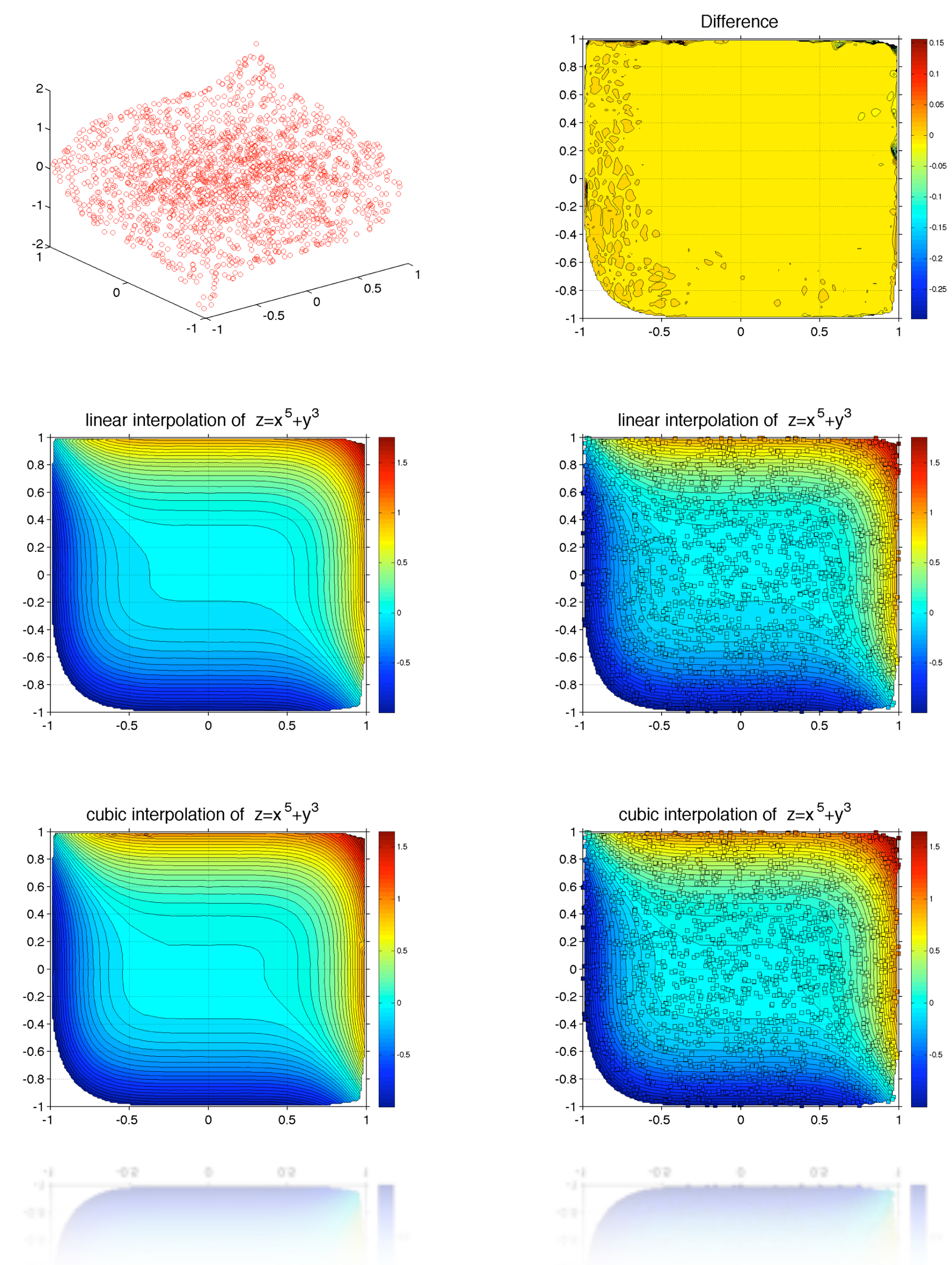
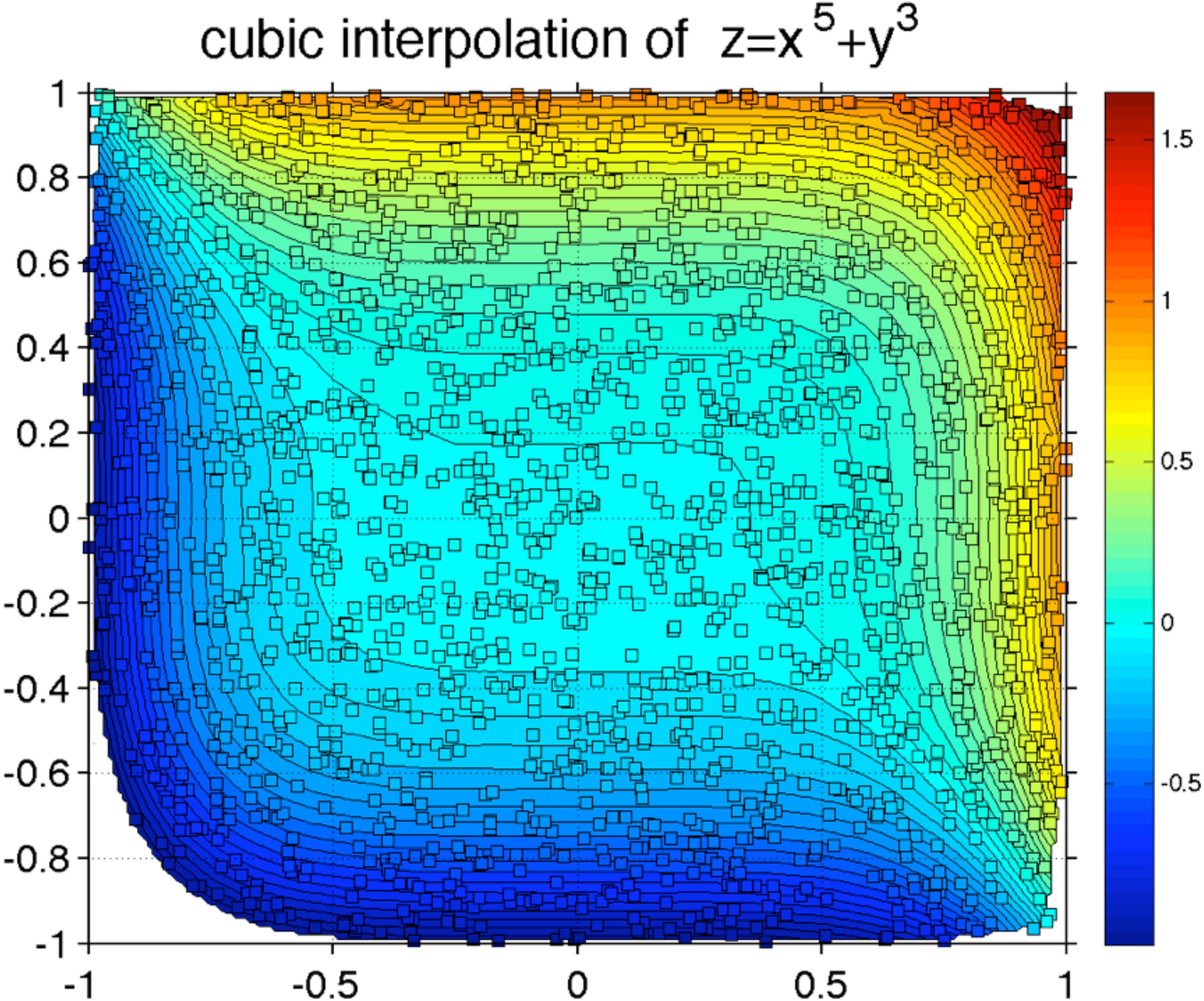
Class Work: Multidimensional Interpolation Challenge

- Use `rand` to create vectors of random numbers **x** and **y** with 2000 elements in the range [-1 and 1].
- Construct the function $z = x^5 + y^3$
- Create a two-dimensional regular grid from -1 to 1 with a resolution of 0.01 (hint: use `meshgrid`)
- Perform two multi-dimensional interpolations, (a) a triangle-based linear interpolation, and (b) a triangle-based cubic interpolation (hint: use `griddata`)
- Plot a color filled contour plot of these two fields (hint: use `contourf`) and add a color scale
- Obscure points less than a threshold value of -1 by setting these points to NaN
- Then overlay the original irregular vector of points (**x**,**y**,**z**) used to create these regular grids as color filled squares. Use the same color scale as you used in the color filled contour plots (hint: check out the `colormap` function)
- Find the difference between these two interpolations




cubic interpolation of $z=x^5+y^3$
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.5
0
0.5
1
1.5
1
0.5
0
-0.5

Class Work: Multidimensional Interpolation Challenge

Elements of the challenge:

- 3D plots
- Griding irregular data using various types of multi-dimensional interpolation
- Comparing interpolation methods
- Color fill contour plots overlaid with color filled symbols
- Masking data points using NaN
- Using TeX in the title

Kriging

Kriging is a group of geostatistical techniques to interpolate the value of a random field (e.g., the elevation, z, of the landscape as a function of the geographic location) at an unobserved location from observations of its value at nearby locations.

The theory behind interpolation and extrapolation by Kriging was developed by the French mathematician Georges Matheron based on the Master's thesis of Daniel Gerhardus Krige, the pioneering plotter of distance-weighted average gold grades at the Witwatersrand reef complex in South Africa. The English verb is to krige and the most common noun is kriging.

Kriging

Kriging belongs to the family of linear least squares estimation algorithms. The aim of kriging is to estimate the value of an unknown real-valued function, f, at a point, x^*, given the values of the function at some other points, $x_1, \ldots, x_n$. A kriging estimator is said to be linear because the predicted value $\hat{f}(x^*)$ is a linear combination that may be written as

$$\hat{f}(x^*) = \sum_{i=1}^{n} \lambda_i(x^*) f(x_i)$$

The weights λ_i are solutions of a system of linear equations which is obtained by assuming that *f* is a sample-path of a random process F(x), and that the error of prediction

$$\varepsilon(x) = F(x) - \sum_{i=1}^{n} \lambda_i(x) F(x_i)$$

is to be minimized in some sense. For instance, the so-called simple kriging assumption is that the mean and the covariance of F(x) is known and then, the kriging predictor is the one that minimizes the variance of the prediction error.