Visualistation Coursework

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# Problem 1

## Reasoning Behind Choices

The goal of this task is to effectively illustrate the different surface elevation of the moon in various areas, to aid scientists in picking a safe place to land the Artemis 3 lander.

The whole GUI can be seen below:

Graphical user interface, website

Description automatically generated

In the top left is a displacement map of the whole moon surface. There is a helpful color bar at the top indicating the colormap values used to show the displacement. This makes it easy for scientists to quickly see the approximate height of any area of the moon from an elevated angle. As can be seen in the screenshot above, a scientist can drag a box of any size over the map in order to zoom into a particular region of the moon. The selected area is then indicated using a red box on the area of interest.

Graphical user interface, website

Description automatically generatedOnce an area has been selected by the scientist to zoom into, 2 maps are rendered underneath. On the left hand side, is a 3D perspective view of the selected area of the moon. This allows scientists to see a 3D representation of the area they would like to investigate further. Then, on the right of this is a flat view of the selected moon surface area. This map shows contours of the selected moon surface, allowing the scientists to analyse the isolines of their selected area of interest. The 3D perspective displacement map and the contour images are displayed alongside each other so that a scientist can easily compare the 2 in order to better determine if a given location is suitable as a landing site for Artemis 3.

By clicking on the flat version of the selected area, a scientist can sample the height of any given point on their area of interest. The point that the scientist clicks on is then indicated by a red point on the map where they clicked, and then the longitude and latitude of the selected point, along with the precise height to 3 decimal places, is supplied just beneath the flat view of the selected moon surface, as shown in the screenshot below:

The screenshot above shows that a scientist has clicked on the point indicated by the red dot, at longitude 105.167 and latitude 22.5, where the height of the moon surface is 0.235 metres.

Scientists may find that different colourmaps allow them to more easily discriminate between height variations on the moons surface. As such, in the top right of the GUI, there is a dropdown menu that allows a scientist to select one of 6 different colormaps, shown in the screenshot below:

Background pattern

Description automatically generated

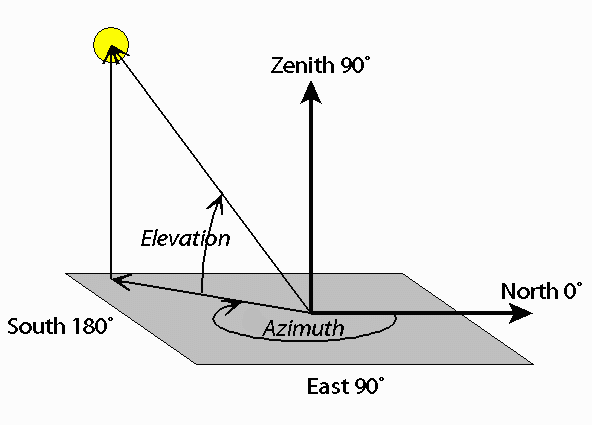
A scientist may also be color blind, and so by providing this functionality, the GUI is capable of being used by someone who may suffer with this disability. The magma colormap is specifically designed so that is can be used by the visually impaired, and as such if someone does have a condition, they can select this colormap, for example.

Once a scientist has chosen a colormap, the GUI renders the maps once again to adapt to this change. For example, if a scientist was to choose the magma colormap, the GUI would change to the following:

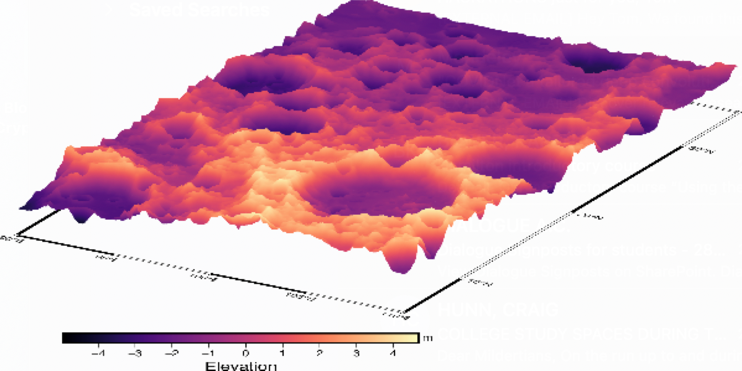
At the bottom of the GUI, there are 2 input boxes. The first allows the scientist to change the perspective of the 3D perspective displacement map. Before the scientist changes the settings that can be inputted into either of these input fields, the current settings are outlined in the text above the 2 zoomed in maps, as shown in the screenshot below:



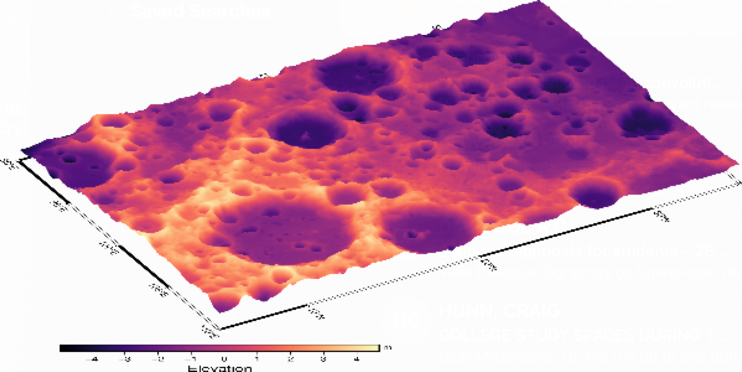
The first bit of information tells the scientist the exact area they have chosen to zoom in upon, given by the minimum and maximum longitude and latitude values. The location of the zoomed in region is given in longitude and latitude values, as this is the standard method for scientists investigating locations. Secondly, the view azimuth is given. The view azimuth helps the scientist to change the orientation at which they are viewing their chosen zoomed in surface. Then, the elevation is displayed, which tells the scientist the height at which they are currently viewing their 3D surface. The diagram below shows a visual representation of view azimuth and elevation, courtesy of Celestis Satellite Tracking [1].



As stated on the first input field, a scientist can enter their chosen View Azimuth and Elevation, in the format specified in brackets. For example, if a scientist wanted to change their view of the 3D surface to a view azimuth of 120 and an elevation of 60, they would put the following in the input field: [120, 60] and press the button: Change Perspective. For example on the following region, the map would change from the figure on the top, to the figure on the bottom as a result of these actions:



View Azimuth: 150, Elevation: 30



View Azimuth: 120, Elevation: 60

As can be seen in the bottom figure, the 3D perspective has clearly been rotated, and the height of the camera pointing at the moon surface has clearly been elevated to a greater height, exactly what the scientist specified.

The second input allows the scientist to change the height at which the isocontours are displayed on the flat version of the zoomed in area of the moon’s surface. By default, due to the moon’s surface being fairly flat and the range of height values not being very large (approximately between -10 metres and 10 metres of elevation), the default height at which isocontours are displayed is every 1 metre of elevation. A scientist can specify any height in order to change this default value. For example, if a scientist wanted to change the height between isocontours to 2 metres, instead of 1, if they thought there were too many isocontours being displayed on the image, making it hard to read, then the below top image would change to the second:

Background pattern

Description automatically generated

Isocontours generated every 1 metre

Background pattern

Description automatically generated

Isocontours generated every 2 metres

## Advantages and Disadvantages of Each Method

Whole Moon Surface Image

3D Perspective Displacement Map

Contour Map

# Problem 2

## Reasoning Behind Choices

##### References

1. <https://www.celestis.com/resources/faq/what-are-the-azimuth-and-elevation-of-a-satellite/>
2. Sanh, V., Debut, L., Chaumond, J. and Wolf, T., 2019. DistilBERT, a distilled version of BERT: smaller, faster, cheaper and lighter. *arXiv preprint arXiv:1910.01108*.
3. https://pytorch.org/docs/stable/generated/torch.nn.BCELoss.html