Tree-Based Clustering for Ad Hoc Networks

CENG797 Special Topics in Computer Engineering: Ad Hoc Networks
2025--2025 Fall
Term Project Report

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29 October 2025

Abstract

Write your abstract here.

An abstract summarizes, in one paragraph (usually), the major aspects of the entire paper in the following prescribed sequence [1]:

- the question(s) you investigated (or purpose), (from Introduction) state the purpose very clearly in the first or second sentence.
- the experimental design and methods used; clearly express the basic design of the study; name or briefly describe the basic methodology used without going into excessive detail-be sure to indicate the key techniques used.
- the major findings including key quantitative results, or trends; report those results which answer the questions you were asking; identify trends, relative change or differences, etc.
- a brief summary of your interpretations and conclusions; clearly state the implications of the answers your results gave you.

The length of your Abstract should be kept to about 200-300 words maximum. Limit your statements concerning each segment of the paper (i.e. purpose, methods, results, etc.) to two or three sentences. The Abstract helps readers decide whether they want to read the rest of the paper, or it may be the only part they can obtain via electronic literature searches or in published abstracts. Therefore, enough key information (e.g., summary results, observations, trends, etc.) must be included to make the Abstract useful to someone who may to reference your work [1].

How do you know when you have enough information in your Abstract? A simple rule-of-thumb is to imagine that you are another researcher doing an study similar to the one you are reporting. If your Abstract was the only part of the paper you could access, would you be happy with the information presented there?

The Abstract is ONLY text. Use the active voice when possible, but much of it may require passive constructions. Write your Abstract using concise, but complete, sentences, and get to the point quickly. The Abstract SHOULD NOT contain [1]:

- lengthy background information,
- references to other literature,
- elliptical (i.e., ending with ...) or incomplete sentences,
- abbreviations or terms that may be confusing to readers,
- any sort of illustration, figure, or table, or references to them.

Table of Contents

List of Figures

List of Tables

1 Introduction

Mobile ad hoc networks are gaining popularity as an alternative to centralized networking schemes, providing a decentralized solution to mobile networking. One of the major problems that arise while trying to orchestrate a mobile ad hoc network is clustering. Clustering nodes and choosing clusterheads fast and effectively is a major problem of ad hoc networks. While networking solutions without clustering exist, it is widely considered that clustering is the ideal solution while trying to handle the problems that arise due to decentralized nature of ad hoc networks. In this paper, we propose a new clustering scheme based on trees that extends hierarchically as the number of users increase, with the aim of load-balancing the number of users a clusterhead serves.

2 Background and Related Work

2.1 Background

Trees are fundamental data structures that are useful in many areas of computer science. There are many types of trees that are suitable for various tasks, but all of them share a couple of traits. All trees have nodes that 'point' (this can be described more formally) to other subtrees. Recursive definitions are natural and common for trees, similar to linked lists. The nodes may also contain some arbitrary data, which may or may not be related to the tree structure itself. The node that points to another node is called the parent of such node, and the reverse relationship is called the child. A node may have one or multiple children or none, but is generally considered that all nodes except one must have exactly one parent, and the node without parent is called the root node. One can see that assigning some nodes (most preferably some parent nodes) as clusterheads in the context of clustering is a natural use of the tree hierarchy.

2.2 Related Work

In their survey of clustering algorithms, Yu and Chong [2] mention load-balancing clustering techniques. Tree-based clustering can be considered a load-balancing technique because of the self-balancing properties of the underlying tree data structure used. Yu and Chong mention adaptive multi-hop clustering (AMC) and degree-load-balancing clustering (DLBC). In AMC, the clusters merge or split according to some lower and higher thresholds. In DLBC, the clusterheads degrade to an ordinary node if they serve too many nodes, and new clusters are created.

3 Main Contributions

You can introduce multiple sections for presenting your contribution. Provide content specific titles.

3.1 Your Contribution 1

Present your proposals, algorithms, techniques etc. here.

3.2 Your Contribution 2

Present your proposals, algorithms, techniques etc. here.

4 Results and Discussion

4.1 Methodology

Writing the methodology lies at the core of the paper, and fulfills one of the basic principles underlying the scientific method. Any scientific paper needs to be verifiable by other researchers, so that they can review the results by replicating the experiment and guaranteeing the validity. To assist this, you need to give a completely accurate description of the equipment and the techniques used for gathering the data [3].

Other scientists are not going to take your word for it, and they want to be able to evaluate whether your methodology is sound. In addition, it is useful for the reader to understand how you obtained your data, because it allows them to evaluate the quality of the results. For example, if you were trying to obtain data about shopping preferences, you will obtain different results from a multiple-choice questionnaire than from a series of open interviews. Writing methodology allows the reader to make their own decision about the validity of the data. If the research about shopping preferences were built upon a single case study, it would have little external validity, and the reader would treat the results with the contempt that they deserve [3].

Describe the materials and equipment used in the research. Explain how the samples were gathered, any randomization techniques and how the samples were prepared. Explain how the measurements were made and what calculations were performed upon the raw data. Describe the statistical techniques used upon the data [3].

4.2 Results

This is probably the most variable part of any research paper, and depends upon the results and aims of the experiment. For quantitative research, it is a presentation of the numerical results and data, whereas for qualitative research it should be a broader discussion of trends, without going into too much detail. For research generating a lot of results, then it is better to include tables or graphs of the analyzed data and leave the raw data in the appendix, so that a researcher can follow up and check your calculations. A commentary is essential to linking the results together, rather than displaying isolated and unconnected charts, figures and findings. It can be quite difficulty to find a good balance between the results and the discussion section, because some findings, especially in a quantitative or descriptive experiment, will fall into a grey area. As long as you not repeat yourself to often, then there should be no major problem. It is best to try to find a middle course, where you give a general overview of the data and then expand upon it in the discussion - you should try to keep your own opinions and interpretations out of the results section, saving that for the discussion [3].

4.3 Discussion

This is where you elaborate upon your findings, and explain what you found, adding your own personal interpretations. Ideally, you should link the discussion back to the introduction, addressing each initial point individually. It is important to try to make sure that every piece of information in your discussion is directly related to the thesis statement, or you risk clouding your findings. You can expand upon the topic in the conclusion - remembering the hourglass principle [3].

5   Conclusion

In general a short summarizing paragraph will do, and under no circumstances should the paragraph simply repeat material from the Abstract or Introduction. In some cases it's possible to now make the original claims more concrete, e.g., by referring to quantitative performance results [4].

The conclusion is where you build upon your discussion and try to refer your findings to other research and to the world at large. In a short research paper, it may be a paragraph or two, or practically non-existent. In a dissertation, it may well be the most important part of the entire paper - not only does it describe the results and discussion in detail, it emphasizes the importance of the results in the field, and ties it in with the previous research. Some research papers require a recommendations section, postulating that further directions of the research, as well as highlighting how any flaws affected the results. In this case, you should suggest any improvements that could be made to the research design [3].

References

[1] G. Anderson. (2016) The structure, format, content, and style of a journal-style scientific paper. [Online]. Available: http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWsections.html

[2] J. Yu and P. Chong, ''A survey of clustering schemes for mobile ad hoc networks,'' *IEEE Communications Surveys & Tutorials*, vol. 7, no. 1, pp. 32--48, 2005.

[3] M. Shuttleworth. (2016) Writing methodology. [Online]. Available: https://explorable.com/writing-methodology

[4] J. Widom. (2006) Tips for writing technical papers. [Online]. Available: https://cs.stanford.edu/people/widom/paper-writing.html

Appendix A About Appendices

Appendices should contain detailed proofs and algorithms only. Appendices can be crucial for overlength papers, but are still useful otherwise. Think of appendices as random-access substantiation of underlying gory details. As a rule of thumb: (1) Appendices should not contain any material necessary for understanding the contributions of the paper. (2) Appendices should contain all material that most readers would not be interested in [4].

Appendix B Assessment

Your report will be assessed based on the following list of criteria.

Appendix B.1 Style

[15 points] The report states title, author names, affiliations and date. The format follows this style?

1. Structure and Organization: Does the organization of the paper enhance understanding of the material? Is the flow logical with appropriate transitions between sections?
2. Technical Exposition: Is the technical material presented clearly and logically? Is the material presented at the appropriate level of detail?
3. Clarity: Is the writing clear, unambiguous and direct? Is there excessive use of jargon, acronyms or undefined terms?
4. Style: Does the writing adhere to conventional rules of grammar and style? Are the references sufficient and appropriate?
5. Length: Is the length of the paper appropriate to the technical content?
6. Illustrations: Do the figures and tables enhance understanding of the text? Are they well explained? Are they of appropriate number, format and size?

Appendix B.2 Abstract

[10 points] Does the abstract summarize the report? These are the basic components of an abstract in any discipline:

1. Motivation/problem statement: Why do we care about the problem? What practical, scientific, theoretical or artistic gap is your research filling?
2. Methods/procedure/approach: What did you actually do to get your results? (e.g. analyzed 3 novels, completed a series of 5 oil paintings, interviewed 17 students)
3. Results/findings/product: As a result of completing the above procedure, what did you learn/invent/create?
4. Conclusion/implications: What are the larger implications of your findings, especially for the problem/gap identified?

Appendix B.3 The Problem

[15 points] The problem section must be specific. The title of the section must indicate your problem. Do not use generic titles.

1. Is the problem clearly stated?
2. Is the problem practically important?
3. What is the purpose of the study?
4. What is the hypothesis?
5. Are the key terms defined?

Appendix B.4 Background and Related Work

[15 points] Does the report present the background and related work in separate sections.

1. Are the cited sources pertinent to the study?

2. Is the review too broad or too narrow?
3. Are the references recent?
4. Is there any evidence of bias?

Appendix B.5   Design

[15 points] Does the report present the design of the study.

1. What research methodology was used?
2. Was it a replica study or an original study?
3. What measurement tools were used?
4. How were the procedures structured?
5. Was a pilot study conducted?
6. What are the variables?
7. How was sampling performed?

Appendix B.6   Analysis

[15 points] Does the report present the analysis?

1. How was data analyzed?
2. Was data qualitative or quantitative?
3. Did findings support the hypothesis and purpose?
4. Were weaknesses and problems discussed?

Appendix B.7   Conclusion and Future Work

[15 points] Does the report state the conclusion and future work clearly?

1. Are the conclusions of the study related to the original purpose?
2. Were the implications discussed?
3. Whom the results and conclusions will effect?
4. What recommendations were made at the conclusion?