

Network Science Course (LTAT.02.011)

Projects

Project submission is part of the *Network Science* course and carries 30 marks (out of 100). You can submit the project individually or in groups. However, the maximum number of group members cannot be more than 3. In Section 1, you can find information about various milestones. Section 2 provides detailed information regarding the Project Presentation and Report. Section 3 provides information regarding examples of good and bad projects.

Section 1: Milestones

Milestones	Description	Deadline	Marks
Milestone1	Register your group (at a maximum 3 students in one group) and topic using the link .	15 April	2
Milestone2	Prepare related work section and share it with us using one of the provided report formats: 1. Microsoft Word 2. Latex source code 3. Overleaf latex	29 April	5
Milestone3	Update the previously shared report and include the Dataset and Methodology sections	13 May	5
Milestone4	Project presentation (including results)	27 May	10
Milestone5	Submit the final report and code	2 June	8

Section 2: Detailed information about project output.

Outcome of project will be judged based on 2 things:

- 1) Presentation of 15 mins, including Q and A [Presentation should not be longer than 10 mins and 5 mins for Q and A]. Total Marks: 10 points
Presentation should include 1) problem statement, 2) motivation behind selecting this problem, 3) description of the dataset used, 4) methodology employed, 5) Results (Qualitative: Visualizations, and Quantitative: Tables, numbers, etc.), 6) Conclusions
- 2) Report [18 points: These points will be earned as part of Milestones 2 (5 points), 3 (5 points) and 5 (8 points)]: 4 page report (PDF) in IEEE style.
 1. **Abstract:** 150 - 200 words
 2. **Introduction:** should have Background of the problem, problem description, motivation behind picking this problem, and methodology being employed, and short results summary. (approximately 1000 - 1100 words)

3. **Related work:** Should have at least 5 to 6 related/relevant papers (more are also welcome). This section should be around 300-400 words.
4. **Dataset:** Describe the dataset you have selected - source of the dataset, data cleaning, and some descriptive analysis if you have performed (Second lecture of the course). Link to your github account containing source code and dataset.
5. **Methodology:** What is your approach (use some Figures if possible like Flowchart, to describe it).
6. **Results:** Here you should have some Qualitative (Visualizations), Quantitative (Tables, numbers, etc.)
7. **Conclusions:** No more than 300 words.
8. **References:** List of papers being discussed in the paper.
9. **Github:**
 - 9.1) **source code and Dataset:** Please put a link to your source code (for example, github) of your project in Report and also in the presentation. Also, do provide the link to the dataset which is being used in your project. Share the exact dataset on github, which you used for your project.
 - 9.2) **Readme File:** Installation/Execution guide about how to run the code.

IEEE style formats for report:

1. [Microsoft Word](#)
2. [Latex source code](#)
3. [Overleaf latex](#)

Section 3: What is a good and bad project.

3.1 Examples of a **Good** Projects

- 1) Graph embedding and graph neural networks: Analyzing the network dataset by exploring network properties. You are free to select any publicly available dataset (reasonably large. For example, 10,000 or more) and then using any graph embedding (node embedding, edge embedding) or graph neural network techniques for clustering/predictive tasks. Note: for predictive (classification or regression) tasks, you should have the ground-truth labels available in the dataset itself. Also, try various parameters of the pre-defined functions of graph embedding (such as changing the number of dimensions of a vector) or graph neural networks (such as changing the number of neurons) and report how various parameters' settings results are different from the default values.
- 2) Knowledge graphs: Using a large corpus of text, apply Knowledge Graph for clustering/Predictive tasks. Note: for predictive tasks (classification or regression), you should have the ground-truth labels available in the dataset itself. Also, try various parameters of the pre-defined functions of the knowledge graph and report how various parameters' settings results are different from the default values.
- 3) Empirical/Prediction Analysis: Take a large network dataset or make a network from the publicly available dataset (reasonably large. For example, 10,000 or more nodes). For example, a large scale transportation network dataset of a city.

3.1) Do some pre-processing. For example, remove nodes which are disconnected or very low number of edges (There should be a proper reasoning for doing that)

3.2) Identify some interesting patterns: Traffic (weights on the edges) during weekdays is more than weekends.

3.3) Identify which parts of the network are central: What is your interpretation about it ? Why you picked a specific centrality measure.

3.4) Now you apply a certain algorithm (for example, link prediction algorithm) for some predictive tasks.

3.5) If you do not wish to do task (3.4) then you might like to see how the network evolves (temporally). From 9 am to 12 noon, there are interesting patterns in the center of the network at a certain part of the network, but after 12 noon to 14 there is another part of the network (city), which attracts more traffic. Also, different parts of the city can be put in different clusters and each cluster has certain characteristics.

3.6) Why do accidents happen more often in a certain part of the city ?

3.7) You can also compare network dataset with other kinds of dataset. For example, mapping transportation network of a city with the economic status (of different part) of the city

3.2 Example of a **Bad** Project

Analysing communities in Karate Club through Visualizations and report the central nodes of the network using various centrality measures

Section 4: Project Entries:

<https://docs.google.com/spreadsheets/d/13G3JivUg8QVvxTQVrMoxwt7qZ9TpErF55UDEAkgT2U/edit?usp=sharing>