An Incremental Priority-Based Solution to the Multiple Asynchronous Edit Problem

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Abstract

We present a solution to the problem of incrementally updating attributes in the context of multiple asynchronous edits to an attributed syntax tree. Our solution is based on using priority numbers to capture topological order of dependency information among attributes, which allows us to efficiently merge the attribute propagations originating from the various edit points. Our algorithm has worst-case time complexity $O(k \cdot (\mid \mathit{Influenced} \mid \cdot \log(\mid \mathit{Influenced} \mid)))$, where k is the number of disjoint times at which overlapping edits occur and *Influenced* is the number of attribute instances reevaluated during the attribute propagation process. Best-case complexity is $O(\mid \mathit{Influenced} \mid \cdot \log(\mid \mathit{Influenced} \mid))$, which will arise when propagations from edits do not overlap, or all edits occur simultaneously. The log factor derives from priority queue maintenance; in practice, the size of the priority queue will often be small enough to make priority queue operations effectively unit-time, reducing the complexity for synchronous replacements to $O(\mid \mathit{Influenced} \mid)$.

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