A little bit about colors in MATLAB:

RGB specification of color:

There is a standard system for specifying color, based on the fact that every color can be considered a combination of red, green, and blue. In this system each color is specified by the ordered triple (r,g,b) where r,g,b are the intensities of red, green and blue, with each intensity scaled in MATLAB to lie in the interval from 0 to 1. The color $(0,0,0)$ corresponds to black and $(1,1,1)$ corresponds to white (red, green and blue at their maximum intensities).

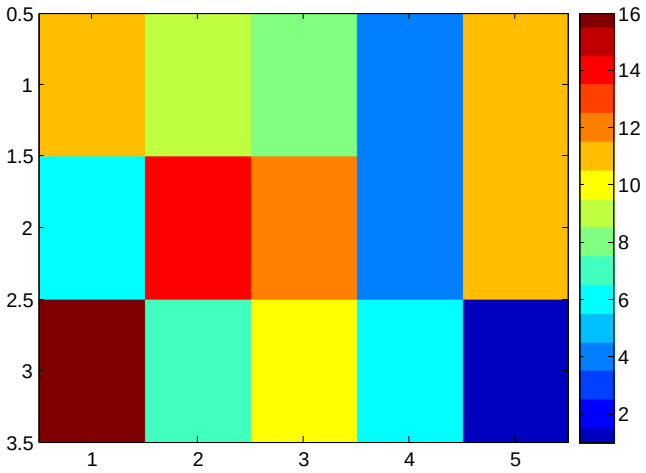
Displaying two-dimensional arrays in MATLAB:

Two dimensional data (e.g. in a matrix) can be visualized by associating a color with each entry in the matrix. The means by which a number is associated with a color is called a colormap. A colormap is simply a specified sequence of colors, specified in MATLAB with an mx3 matrix where each row is a color represented with an (r,g,b) triple. For example, the built-in color map jet with 16 colors is specified and numerically displayed below:

```
>> colormap jet(16) %specifies the colormap
>> colormap   %displays the colormap
ans =
 0      0      0.7500
 0      0      1.0000
 0      0.2500 1.0000
 0      0.5000 1.0000
 0      0.7500 1.0000
 0      1.0000 1.0000
 0.2500 1.0000 0.7500
 0.5000 1.0000 0.5000
 0.7500 1.0000 0.2500
 1.0000 1.0000 0
 1.0000 0.7500 0
 1.0000 0.5000 0
 1.0000 0.2500 0
 1.0000 0      0
 0.7500 0      0
 0.5000 0      0
```

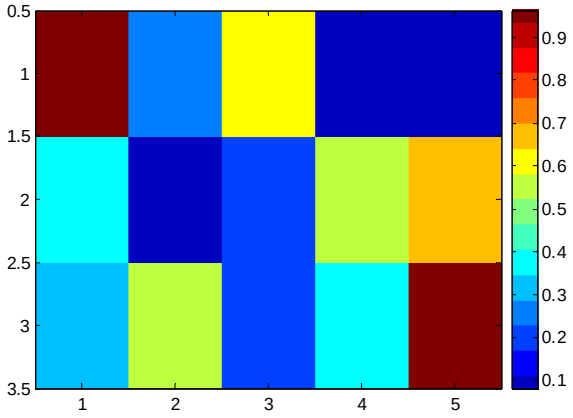
Now if I have an array A each of whose entries is an integer from 1 to 16 and use the MATLAB command image(A), each element of A will be associated with a color according to its value. Here is an example:

```
>> A=ceil(16*rand(3,5)); %entries are integers between 1 and 16
>> A
A =
 11  9  8 4 11
  6 14 12 4 11
 16  7 10 6  1
>> image(A);
>> colorbar %displays the colormap at the right
```



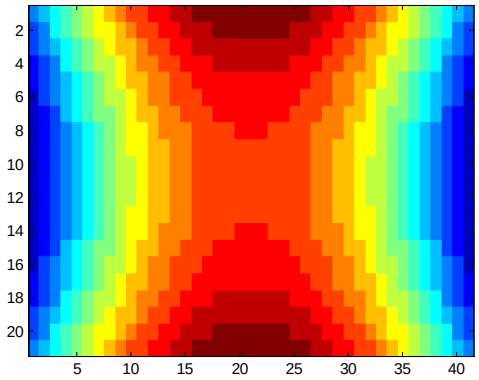
The MATLAB command imagesc(A) will "scale" the values in the matrix A so that they range from the lowest-number color to the highest-number color. For example:

```
>> A=rand(3,5);
>> A
A =
 0.9925 0.2476 0.6391 0.0665 0.0594
 0.3879 0.0504 0.2129 0.5469 0.6470
 0.2991 0.5542 0.2264 0.3505 0.9731
>> imagesc(A);
>> colorbar
```



In many applications the data will come from a function and be relatively smooth. Consider the example below:

```
>> x=-1:.1:1;y=-2:.1:2;
>> for i=1:21, for j=1:41, A(i,j)=x(i)^2-y(j)^2;end;end
>> imagesc(A)
```



We will study other MATLAB commands for visualizing two-dimensional data later, in particular the command pcolor.

For the time being, we are interested in displaying matrices of 0's and 1's. For this purpose, we use the colormap gray(2) which consists of two colors, the first is black (0,0,0) and the second is white (1,1,1). In a matrix A of 0's and 1's however, we want to display a 1 as black and a 0 as white so we use the commang image(2-A). Then is a(i,j)=0 we display color number 2-0=2 which is white and if a(i,j)=1 we display color number 2-1=1 which is black.