



(12) **United States Patent**
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(54) **RAPID PRODUCTION OF OPTIMAL-QUALITY REDUCED-RESOLUTION REPRESENTATIONS OF VERY LARGE DATABASES**

OTHER PUBLICATIONS

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(57) **ABSTRACT**

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View space representation data is produced in real time from a world space database representing terrain features. The world space database is first preprocessed. A database is formed having one element for each spatial region corresponding to a finest selected level of detail. A multiresolution database is then formed by merging elements and a strict error metric is computed for each element at each level of detail that is independent of parameters defining the view space. The multiresolution database and associated strict error metrics are then processed in real time for real time frame representations. View parameters for a view volume comprising a view location and field of view are selected. The error metric with the view parameters is converted to a view-dependent error metric. Elements with the coarsest resolution are chosen for an initial representation. Data set first elements from the initial representation data set are selected that are at least partially within the view volume. The first elements are placed in a split queue ordered by the value of the view-dependent error metric. If the number of first elements in the queue meets or exceeds a predetermined number of elements or whether the largest error metric is less than or equal to a selected upper error metric bound, the element at the head of the queue is force split and the resulting elements are inserted into the queue. Force splitting is continued until the determination is positive to form a first multiresolution set of elements. The first multiresolution set of elements is then outputted as reduced resolution view space data representing the terrain features.

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(51) **Int. Cl.**⁷ **G06F 17/30**

(52) **U.S. Cl.** **707/104; 707/6; 707/10; 707/102; 704/226; 704/227; 382/124**

(58) **Field of Search** 345/419, 421, 345/422, 427, 430, 355; 382/124, 260, 125; 704/226, 227, 233, 211, 222; 707/5, 6, 10, 2, 3, 102, 104, 522

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14 Claims, 19 Drawing Sheets

