

Homework 1 : Due Feb. 9, 2006

CS 791 / 593

January 19, 2007

Display all results by using 'imagesc' and 'colormap(gray)'. Attach all Matlab code.

1 Load Volume Data

Load the sample dataset given on the class webpage. The file is a sequence of unsigned bytes with no header. Reshape the data into a 3d array ($181 \times 217 \times 181$). Extract slice 90 ($z = 90$) of the dataset, and display.

2 Heat Equation

Implement the 2D heat equation using the implicit discretization. Review the Matlab commands 'sparse' and 'spdiags' for forming the matrix of coefficients. Use time step $\delta = 2.0$.

Specify which boundary conditions you choose to impose.

Run the algorithm on the slice extracted in Part 1. Display the results for time $t = 2.0, 4.0, 6.0, 8.0$.

3 Perona-Malik Equation

Implement the Perona-Malik algorithm as presented in the paper, using $g = 1/(1 + (||\nabla I||/K)^2)$ with a constant K value. Use $\lambda = 0.25$.

Display 3 images showing the piecewise smoothing effect of the algorithm, and specify K you used and t for each image. Also plot the images of $c(x, y)$ at the same times.

4 If you are registered for CS 791

Demonstrate the edge enhancement properties of inhomogeneous diffusion. Create a synthetic 2D image with 2 regions and a planar edge between them. Set the parameters of the diffusivity function so that the edge slope increases with time. Demonstrate this by plotting the heightmap of the surface as a mesh and also report the numerical values of the slope.