

Introduction to Spatial Computing- CSE 5ISC

Homework 2

Due date: Sept 18, 2015 23:59pm

Instructions:

- All submissions must be made through usebackpack site for this course (www.usebackpack.com/iiitd/m2015/cse5isc/info)
- Only one submission per team would be considered and graded. It would be assumed that all members of the team participated equally and same score would be given to all members of the team.
- Any assumptions made while solving the problem should be clearly stated in the solution.

Question 1 (40 points)

Game of life is a binary-valued field defined over a rectangular grid of cells. A cell has a value of "occupied" (represented by number 1) or "unoccupied" (represented by number 0) in a given generation. A simple neighborhood is defined using eight cells sharing a corner or an edge, i.e. adjacent horizontally, vertically or diagonally. A new generation is defined using following rules:

1. An occupied cell with two occupied neighbors remains occupied.
2. An unoccupied cell with two or three occupied neighbors becomes occupied.
3. All other cells become unoccupied.

- (a) Write a pseudocode which takes the binary field containing a generation as an input and outputs a new generation.
- (b) Derive a map algebra expression to return a new generation from the last generation. Your answer should include a description of all “mini-expressions” which are part of the final map algebra expression. Also, give a detailed explanation if you feel that a map algebra expression cannot be derived for these rules. Your final expression can use the following operators. If needed you are free to define your own local, focal or zonal operators.

1. Add(Field F, Field G): Increase each element in F by corresponding element of G
2. Subtract(Field F, Field G): Reduce each element in F by corresponding element of G
3. Multiply_int(Field F, integer J): Multiply each element in F by integer J
4. Multiply_field(Field F, Field G): Multiple each element in F by the corresponding element of G
5. Focal_Sum(field F, Neighborhood_size N): for each element in F, computes sum of values in the square neighborhood of size N by N cells. One may use N = 3 to define the neighborhood with 8 adjacent cells.
6. Threshold(field F, integer J): Replace each element of F by 1 if the element is smaller than or equal to J. Otherwise the element is replaced by 0.

Note: (a) The above defined operators take their parameters “by value” and not “by reference.” This in turn implies that the all the operators defined above would return a Field. (b) For the purposes of this question assume that operation is done on all cells simultaneously. For example, the operator Add(Field F, Field G) would perform the operation on all cells of Field F simultaneously. Of course the standard rules of function compositions apply.

Hint: (a) Determine all possible combinations of values of cell (occupied or unoccupied) and its neighbors (occupied or unoccupied) and attempt to derive a mathematical equation which incorporate the above mentioned rules for next generation. (b) This mathematical equation would be written in terms of the above mentioned map algebra operations.

Question 2 (40 points) Programming Based

For this question you would be using the Twitter location API to study the tweets coming from some locations. Twitter APIs (<https://dev.twitter.com/overview/documentation>) come in many languages (e.g., PHP, Ruby, Java etc). You are free to choose any language you want. If you decide to use Java, then Twitter 4J (<http://twitter4j.org/en/index.html>) is a nice set of libraries which can be used for this question.

Problem Description: Collect tweets (for about half a day) from following three regions: (1) Northern New Delhi. (2) South Delhi, (3) Mumbai. Define the bounding boxes for these regions appropriately. Use the google API to get the latitude longitude information to define the bounding boxes. Determine the following:

- (a) What are the top-3 most frequent hashtags (need to extract these from the tweets) in each of these regions?
- (b) How many tweets contain (extract the text portion of the tweet) the keywords “cricket” “bollywood” “Shahrukh (or pic your favorite actor/actress)” “traffic” in each of these regions?

Some helpful links:

Getting started with twitter:

<http://www.java-tutorial.ch/framework/twitter-with-java-tutorial>

<http://alvinjayreyes.com/2012/01/02/twitter-api-on-your-java-application/>

Twitter 4J:

<http://twitter4j.org/en/index.html>

Filter method:

<http://twitter4j.org/javadoc/twitter4j/TwitterStream.html#filter-java.lang.String...->

What twitter data looks like?

<http://badhessian.org/2012/10/collecting-real-time-twitter-data-with-the-streaming-api/>

Filter example:

<http://stackoverflow.com/questions/10938076/can-i-request-filter-the-twitter-streaming-api-to-return-only-tweets-with-geotag>

<http://davidcrowley.me/?p=513>

Note on filter

<http://stackoverflow.com/questions/18233641/twitter4j-getting-tweets-outside-of-the-bounding-box>

Things to be submitted: A zipped folder containing the following items. Please include your team information with the submission.

- (a) A pdf file containing the solution of Question 1 and Question 2.
- (b) Java code for Question 2.