LECTURE -10

Writing Research Articles

Course Instructor

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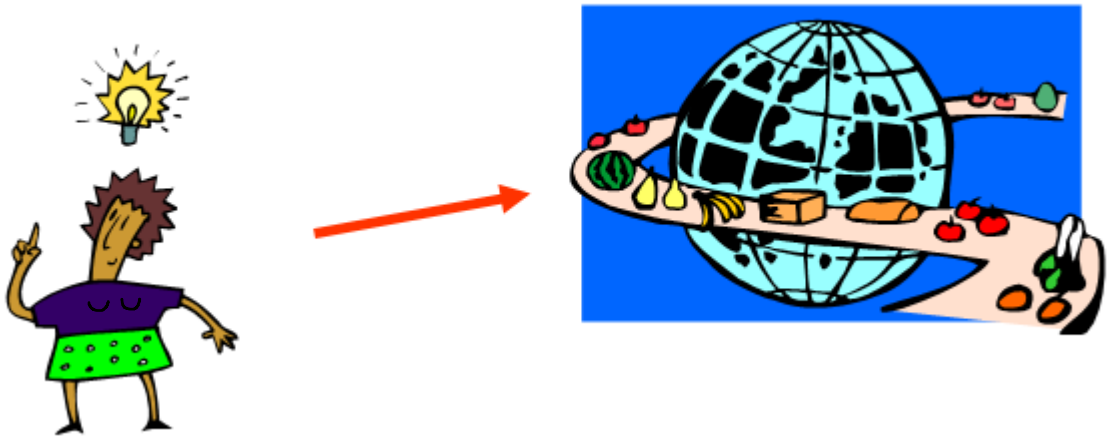
What is Research?

- Discovery of new things that have been independently verified by other professionals.
- Contribution to the existing knowledge in some way.
- Something new to humanity (not just new to you or your group).



Problem Identification for Research

- The most important step in research is problem identification (i.e. the problem that you want to work on or address).
- If the answer to a research question is very simple or obvious, then we are dealing with a routine engineering exercise that can be solved without further research.

Not Every Problem is a Research Problem!

- This is also a problem, but can be solved with existing techniques.
- Remember: Not every problem is a research problem.

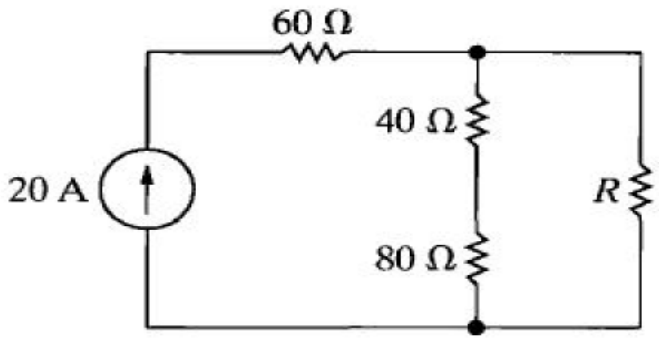


Figure 1: Figure to consider for Question 1 part a, b and c.

Part a (3 marks) Find the value of R that will cause 5A of current to flow through 80Ω resistor in the circuit shown in Figure 1?
Part b (3 marks) How much power will the resistor R from part (a) need to dissipate?
Part c (4 marks) How much power will the current source generate for the value of R obtained in part (a)?

Structure of Research Articles

- The research article usually has the following components.
  - Title.
  - Abstract.
  - Introduction.
  - Literature Review/Related Work.
  - Methodology.
  - Results and Discussion.
  - Conclusion.
  - Acknowledgement.
  - References.

I. Title

- 10-15 words is most common.
- Must be sufficiently specific.
- Some Examples
  - **Deep learning approaches for flood classification and flood aftermath detection.**
  - **Active Learning for Event Detection in Support of Disaster Analysis Applications.**
  - **PSO and Genetic modeling of Deep Features for Road Passibility Analysis during Floods.**

2. Abstract

- It is a summary of a body of information, it expresses the main claim and argument of a paper.
- Should be consistent with the title of the paper.
- Broadly, should have 6-7 sentences:
  - 2 sentences about the research area/title area and its significance.
  - 2 sentences about the proposed methodology work.
  - 2 sentences about concluding results/ simulations / experiments.

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Abstract Contents

- A good abstract answers the following questions.
  - Why did you do this study or project?
  - What did you do and how?
  - What did you find?
  - What do your findings mean?

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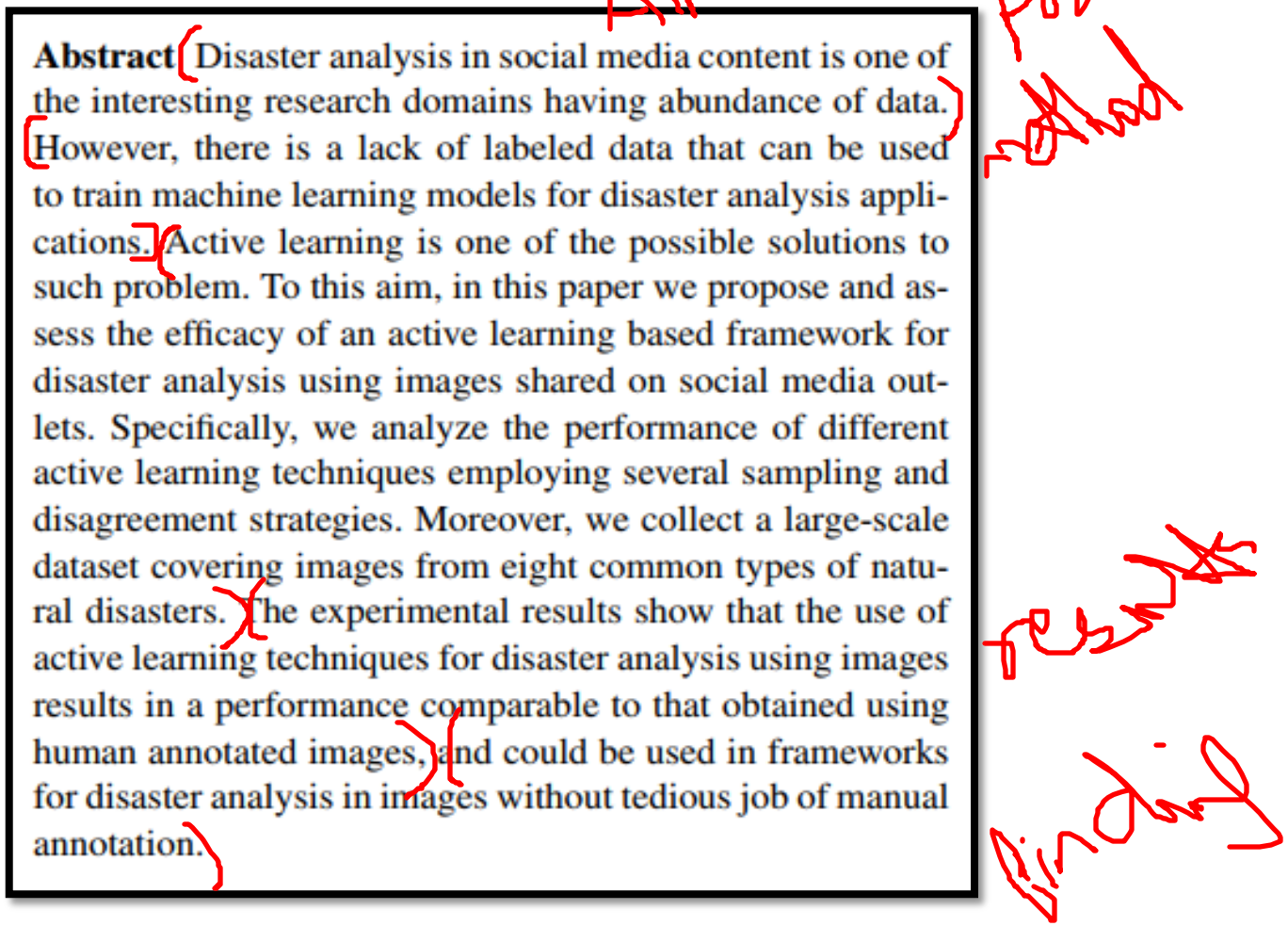
Abstract Example



Abstract Disaster analysis in social media content is one of the interesting research domains having abundance of data. However, there is a lack of labeled data that can be used to train machine learning models for disaster analysis applications. Active learning is one of the possible solutions to such problem. To this aim, in this paper we propose and assess the efficacy of an active learning based framework for disaster analysis using images shared on social media outlets. Specifically, we analyze the performance of different active learning techniques employing several sampling and disagreement strategies. Moreover, we collect a large-scale dataset covering images from eight common types of natural disasters. The experimental results show that the use of active learning techniques for disaster analysis using images results in a performance comparable to that obtained using human annotated images, and could be used in frameworks for disaster analysis in images without tedious job of manual annotation.

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Things to Avoid in Abstract

- Do not cite literature in abstract.
- Do not use paragraphs/sections.
- Do not use equations in abstract.
- A thesis abstract is different than paper abstract (in the sense that it can have multiple paragraphs).

3. Introduction

- The primary purpose of an introduction is to frame the paper for its readers. It should provide
  - Brief description of the topic.
  - Statement as to why the topic is worth researching or why it could be found interesting.
  - Statement of the research objectives.
  - Statement of the method(s) and the scope of study.
  - An overview of the rest of the paper.
- In introduction, you start generally and then get to more specific details about your research work.

4. Literature Review

- Review of the existing work relevant to the research topic.
- Four guide questions for literature review:
  - What is the present state of knowledge regarding the topic under consideration?
  - How are the studies related to the one being proposed?
  - What is the quality of the studies reviewed?
  - How will the proposed study contribute to the existing literature?

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- Literature review should be related to your problem – not the whole area that you are working in.
  - For example, do not talk about computers (like when they were invented, or what are their advantages).
- Remember: Every paper that you read is not a part of your literature review.
- You may read, say, 40 papers related to your research, but can you use all of these 40 papers in literature review?

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- You may not need to cite all papers in literature review.
- If you cite a paper in literature review, then you need to write at least the following 2 main sentences about that paper:
  - **The main contribution of that paper.**
  - **The limitation of that paper.**
- A good research paper/proposal/thesis always mentions about the limitation of previous research papers.
- Be polite when writing the limitations of a paper. Research community all over the world has polite people and nice writings.

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- **Question: How do I find the key papers in my research area?**
  - Pick a famous or renowned paper in your research area, and see all the references, and then read all those referenced papers.
- **Another question: Will you always understand a paper by reading it once?**
  - No, you may need to read a paper twice, thrice and so on. You might still not completely understand a paper after your defense!
  - Understanding a paper is not a very easy job.

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Key to a Good Literature Review

- Find research groups working in your area.
- Good universities have research groups composed of professors, post-doc fellows, PhD and MSc students.
- Find those research groups, follow their papers and their thesis.
- Download PhD and MSc thesis of students who have graduated working with a research group.
- Thesis are usually more helpful compared to journal/conference papers, as thesis have more details compared to papers.

5. Methodology

- Methodology section is written
  - To demonstrate that you are aware of the research methods used to conduct this research.
  - To justify the research method and approach you have taken.
  - To explain and justify the method of data collection and analysis.

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Methodology Guidelines

- Should be written in past tense.
- May include tables and figures — for example:
  - Flowcharts.
  - Diagrams of apparatus.
  - Tables of experimental conditions.

6. Results

- The core of the paper.
- Presents key findings with respect to the central research question.
- Presents secondary findings (secondary outcomes).
- Often includes tables and figures.
- Presents results but not comment on them.
  - Some journals, however, combine the results and the discussion sections.

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Results Guidelines

- Should be written in past tense.
- Are often presented in the form of tables and figures.
- Text should present only the main points from the tables and figures.
- Details should be clear from the table or figure.
- Mention every table and figure in the text.

7. Discussion

- One of the most difficult parts to write, because the writer has more choice of what to say.
- Often should begin with a brief summary of the main findings.
- Should answer the question(s) stated in the introduction (or address the hypotheses stated in the introduction.

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Discussion Possible Content

- Strengths of the study.
  - For example, superior methods, extensive data.
- Relationship to findings of other research, for example
  - Similarities to previous findings (your own and others').
  - Differences from previous findings.
  - Possible reasons for similarities and differences.
- Applications and implications — for example
  - Possible uses of the findings in policy and practice.

8. Conclusion

- The conclusion section is written
  - To sum up your findings and highlight the significance of the outcomes of your study.
  - To outline any implication or recommendations indicated by the findings.
  - To Indicate any future directions to enhance the research work.

9. Acknowledgment

- A place to thank people who helped with the work but did not make contributions deserving authorship.
- Sometimes the place where sources of financial support are stated.

10. References

- References is the list of all the reference materials that have been cited in the text of the paper.
- Adds credibility to your work by showing that you used valid information sources.
- Should contain all sources cited in the text.
- Various formats exist for citation in text — for example
  - Accuracy of references is important (Day & Gastel, 2011).
  - Accuracy of references is important [3].
- Should consistently follow one recognizable system.

Assignment

- Write down the Abstract and Literature Review for your potential FYP proposal.
- This is a group assignment (groups of 3)
- For the literature review, each member of the group should read 3 papers and then write the literature review according to the guidelines.
- Find out about various referencing styles and use one consistently for this assignment.
- Submit the assignment to google classroom before the next week class.

Acknowledgment

The content presented in this lecture is partly inspired by Prof. Dr. Khalid Mehmood's (University of Punjab) lecture on HOW TO WRITE A JOURNAL ARTICLE.