Scattered data approximation by LR B-spline surfaces. A study on refinement strategies for efficient approximation

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Locally refined B-spline (LRB) surfaces [1] provide a representation that is well suited to scattered data approximation. When a data set has local details in some areas and is largely smooth elsewhere, LRB-splines allow the spatial distribution of degrees of freedom to follow the variations of the data set. An LRB surface approximating a data set is refined in areas where the accuracy does not meet a required tolerance.

The surface approximation is performed iteratively and at each step new degrees of freedom are added to the surface representation. The accuracy of the approximation and the data volume of the final surface depend on the strategy for refinement. In a systematic study, different LRB refinement strategies and polynomial degrees are applied to approximate geospatial data sets of different sizes and with different structural behaviour. The strategies full span, minimum span and structured mesh [2] are tested along with a new strategy called restricted mesh. The basic strategies are varied with a set of means to reduce the pace in which new degrees of freedom is added. The relative performance of the refinement strategies is reasonably coherent for the different data. An overall evaluation indicates that bi-quadratic LRB are preferable for the use cases tested, and that some versions of the full span strategy have the overall best performance.

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