Stanley Zheng
Assignment #6
Due: 11:59pm Oct 31

(10 points)

1. We know the result of the Karate Club (Zachary, 1977) split.
Prove or disprove that the result of split could have been predicted by the weighted graph of social interactions. How well does the mathematical model represent reality?

Generously document your answer with all supporting equations, code, graphs, arguments, etc.

The mathematical model represents as a whole which members followed Mr. Hi and John A. very well. In the paper analysis of this event, it mentioned the strengths of measuring relationships between nodes mathematically. As noted from source 1, this problem excelled by having the following properties:
Problem

- John A. & Mr. Hi has distinct different ideologies
- There was a split and it was over time
- The problem wasn't overtly challenging that highly politicized or that members quit karate because of it.

Known factors (from paper)

1. Association in and between academic classes at the university.
2. Membership in Mr. Hi's private karate studio on the east side of the city where Mr. Hi taught nights as a part-time instructor.
3. Membership in Mr. Hi's private karate studio on the east side of the city, where many of his supporters worked out on weekends.
4. Student teaching at the east-side karate studio referred to in (2). This is different from (2) in that student teachers interacted with each other, but were prohibited from interacting with their sutdents.
5. Interaction at the university rathskeller, located in the same basement as the karate club's workout area.
6. Interaction at a student-oriented bar located across the street from the university campus.
7. Attendance at open karate tournaments held through the area at private karate studios.
8. Attendance at intercollegiate karate tournaments held at local universities. Since both open and intercollegiate tournaments were held on Saturdays, attendance at both was impossible.

Deterministic factors given a group that gains new members over an extended period of times allows a stronger confidence in reliable results. (figure 1) From the end result producing a 97% successful prediction rate is fairly amazing. As the powerpoint from source 2 suggests, determining the edges, which are obtained from the above factors assists in the prediction.

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Figure 2
Girvan-Newman Algorithm - Modularity equation

$$Q = \frac{1}{4m}\sum_{ij}\left(A_{ij} - \frac{k_i k_j}{2m}\right)s_i s_j = \frac{1}{4m}\mathbf{s}^T\mathbf{B}\mathbf{s}$$

Figure 3

TABLE 3

EVALUATION OF THE HYPOTHESES

INDIVIDUAL NUMBER IN MATRIX C	FACTION MEMBERSHIP FROM DATA	FACTION MEMBERSHIP AS MODELED	HIT/ MISS	CLUB AFTER SPLIT FROM DATA	CLUB AFTER SPLIT AS MODELED	HIT/ MISS
1	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
2	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
3	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
4	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
5	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
6	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
7	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
8	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
9	John	John	Hit	Mr. Hi's	Officers'	Miss
10	John	John	Hit	Officers'	Officers'	Hit
11	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
12	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
13	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
14	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
15	John	John	Hit	Officers'	Officers'	Hit
16	John	John	Hit	Officers'	Officers'	Hit
17	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
18	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
19	John	John	Hit	Officers'	Officers'	Hit
20	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
21	John	John	Hit	Officers'	Officers'	Hit
22	Mr. Hi	Mr. Hi	Hit	Mr. Hi's	Mr. Hi's	Hit
23	John	John	Hit	Officers'	Officers'	Hit
24	John	John	Hit	Officers'	Officers'	Hit
25	John	John	Hit	Officers'	Officers'	Hit
26	John	John	Hit	Officers'	Officers'	Hit
27	John	John	Hit	Officers'	Officers'	Hit
28	John	John	Hit	Officers'	Officers'	Hit
29	John	John	Hit	Officers'	Officers'	Hit
30	John	John	Hit	Officers'	Officers'	Hit
31	John	John	Hit	Officers'	Officers'	Hit
32	John	John	Hit	Officers'	Officers'	Hit
33	John	John	Hit	Officers'	Officers'	Hit
34	John	John	Hit	Officers'	Officers'	Hit
TOTALS		34 hits, 0 misses 100% hits, 0% misses			33 hits, 1 miss 97% hits, 3% misses	

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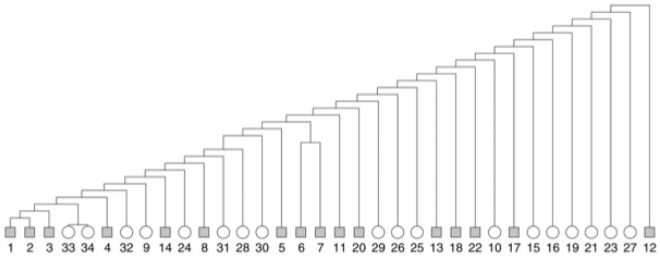
Karate club
source 4 3

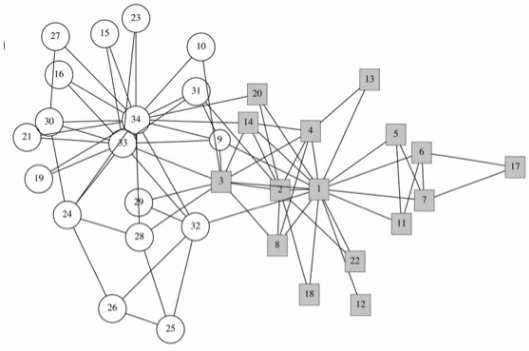
Example: Zachary karate club data

- Cores of communities (vertices 1, 2 & 3) and (33 & 34) are correctly identified, but the divisive structure is not captured



Zachary karate club data hierarchical clustering tree using edge-independent path counts

Example: Zachary Karate Club



Useful sources include:

- Original paper
- Slides
- Code and Data

Sources

1. http://aris.ss.uci.edu/~lin/76.pdf
2. http://www-personal.umich.edu/~ladamic/courses/networks/si614w06/ppt/lecture18.ppt
3. http://clair.si.umich.edu/si767/papers/Week03/Community/CommunityDetection.pptx
4. http://networkx.github.io/documentation/latest/examples/graph/karate_club.html
5. http://nbviewer.ipython.org/url/courses.cit.cornell.edu/info6010/resources/11notes.ipynb
6. http://stackoverflow.com/questions/9471906/what-are-the-differences-between-communi

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ty-detection-algorithms-in-igraph/9478989#9478989

7. http://stackoverflow.com/questions/5822265/are-there-implementations-of-algorithms-for-community-detection-in-graphs
8. http://konect.uni-koblenz.de/networks/ucidata-zachary
9. http://vlado.fmf.uni-lj.si/pub/networks/data/ucinet/ucidata.htm#zachary

(extra credit, 3 points)

External

1. http://networkdata.ics.uci.edu/data/karate/
2. http://vlado.fmf.uni-lj.si/pub/networks/data/ucinet/ucidata.htm#zachary

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2. We know the group split in two different groups. Suppose the disagreements in the group were more nuanced -- what would the clubs look like if they split into groups of 3, 4, and 5?