

## **A Constant Time Point Location Algorithm Based on Calculation Approach to Beat the Well-Known $\log(n)$ Algorithms**

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### **Abstract**

Repetitive-mode point location is a classic problem in computer graphics applications. Memory-based method is used instead of CPU-based method to solve the point location problem of repetitive mode. CPU operations and memory locations are ingeniously cooperated in the preprocessing phase to accomplish a series of algorithms with time complexity order one. The fundamental philosophy behind is to pre-store all the necessary information which can only be obtained by time consuming calculation by using the required memory. The proposed algorithms are classified as angle-based and edge-based approaches. Both proposed approaches are then applied to both the single-polygon case and multiple-polygon case. It has been shown theoretically that our algorithms are superior to the best conventional CPU-oriented binary search method. The experimental results also strongly support the superiority of our algorithms, and this implies that the proposed memory-based algorithms are much better than the best conventional CPU-oriented approach with time complexity order  $\log_2 n$ . As far as time efficiency is concerned, the proposed approaches can beat not only the calculation approach but also the commonly acknowledged polygon filling approach. The proposed algorithms have been implemented and will be incorporated into TIGER, a real-time multimedia-animation authoring system, currently being developed by professor Liu at Tamkang University.

*Keywords:* Memory-Based, Repetitive-Mode, Single-Shot, Preprocessing, Angle-Based, Edge-Based, CPU-Oriented, Smallest Angle