

## **ENGR 518 Term Project**

One of the assessments that will be used in ENGR 518 will be a term project. In this project, groups of students will implement machine learning algorithms in Python. The assessment will include the following:

- 1) Preliminary report (10% of course grade)
- 2) Final report (30% of course grade)

Combined with 10% on assignments, 30% on the midterm, and 20% on the final exam, this will constitute the total 100% of the course grade. Students must score a passing grade on the project (>20%) in order to pass the course.

### **Groups**

Students will work on the projects in groups of four. The groups will be determined at the beginning of the term. All group members are expected to contribute to their assigned project. Group members are encouraged to resolve any potential conflict internally early enough to make sure that every member is committed to doing their task. If a conflict cannot be resolved internally, a complaint can be made to the instructor who will meet with the group and assess the situation. Grades may be deducted from members who do not contribute to their project. The final exam of the course will be a short final exam focusing on questions on the project.

### **Project Selection and Description**

Students are required to propose their own projects, which will be studied by the instructor and approved if appropriate. Specifically, once any group agreed on a project, they have to send a brief description (not greater than 300 words) of it by email to the instructor for approval. Some datasets available through <https://www.kaggle.com/datasets> may be useful to inspire some good projects. The students can also select a project from the list shown at the end of this file. A description of each project is posted on Canvas. Project selection should be finalized as soon as possible after the beginning of the term. The deadline for project selection is the 28th of September 2022.

### **Project Execution and Evaluation**

The main steps of a machine learning project is as follows:

- 1- Look at the big picture
- 2- Collect the data
- 3- Discover and visualize the data to get insights
- 4- Prepare the data to be ready for machine learning algorithms
- 5- Select a model and train it
- 6- Fine-tune your model
- 7- Present your solution
- 8- Write a report that discusses the previous points and analyses the results

Please note that if the model does not perform well, you may consider collecting more data to improve its performance.

Projects must be implemented in Python. Students will implement their algorithms and submit their code and datasets in addition to reports. Students **cannot** use existing machine learning toolboxes and functions, and must implement their own functions.

- 1) **Preliminary report (10%):** This report is intended to be your first milestone towards completing the project. You must follow the report template on Canvas, with a maximum length of 5 pages excluding references. The report must include information about the collected data, properties of the data, in addition to a plan regarding the machine learning algorithm that you intend to implement based on your analysis of the data. Use of figures, flowcharts, pseudocodes, and tables is encouraged. For instance, you can include some plots obtained from the data, in addition to conclusions regarding what methods you will be using in the project in light of these plots.
- 2) **Final report (30%):** The final report must follow the template on Canvas, and must be 6 pages maximum in length excluding references. The report must clearly explain the methods and results and discuss methods that can be used to improve the results. The report must especially explain clearly any function that you use that has not been explained in the class. Use of figures, flowcharts, pseudocodes, and tables is encouraged. In addition to the report, each group must submit their code in the form of a Python notebook (\*.ipynb), in addition to their datasets in a zip file. To avoid losing marks, make sure that your code includes a header comment with the group number, the names of the team members, and the project title. Also, make sure that your code is well commented and easy to follow. Your Python notebook must be named 'ENGR\_518\_group\_x.ipynb' where x is the group number. The datasets must be placed in a folder with the name 'ENGR\_518\_group\_x\_datasets', and then compressed into a zip file. The contents of this folder (files and folders) must be named such that they can be called from your python notebook (i.e., same names that you used during your project execution). Both the report, code, and datasets must be submitted before the deadline, which is the scheduled date of the final exam (to be determined later). The grade of the final report will be split equally between the code and the report.

In addition to the reports and code, some questions in the final exam will be used to assess your understanding of the project and its considered methods.

### Reports

Reports must be written in 12pt font, Times New Roman, with 1 inch margins, and must be no longer than 6 pages excluding references. They must be submitted in pdf format. You may include figures, tables, flow-charts, etc., as deemed necessary. Readability, presentation, and structure of the report will be also evaluated. More details on the structure of the report are given in the report template on Canvas. The 6-page limit is a soft limit, but you are encouraged to avoid exceeding this limit. Your datasets and code must be submitted in separate files along with the report.

### Projects list

In case any group could not come up with their own project, here are some project topics that can be adopted by students groups:

- 1) Circle detection
- 2) UAV landing: Flat ground detection

- 3) Decoding random codes classification
- 4) Solar energy classification
- 5) Square detection
- 6) Text clustering
- 7) Water Quality: Thiabendazole Prediction
- 8) Solar energy prediction
- 9) TBD
- 10) TBD

The detailed descriptions of the projects can be found in the zip file 'Project descriptions.zip' on Canvas.