University of Waterloo
Department of Electrical and Computer Engineering
ECE 417 – Image Processing
Winter, 2019

Final project description and requirements

Principal idea

The fundamental idea of the project is to let the students reproduce the results of published research using their knowledge of the basic methods of image processing. To this end, each project team (up to three students) will be assigned a scientific paper that describes a solution to some problem. The project teams are expected to understand the problem at hand and be able to reproduce the results reported in the paper. It is expected that the students will mainly use the image processing toolbox of MATLAB (`https://www.mathworks.com/products/image.html`). Under no circumstances, the students are allowed to use publicly available codes provided by the authors or other researchers.

Project format

The final projects will have to be submitted in the form of HTML documents generated by means of MATLAB's publishing tools (`http://www.mathworks.com/help/matlab/ref/publish.html`). A particularly simple and efficient way to use these tools is offered by MATLAB's editor, which allows one to convert an m-file into a bona fide webpage by merely clicking the "Publish" button (as it is shown in Figure 1). It is worthwhile noting that the editor also offers a scope of convenient means to create sections and subsections, use text formatting, create bulleted and numbered lists, as well as to incorporate formulas through the use of inline LaTeX facilities. All this should help you make your final submission presentable, well-structured, and informative.

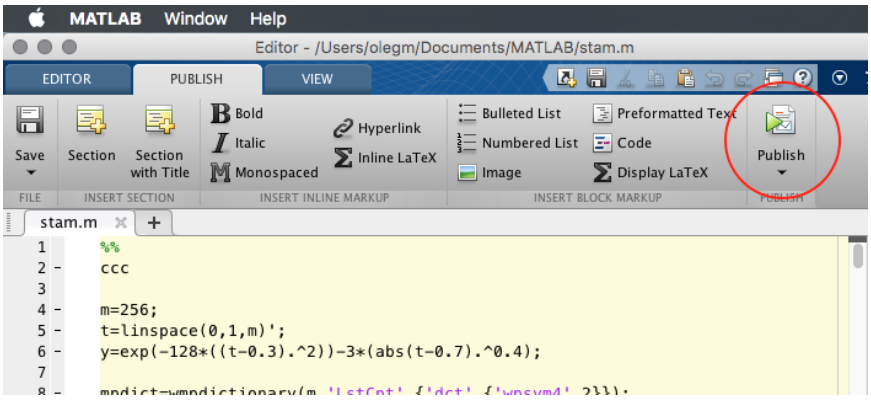

Figure 1: MATLAB editor publishing tools.

To create a successful report, it is necessary to start with a MATLAB code, which should consist of three parts: 1) data synthesis/import; 2) numerical solution, and 3) visualization. Subsequently,

the code needs to be properly commented to clarify the objectives and results of the project, as well as any relevant conclusions. Specifically, an admissible report should include the following sections:

1. Problem formulation (no literature reviews are necessary; just a clear description of the problem to be solved).
2. Proposed solution (overall algorithmic workflow of the proposed algorithm).
3. Data sources (either a description of how the problem data have been synthesized/generated or specification of alternative data sources; description of problem parameters).
4. Solution (some necessary details on the structure of the algorithm).
5. Visualization of results
6. Analysis and conclusions (Have you been able to reproduce the results reported in the original paper? Did the algorithm behave in a predictable way, i.e., as described by the authors? Do you own conclusions support those made by the authors? What are the drawbacks (if any) of the proposed solution?)
7. A list of (linked) custom source files/functions necessary for your implementation of the algorithm.

A very nice example on how to create such a project report is available at:

`http://www.mathworks.com/academia/matlab-examples/index.html`

Further notes

When working on the project, you are allowed to take advantage of the following simplifications.

1. Python and Jupiter-Notebook can be used instead of MATLAB. However, the report will still have to be submitted in the form of an HTML document.
2. Using real-life data is optional (demonstration of your results on synthetic data should suffice, as long as the demonstration is clear, unambiguous, and informative).
3. Reproducing reference methods is optional.
4. If there are more than one solution proposed by the authors in the original paper, you are free to pick and implement only one of them.

Finally, 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, occurance 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.