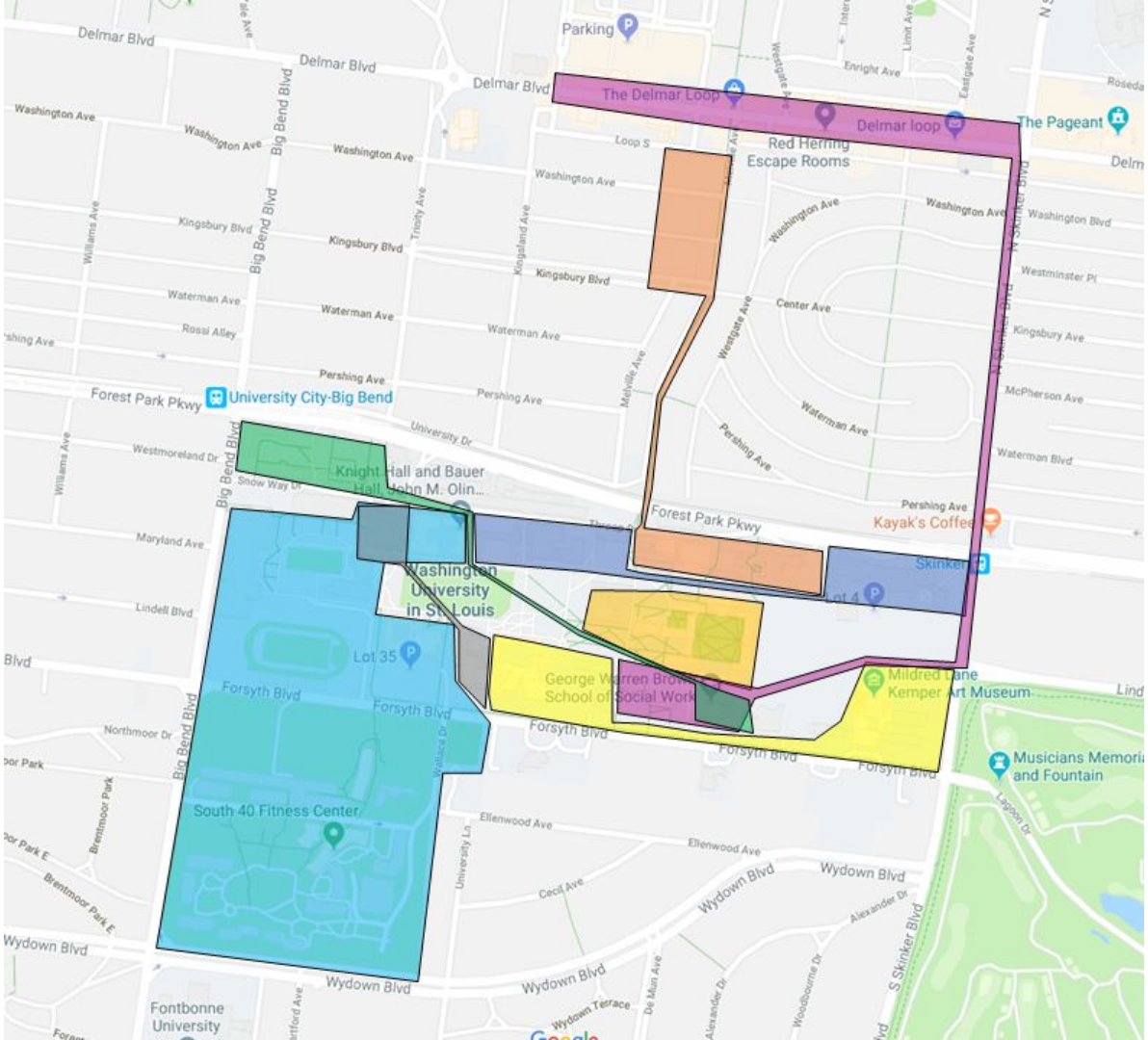
Graph layout used: Fruchterman-Reingold-Grid

Community detection using R igraph library - Betweenness-based clustering

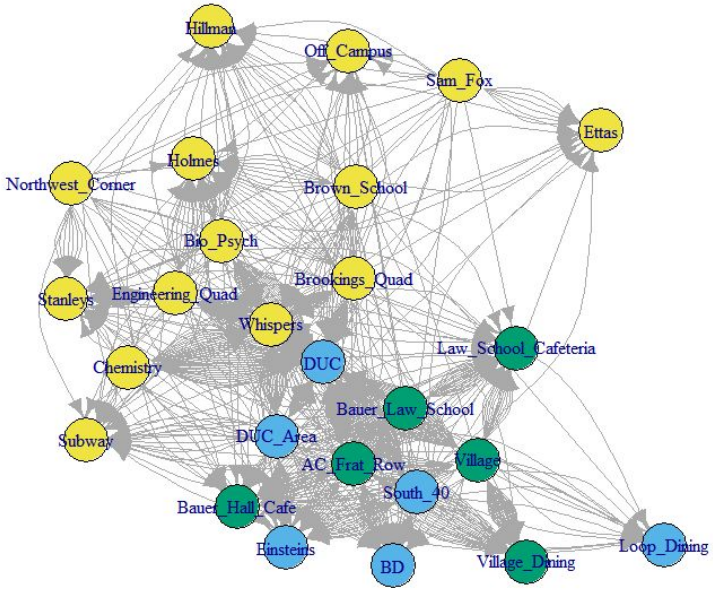


Interesting findings:

- Bridges exist among different segments of buildings on campus, which can be mostly explained by the schools that students are in
- Two anomalies
  - Law school and Subway are in a cluster
  - Hillman and Village / Bauer Hall Cafe are in a cluster
  - Maybe due to the sampling bias - our sample population is majorly undergraduates, so might give a biased measure on graduate school buildings

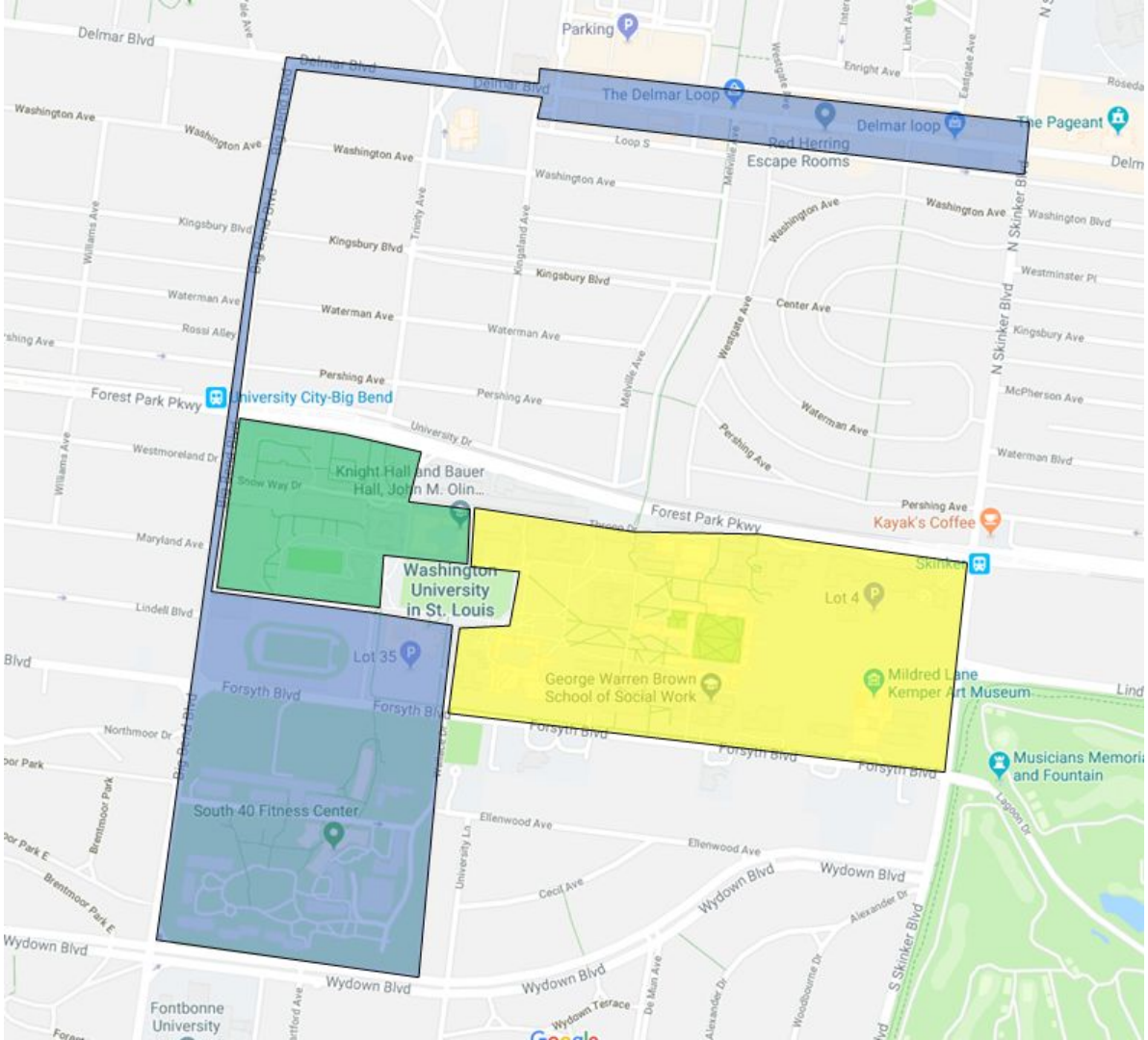

Delmar Blvd
Parking
The Delmar Loop
Delmar loop
The Pageant
Red Herring Escape Rooms
Washington Ave
Big Bend Blvd
Kingsbury Blvd
Waterman Ave
Pershing Ave
Forest Park Pkwy
University City-Big Bend
Knight Hall and Bauer Hall
Kayak's Coffee
Skinker
Washington University in St. Louis
Lot 35
Lot 4
George Warren Brown School of Social Work
Mildred Lane Kemper Art Museum
Musicians Memorial and Fountain
South 40 Fitness Center
Forsyth Blvd
Ellenwood Ave
Wydown Blvd
Fontbonne University
Center Ave
Westgate Ave
Melville Ave
Kingsland Ave
Trinity Ave
Williams Ave
Westmoreland Dr
Maryland Ave
Lindell Blvd
Northmoor Dr
Brentmoor Park
Cecil Ave
University Dr
Enright Ave
Limit Ave
Eastgate Ave
Westminster Pl
McPherson Ave
Waterman Blvd
Kingsbury Ave
Washington Blvd
Lagoon Dr
Alexander Dr
Woodbourne Dr
De Mun Ave
Wydown Terrace
S Skinker Blvd
N Skinker Blvd

Community detection using R igraph library - Modularity Maximization



Interesting findings:

- Shows the communities based on dense connection to each other (more student movements among buildings) but sparse connection with nodes in other communities
- Basically makes sense with actual distances among buildings
- If we were to have more data, we could have gotten better resolution in terms of communities (micro-communities could have been detected)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Wydown Blvd
Fontbonne University
Wydown Terrace
N Skinker Blvd
Westgate Ave
Melville Ave
Trinity Ave
Kingsland Ave
Big Bend Blvd
Westminster Pl
McPherson Ave
Lagoon Dr

Conclusion

There is a definite student flow on campus through dining areas

Whisper’s is less important than we theorized, the DUC is core to student flow

Moving forward

If we were to have more data, we could have gotten better resolution on community detection.

More options for sources and targets

Collecting over a longer period of time