University of Waterloo
Department of Electrical and Computer Engineering
ECE 602 – Introduction to Optimization
Winter, 2024

Final Project: Description & Requirements

Principal idea

The main idea of the final project consists in reproduction of the results of selected research publication using the knowledge of the concepts and methods of numerical optimization. To this end, each student has been assigned a research publication that describes an optimization-based solution to an applied engineering problem. The principal objective is to understand the problem and the proposed solution as well as to reproduce the results reported in the paper using either MATLAB® or NumPy®. While the use of CVX is permitted (and even encouraged), the use of publicly available codes (provided, e.g., by the authors) is strictly forbidden.

Project format

The project reports have to be submitted *in the form of an HTML document* containing a problem statement, a brief description of the proposed solution as well as your code, results and conclusions. If you choose to write your code in NumPy®, such a document can be composed using Jupyter Notebook®, followed by its conversion to HTML (`https://mljar.com/blog/jupyter-notebook-html/`). Alternatively, if you choose to use MATLAB®, the project can be put together directly in MATLAB Editor®. In this case, the HTML file(s) will be generated by means of MATLAB's publishing tools (`http://www.mathworks.com/help/matlab/ref/publish.html`). As shown in Figure 1, conversion of m-files to HTML is a single-click procedure.

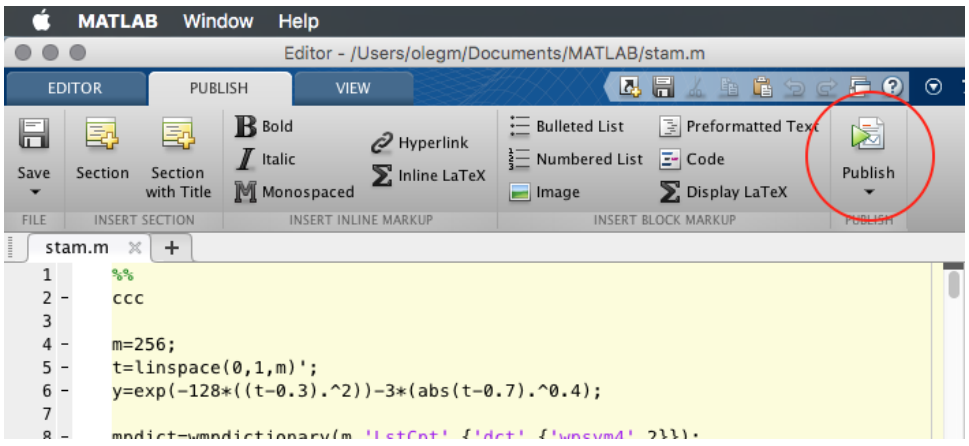

Figure 1: MATLAB editor publishing tools.

It is important to note that MATLAB Editor® offers a range of markup tools which can be used to make your report well-structured, consistent, and more presentable.

Before you start, please see the examples of course projects from earlier year available at:

`http://www.uwaterloo.ca/ece602/projects.html`

Regardless of the choice of programming language, the source file of your project should consists of:

1. Project title and your name,
2. Concise formulation of the problem being addressed (no literature reviews are necessary; just a clear description of the problem to be solved),
3. Proposed solution and its related optimization problem (minimization problem to be solved with its parameters and optimization variables; overall algorithmic workflow),
4. Data source(s) and numerical solution (either an apt description of how the data have been synthesized/generated or specification of alternative data sources; description of problem parameters),
5. Demonstration of results (similarly to what is done in the original paper), and
6. Summary & conclusions (Have you been able to reproduce the results reported in the original paper? Did the algorithm behave as described by the authors? Do your own conclusions support those made by the authors? What are the drawbacks (if any) of the proposed solution?).

Each student will be expected to submit (via UW Learn) a zip-archive named `project.zip` containing:

1. A source file (e.g., `main.m`) and its associated `main.html`
2. All related files required for viewing `main.html` in a standard Internet browser, and
3. All related subroutines required for running the main code.

Further notes

When working on the project, you are allowed to make the following simplifications:

1. Using real-life data is optional (demonstration of your results on synthetic data should suffice, as long as the demonstration is clear, sound, and informative).
2. Reproducing the results of reference methods is optional.
3. If there are more than one solution proposed by the authors in the original paper, you are free to implement only one of them.

The students should do their best to try to implement their assigned algorithms. If, for some reasons, your algorithm keeps either diverging or exhibiting unstable behaviour (e.g., division by zero, occurrence of `Inf`'s and/or `NaN`'s, memory overflow, etc), you should try either to propose an effective workaround or, at the very least, explain why, in your opinion, the above problem happens. Simply concluding "it does not work" is not an admissible answer.