**Test and issues**

This document mainly focuses on testing and issues encountered during the experiment. And the test idea and the outcomes of issues are described in it.

**Test**

The unit test is used to test a part of code. General idea is using specific values for variables in a function and comparing them with expected output. The process used for this is weighted raster in model.py. The variables used are geology, transport and population weights and initial raster data are defined manually and randomly. The test is successful in the end.

**Issues encountered during coding**

1. The first issue that encountered during the experiment is the final result which has been weighted and rescaled can’t be changed with scales. In the new GUI, the final result is displayed only with initial value and when scales changing, it doesn’t have any variation.

The reason of the problem is although there is a plot() function with weighting and rescaling loops and the necessary components like scale, scale label and figure are correct, the connection in these parts is missing. The methods used to solve this problem are two steps. The first step is creating a new function called update(), which is composed of a updating command and label. The updating command is come true by using get() function, which is combined with raster weights. When raster weight is changed by users, the values also will be changed. The second step is calling raster weights in update() function in plot(). Through adding three raster weights (gw, tw, pw) as positional arguments in plot(), the final result in GUI can be changed with update().

2. The second issue that encountered in the process is when the GUI window containing three input raster files, the final result disappears. Because final result is realized before displaying, final result is influenced by other figures and canvases. And there are three windows in total, which is GUI, figure 1 and figure 2 respectively.

Much time is spent on solving final result disappearance and pop-ups problem due to incomprehension on what kinds of reasons cause these. Many methods are used to figure out like changing the way to create subplots, plots and canvas, changing the locations of each canvas, closing canvas or figures in plot() and GUI. Seems like adding some subplots and canvas effects the call function for plotting and updating. After multiple attempts, the final result appears in the GUI, and three subplots are displayed in the left canvas through closing some figures in or out of functions, initializing and defining figures and decide where to close them in the plot() function and GUI. To avoid the effects of former canvas, I try to create new final result to overlap on the old ones and adjust the size of new canvas to make them look the same. As for pop-ups, it is solved by adding “matplotlib.use('Agg')” sentence at the beginning of codes. So far, the input raster files, final result and scales are displayed in only one window.

3. The third problem encountered during coding is there are a lot of errors in the console. Although they don’t influence and stop the running, and they won’t have any effect on final result. I still try to figure them out. There are two errors in the console. The first one is scale1, scale2 and scale3 are not defined. Another one is the console shows that in the weighted raster formula, the outcome has float division by zero.

Based on scales have been defined in the codes, the possible reason is they are defined in the function or loop. And every time when the function finishes running, it will clear the inside variables. So, when software accessing variables outside the function, it will report the error. The first method used to solve it is defining global variables. But it doesn’t work. And I also try to reassign the variables in the function after initialize them. The problem is solved by changing the scale.set() sentence in the part of scale definition. Three scales’ set() sentences are moved to the end of definition rather than putting them inside the definition.

As for the second one, because in the input raster, there exist cells have zero value and once the software is running, the first outcome is initialized value. But when users change the scales, there is not error like this appearing in the console. The problem has not been solved so far.

4. The fourth problem encountered is about outputting. When the ‘Output’ button is clicked, the output file only has an empty image. There is not having any data in it.

The problem is figured out by adding a new argument in plot() called ‘do\_output’ and when the ‘output’ list in plot() is completed, it will run the ‘do\_output’ to save image to the file. Also, in the output() function, it calls the three weights to change the output image when the result is changed by users.

Actually, there are many other issues during the coding while they are figure out quickly and the issues mentioned in the document cost much time to find methods to solve.