1 Thin Plate Spline Demo

There is a thin plate spline demo in R/tps.fields with some documentation from the R fields package. There is a demo which generates Franke’s (Wendelberger’s) 3-d test function, generates noisy data, and fits a tps with the gcv estimate of $\lambda$, with $\lambda$ too large, and $\lambda$ too small. Run the code, and then modify it to generate noise with various values of the standard deviation of the noise. (at rnorm), from about .001$m$ to .25$m$ where $m$ is about the maximum height of the true curve. Report what happens to the curves, to $\lambda$, and to the estimate of $\sigma$.

(Note: The estimate of $\sigma^2$ is

$$\hat{\sigma}^2 = \frac{RSS}{tr(I - A(\lambda))}$$

where $RSS = \|(I - A(\lambda))y\|^2$, the residual sum of squares, and $tr(I - A(\lambda))$ is the degrees of freedom for noise.)

Alternate hw:

There are a large number of tps codes in R. The tps demo in the R directory uses fields (Douglas Nychka). Other packages in R that include tps codes include assist–Yuedong Wang, mgcv–Simon Wood, rgcvpack—Xianhong Xie, gss–Chong Gu, there may be others.

It would be interesting to what extent these codes give the same answer. For those conversant with R, you may work in pairs or larger groups to compare these codes (at least one code per each person in the group) by giving them exactly the same data and see how the results compare. (Put all contributors names on one hw).