2D Computer Graphics and Image Processing
Assignment 7: Hough Transform

Due: December 4th, 2018

Abstract

In this assignment we will implement the Hough Transform to detect lines.

Instructions are provided first for a reason.
Please read the instructions carefully.

1 Instructions

1.1 Submission package

Within the homework assignment package, there should be a `submission-package.zip`, which contains the directory structure and empty files for you to get started. Please edit the contents within the file for code, and then create a `zip` archive with the file name `submission-package.zip`, and submit it. **Do not use other archive formats such as `rar` or `tar.gz`.**

All assignments should be submitted electronically. Hand written reports are **not** accepted. You can, however, include scanned pages in your report. For example, if you are not comfortable with writing equations, you can include a scanned copy.

1.2 Code

All assignments should be in `Python` 3. Codes that fail to run on `Python` 3 will receive 20% deduction on the final score. In other words, do **not** use `Python` 2.7.

For this assignment, you should **not** need to create additional files. Fill in the skeleton files in the submission package. Do **not** change the name of these scripts. Your code should run as specified by the assignment specs by simply doing

```
python solution.py
```

in the command line. Do **not** expect additional command line arguments as input.

It is **strongly encouraged** to follow `PEP8`. It makes your code much more readable, and less room for mistakes. There are many open source tools available to automatically do this for you.

1.3 Delayed submission

In case you think you will not meet the deadline due to network speed or any other reasons, you can send an email with the `SHA-256` hash of your `.zip` archive first, and then submit your assignment through email later on. This will **not** be considered as a delay.

Delayed submissions are subject to 20% degradation per day. For example, an assignment submitted 1 minute after the deadline will receive 80% of the entire mark, even if it was perfect. Likewise, an assignment that was submitted one day and 1 minute after the deadline will receive 60%.

1.4 Use of open source code

Any library under any type of open source license is allowed for use, given full attribution. This attribution should include the name of the original author, the source from which the code was obtained, and indicate terms of the license. Note that using copyrighted material without an appropriate license is not permitted. Short snippets of code on public websites such as StackOverflow may be used without an explicit license, but proper attribution should be given even in such case. This means that if you embed a snippet into your own code, you should properly cite it through the comments, and also embed the full citation in a LICENSES file. However, if you include a full, unmodified source, which already contains the license within the source file, this is unnecessary. Please note that without proper attribution, *it will be considered plagiarism.*

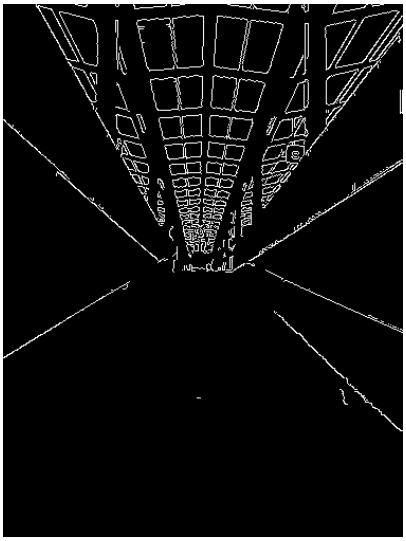
In addition, as the assignments are intended for you to learn, (1) if the external code implements the core objective of the task, no points will be given; (2) code from other CSC205 students will count as plagiarism.

2 Hough Transform to detect lines (10 marks)

Implement `solution.py` according to the specification in the comments. Note that a lot of the starter code is already done for you. Places that you will have to implement yourself is marked as `TODO`. Implement the TODOs. Detailed instructions on the implementation specifications are provided as comments in the starter file. This assignment is heavily tied with lecture 29 and lecture 30.

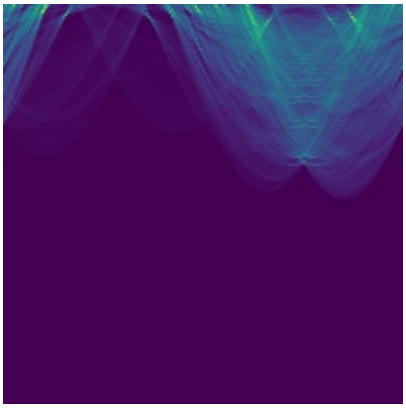
This time, the there is a two-tier system for the marks. Even when your implementation is correct, it will run painfully slow if implemented using for loops. To get full marks, you should not use any loops when implementing the `TODO`s.

The multiple `imwrite` calls should generate the following images. They are also included in the package file for you to compare against.

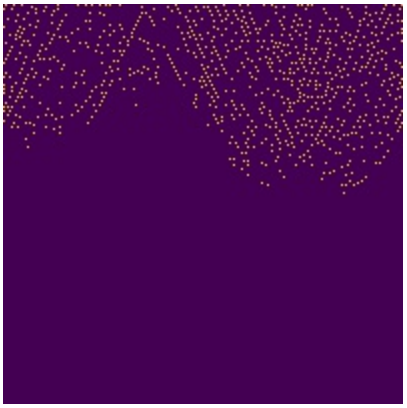


(a) Edges

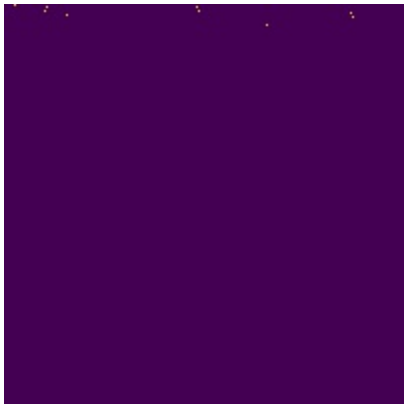
(b) Result



(c) Accumulator



(d) Non-Maximum Suppression result



(e) Top selected points

Figure 1: Reference results.