

Surface Interpolation: higher dimensional curve fitting Course Project Proposal

Background: We studied curve fitting and interpolation for a univariate function. What about a bivariate function whose graph is a surface in dimension three? Why would we do this? A typical example might be estimating a patient's resting heart rate if you know the patient's body mass index and their cholesterol level. After taking data from a set of patients, one might hope to estimate the resting heart rate of a patient when only BMI and cholesterol are known. Another example from topography is generating the 3D surface of a mountain from some known points given in longitude, latitude, and elevation. How do we do this?

Project: Develop a numerical software package that will interpolate a missing value from two-dimensional data. Then develop a package that will produce a Bezier surface from a given set of three-dimensional data. This project is an extension of the one-dimensional case. It will require you to find a suitable resource that discusses these methods and then implement them. To generate the actual surface, first construct the approximating bivariate Bezier function and use MATLAB's surf command to display the image. You are encouraged to find your own data sets to work with. If this is impossible, I can help you find some.

Paper: Write a paper detailing the mathematics behind your software including any mathematical preprocessing included in your algorithms. The paper should also include necessary background to state the problem, a concise statement of the problem being addressed, a description of the software package including an error analysis, tests on known data, and a performance comparison of the various functions in the package. A brief users guide (i.e. instructions on how to run your software) should be included as an appendix.

Presentation: At the end of the semester, your group will give a 7-10 minute presentation on this project.

Peer Evaluations: Peer evaluations will be emailed to me by the individuals. Each student will numerically rank the participation of the group members and provide a written account of who did what during the project. Each group member must write at least one routine in the project to receive any credit for the project.