Moon as Never Seen Before

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Figure 1 is the original JPEG image captured with a 6" Celestron telescope NextStar130SLT, a barlow lense, and a Canon Rebel T1i camera, the files generated are 657 kB size in RGB.

Figure 1: Original picture

Figure 1 is imported into the Matlab workspace and converted from RGB into grayscale image of 1568x2352 pixels. This image size is large and as it can be noticed a considerable portion of it is composed of the dark background (space). The image was first processed using a binary conversion to differentiate the pixels corresponding to the moon and the space.

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Figure 2 is processed with a custom MatLab code to highlight features normally not seen. The resulting figure is constructed from two images, the first image is the result of a gaussian high frequency pass filter followed by a wiener 2D filter to remove noise, the second image is the result of a gaussian low frequency pass filter. Figure 2 shows shades caused by craters, impacts, and uneven features on the terrain. Such features are only vissible after the filtering process or by using high resolution equipment as the one typically used by astronomer scientists.

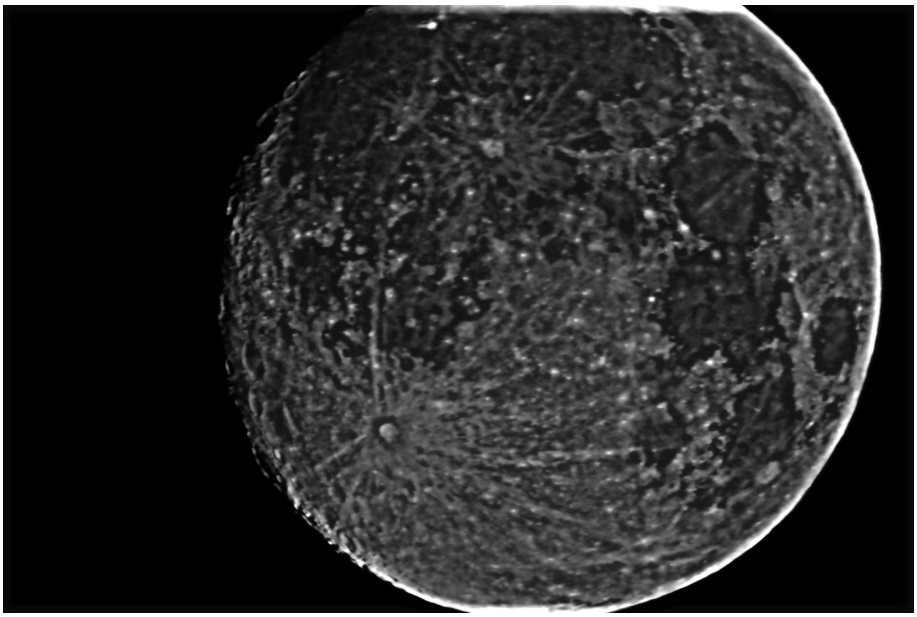

Figure 2: Moon terrain

The next image (Figure 3) is the result of using the image processed with the high pass filter and the wiener 2D filter. The contrast of this image is enhanced by raising each pixel value to the power of 0.5 and later normalizing the maximum value to 255. The image is eroded with a disk mask of radius size of 3 pixels. You can notice from the original figure, the image has different intensities, thus to enhance the desired features the original image was partitioned and different contrast enhancement powers and threshold values are used. Figure 3 can be interpreted as an X-ray highlighting meteoride impact locations, all other terrain features have been removed by the contrast enhancement technique.

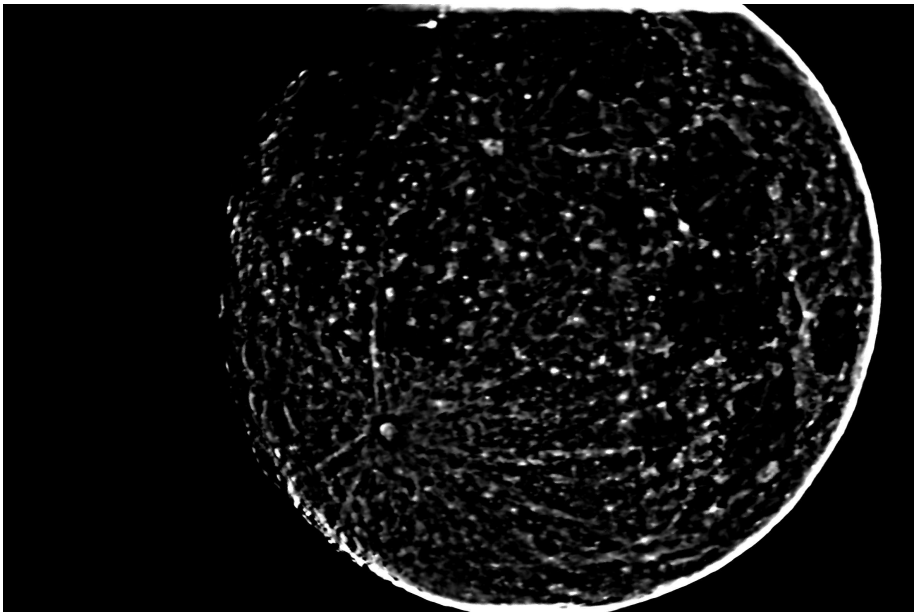

Figure 3: Moon impacts

Have you ever wonder how would the moon look with a terraformed landscape? The next image (Figure 4) is constructed from the original picture and processed (contrast enhancement, filtering, and eroding) after the segmentations and a series of thresholds and a colormap is generated assigning a color for any given pixel intensity. The colormap is custom generated, having four basic colors: white, green, brown, blue with different level intensities. The resulting image is

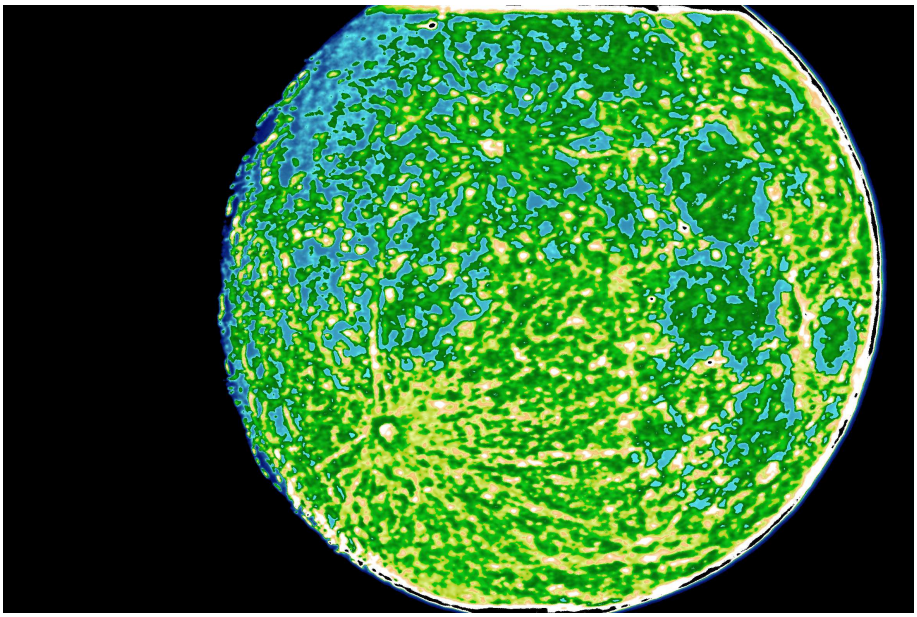

Figure 4: Terraformed Moon with water pool color map proportional to the original image pixel intensity.

The color intensities in the water pools (blues) is interpreted as the depth. A second color map (Figure 5) is generated assuming only pixels near the landscape (green, brown, white) is shallow in some locations and the rest of it is deep resulting in darker blues. Additionally the threshold values are changed to have a larger continuous water body. The resulting image is shown below

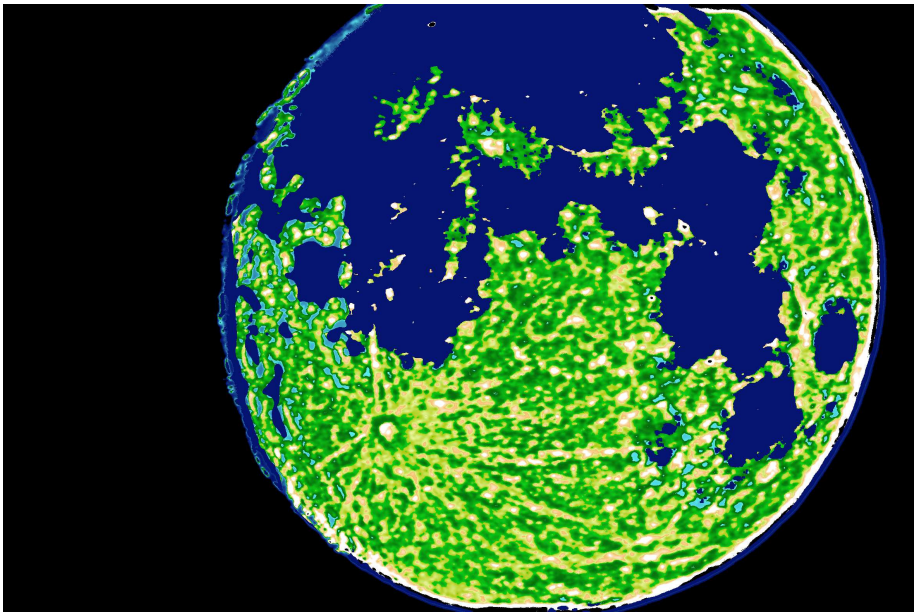

Figure 5: Terraformed Moon with water pool color map defined for higher original pixel intensity to generate larger continuous water bodies

You will find the code as a separate file in the GitHub site Any questions you may have about direct them at checoev@gmail.com