CS 292F.300 Final project proposal

Ashley Bruce

TOTAL POINTS

1 / 1

QUESTION 1

1 Proposal submitted 1 / 1

✓ **- 0 pts** **Correct**

This sounds great. I look forward to seeing the results.

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CMPSC 292F: Graph Laplacians

Project Proposal
Correlation Between Graph Conductance and the Fiedler Value

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INTRO

The conductance of a graph, also known as Cheeger's constant, is a measure of how "well-knit" the graph is. The Fiedler value, the second smallest eigenvalue of a graph, gives us a measure of the algebraic connectivity among the elements in a network. As both of these measure how connected a graph is, it would make sense that there might be a correlation between the conductance and the Fiedler value of a graph. Our project proposes a case study to compare how these two values relate across different graphs.

IDEA

- Compare Fiedler value to conductance
- Try to find a few approximations of conductance as well, since the problem is NP-hard
- Compare measures of conductance between one another
    - Which approximations work best for the graphs we choose?
    - Is there a limit on the size of the graphs we can estimate conductance for?
- Try and understand the "psychology" of graphs by comparing them in as many ways as possible
    - Collect several graphs and approximate their conductances
    - Compute other metrics on the graphs (Fiedler vector, etc) and compare them
        - See how graphs with similar conductances compare with other metrics
        - See how the Fiedler vector correlates with conductance
- Is there an axis on which the graphs are similar?
- Start off by calculating conductance and the Fiedler value for smaller graphs
    - Once we move to bigger graphs, focus more on the approximations for conductance, as calculating the actual value will take exponential time

REFERENCES

- A hybrid evolutionary algorithm for finding low conductance of large graphs
    - https://www.sciencedirect.com/science/article/abs/pii/S0167739X19320540
- Another paper on approximating graph conductance

    - http://math.uchicago.edu/~may/REU2020/REUPapers/Zhang,Yueheng.pdf
- Set of graphs we can choose from:
    - https://sparse.tamu.edu/
- Papers that mention relationship between Fiedler vector and conductance:
    - http://snap.stanford.edu/class/cs224w-2016/slides/clustering.pdf
    - https://arxiv.org/pdf/2003.00992.pdf
- Spielman Lecture relating conductance to second eigenvalue
    - https://www.cs.yale.edu/homes/spielman/561/2012/lect06-12.pdf'

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✓ **- 0 pts Correct**

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