Detecting Clusters and Nonlinearity in 3D Dynamic Graphs

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Abstract

Three-dimensional dynamic scatterplots can reveal certain features of data that cannot be apprehended in marginal two-dimensional displays. Using graduate students as subjects, we sought to establish whether the detection of clusters and nonlinearity in 3D plots varies by easily characterized properties of the data and the design of the display. We found that the probability of detection of clusters increased smoothly with cluster separation, and that, at a fixed level of separation, 'diagonally' displaced clusters were easier to detect than 'horizontally' displaced clusters. Cluster detection appeared to be affected to a smaller extent by the design of the display. Three further experiments addressed the detection of nonlinearity in 3D dynamic scatterplots. Most subjects were able to respond in a reasonable manner to properties of the data, so that the probability of detection of nonlinearity increased with its level, particularly when the signal was strong. As in the experiment on cluster detection, subjects' performance was also affected, though to a lesser extent, by characteristics of the displays; for example, spinning the display horizontally in the regression plane was particularly effective. We discuss the implications of these results for the design of statistical software incorporating dynamic 3D scatterplots.