

CEG4316 Digital Image Processing Sept. 9, 2011

Getting started with creating and visualizing two-dimensional functions

Creating two-dimensional functions defined by an analytical formula can be done quite compactly using MATLAB matrix expressions. The steps are:

1. Define the set of points (x,y) at which the function will be evaluated, typically an N by N array of points. The value of N will depend on the type of plot and may be lower for perspective plots, and higher for contour and intensity plots.
2. Create two N by N arrays, the first with the x coordinate at each point and the second with the y coordinate, using the MATLAB function `meshgrid`.
3. Write a MATLAB expression to evaluate the given function at all the N^2 points in one shot.
4. Display a perspective, contour, or intensity plot as desired.
5. Set parameters of the plot, axes, etc.

Example

Generate a two-dimensional sinusoidal function with given frequency u,v for $0 \leq x,y \leq 1$

$$f(x,y) = 0.5(1 + \cos 2\pi(1.5x + 2.5y))$$

```
clear all, close all
N=512; %generate a 512 by 512 array of points
x=0:(1/(N-1)):1; y=x; % x and y values between 0 and +1 spaced by
% 1/N

u = 1.5; %set the horizontal frequency parameter
v = 2.5; % set the horizontal frequency parameter

[X,Y]=meshgrid(x,y); % generate 2D grids of x,y values (N by N
%arrays) X(i,j) = x(j) and Y(i,j) = y(i)

Z=0.5*(1+cos(2*pi*(u*X+v*Y))); % generate the
%sinusoidal function on the grid

imshow(Z)
```