

July 2008

MADALGO seminar by Jeff M. Phillips, Duke University

Creating ε -Samples for Terrains

Consider a point set D with a measure function $\mu : D \rightarrow R$. Let A be the set of subsets of D induced by containment in a shape from some geometric family (e.g. axis-aligned rectangles, half planes, balls, k - oriented polygons). We say a range space (D, A) has an ε -sample (a.k.a. ε -approximation) P if

$$\max_{R \in A} |\mu(R \cap P) / \mu(P)| - |\mu(R \cap D) / \mu(D)| \leq \varepsilon .$$

We describe algorithms for deterministically constructing discrete ε - samples for continuous point sets such as distributions or terrains.

Furthermore, for certain families of subsets A , such as those described by axis-aligned rectangles, we reduce the size of the ε - samples by almost a square root from $O(1/\varepsilon^2 \log 1/\varepsilon)$ to $O(1/\varepsilon \text{ polylog } 1/\varepsilon)$. This is often the first step in transforming a continuous problem into a discrete one for which combinatorial techniques can be applied. I will describe applications of this result in geo-spatial analysis, biosurveillance, and sensor networks.