

Verification of Distances in Two-Dimensional Space

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Abstract

Computing a distance in the two-dimensional space, for example, a distance of two points, is a basic and important task in the field of computational geometry. The distance is simply computed in several operations. However, computed results by floating-point arithmetic may not be accurate due to accumulation of rounding errors [1]. For example, there are three points A, B and C. The problem is to judge whether the point A is far or the point B is far from the point C. The point A is actually far from the point C but a computed result may indicate that the point B is far under the influence of rounding errors. Therefore, verification of the relation is important.

In this talk we will introduce a so-called floating-point filter for the comparison of two distances. The filter gives a sufficient condition for the correctness of the computed result. The filter for the two-dimensional orientation problem was discussed in several papers, for example [2]. However, no special method has been proposed for the comparison of distances. Our filter is specialized to the comparison of distances so that a constant of the error bound is very small. Finally, we show how to obtain the farthest point or the closest point from a point or a line by the floating-point filter, which is necessary for algorithms of Voronoi diagram and convex hull.

References

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