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Determining the Line of Correlation Between Two Wells: Application to Multivariate Biostratigraphic Data

A typical objective of stratigraphic studies is to construct a line of correlation between two wells. The common approach of correlation of discrete events (FADS and LADs) is problematical at the reservoir or field scale, where there are often few discrete events with biostratigraphic utility. One solution is to develop new correlation methods that use patterns in non-discrete (vector) data. The method discussed herein involves (1) calculation of total fauna similarity between all possible sample pairs in two wells; (2) determination of the optimal pathway through that similarity matrix, constrained by stratigraphic principles; and (3) conversion of results to a format that can be evaluated in biostratigraphic/geological context. Our method allows calculation of similarity metrics using a number of options for both data transformations and similarity metrics (e.g. cosine-theta and euclidean distance). Locating an optimal high correlation path across a similarity matrix is not at all trivial. The number of possible paths rises exponentially with the size of the similarity matrix. Evaluating all possible paths is impractical with modern computers and typical datasets. Our method involves an algorithm that identifies a high correlation path in seconds, using a hill-climbing technique. Interaction with the biostratigrapher is accomplished through a series of visualization tools: two-well similarity maps, butterfly plots (a.k.a. tornado plots), and visual comparison to non-biostratigraphic data (e.g. petrophysical curves, paleobathymetry curves, synthetic seismic). These graphical tools are integrated through a series of point and click displays, facilitating interactive querying of the biostratigraphic datasets.