**CSU ECE Department Seminar Series - Spring 2007**

The Department of Electrical and Computer Engineering at Colorado State University is pleased to present a seminar by

**Denis J. Dean, Ph.D., Associate Professor of Geospatial Science, Colorado State University**

**Title: "Spatial Interpolation via a Hybrid Artificial Neural Network/Kriging Approach"**

**Monday, April 16, from 4:10 to 5:10pm, Engineering Building, Room B101**

**Abstract:** Spatial interpolation is the process of estimating a value for some variable $Z$ at point $(X_0, Y_0)$ based on values of $Z$ measured at locations $(X_1, Y_1)$, $(X_2, Y_2)$, …, $(X_n, Y_n)$. Spatial interpolation is one of the most common tasks facing geospatial scientists, because logistics, economics, or other factors often prevent measuring $Z$ at all points of interest. Indeed, for any *spatially continuous* variable (i.e., a variable whose value changes continuously across space, e.g., elevation, temperature, or soil depth), it is impossible to measure the variable at all locations where it might assume a unique value, and therefore spatial interpolation becomes mandatory.

Given the widespread need for spatial interpolation, it is not surprising that many techniques exist, some of which have been in use for hundreds of years. Currently, one technique – kriging – is considered superior to all others in most spatial interpolation situations. Kriging is basically a weighted averaging technique, where an estimated value of $Z$ at point $(X_0, Y_0)$ is computed as a weighted average of the $Z$ values measured at points $(X_1, Y_1)$, $(X_2, Y_2)$, …, $(X_n, Y_n)$. However, weights are computed in a sophisticated, multi-step process that ensures that the estimates produced by the kriging process are unbiased and minimum variance. One step of this process involves performing a regression analysis on data derived from the measured $Z$ values. However, it can be shown that the data used in this analysis does not conform to the assumptions inherent in regression.

In this study, we replaced the regression component of the kriging process with an artificial neural network (ANN), thereby creating a hybrid interpolator we termed ANN-kriging. ANN-kriging was compared to conventional kriging under a variety of circumstances, and found to outperform conventional kriging in nearly 80% of the situations evaluated.

**Short Bio:** *Denis J. Dean is an associate professor of geospatial science at Colorado State University, and was director of the university's Remote Sensing/GIS program from 1997 to 2006. He is an internationally recognized expert in geospatial science, having lectured in over two dozen countries on five continents. He has published over 50 papers in journals and refereed conference proceedings, and teaches both graduate and undergraduate courses at all levels (introductory to advanced) in the geospatial sciences area.*