My NASA Data - Mini Lesson/Activity

Creating and Interpreting Images as Models

Student Directions

Background

1. This false-color image, captured by the Thematic Mapper (TM) instrument on Landsat 5, shows Alaska's Columbia Glacier and the surrounding landscape in 2011. Instruments can measure different wavelengths in the electromagnetic spectrum.
   - Some of these wavelengths, or bands, are not in the visible spectrum but can provide
useful information. Band combinations and shades in this Landsat image were selected to highlight Alaskan landscape.

- By obtaining images of the same place using different filters on the sensor for different wavelengths, scientists can identify the specific 'colors' of hundreds of different surface features.
- Let's see how this works! Snow and ice appear bright greenish-blue color, vegetation is green, clouds are white or light orange, and the open ocean is dark blue. Exposed bedrock is brown, while rocky debris on the glacier's surface is gray.

2. Array Tables

- An array table is a way to visualize and organize data
- Numbers from a data set are input sequentially from left to right, then continuing to the next row, also from left to right.
- Below is an example data set and its translation into a 4 column, 3 row array table.

Data set= \{5, 6, 2, 7, 1, 0, 2, 6, 3, 8, 9, 4\}

Array table= \[
\begin{array}{c}
5, 6, 2, 7 \\
1, 0, 2, 6 \\
3, 8, 9, 4
\end{array}
\]

Now, let's apply this process to an unknown area!

Steps

Suppose that you are an astronomer, and you have the first image of a planet orbiting another star. The satellite image of the planet's surface is shown in pixels an 8 (rows) x 9 (columns) grid. Images were obtained in three different color filters: Red, Green and Blue, so that surface features can be classified as water, land, snow, or vegetation.

The pixel data sequences for the three tables used to make the "satellite" image are shown below:
1. Check with your instructor on how to submit answers.
2. Create three array (grid) tables (8 columns x 9 rows) using the data provided. See
   ![Examples of array tables](https://spacemath.gsfc.nasa.gov/
   https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/Screen%20Shot%202021-02-18%20at%209.29.37%20AM.png)
3. Use the array tables you created in Step 1 to form a combined array table of coordinates.
   Input the numbers from the same relative position in each table to find the coordinates for the sequenced positions. See the example below for the first set of coordinates. Note: the colors of the data values in the example below are for visual aid only. Students do not need to color
   ![Example of a combined array table](https://spacemath.gsfc.nasa.gov/
   https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/Screen%20Shot%202021-02-18%20at%209.23.03%20AM.png)
4. Use the combined array table from Step 3 and the key below to determine the color of each their combined coordinates.
5. Using the key, shade in the associated color of the coordinate using the squares (shown at the bottom of the grid) in each pixel. It is possible in Google Slides Edit mode (not Present mode) where you can change the content on the slide to drag and drop the squares to the pixels.

<table>
<thead>
<tr>
<th>Coordinates (R,B,G)</th>
<th>Symbol and Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0,0,0)</td>
<td>Dark Sky (S)</td>
</tr>
<tr>
<td>(0,5,0)</td>
<td>Water (W)</td>
</tr>
<tr>
<td>(5,5,5)</td>
<td>Ice (I)</td>
</tr>
<tr>
<td>(5,0,5)</td>
<td>Land (L)</td>
</tr>
<tr>
<td>(0,0,5)</td>
<td>Plants (P)</td>
</tr>
</tbody>
</table>

6. Where is the ice represented in the image?

Sources:

2. Video: NASA - Landsat 5
Teachers, these mini lessons/student activities are perfect "warm up" tasks that can be used as a hook, bell ringer, exit slip, etc. They take less than a class period to complete. Learn more on the "My NASA Data What are Mini Lessons?" page.

Teachers who are interested in receiving the answer key, please complete the Teacher Key Request and Verification Form. We verify that requestors are teachers prior to sending access to the answer keys as we’ve had many students try to pass as teachers to gain access.