Viewing Streaming Spatially-Referenced Data at Interactive Rates

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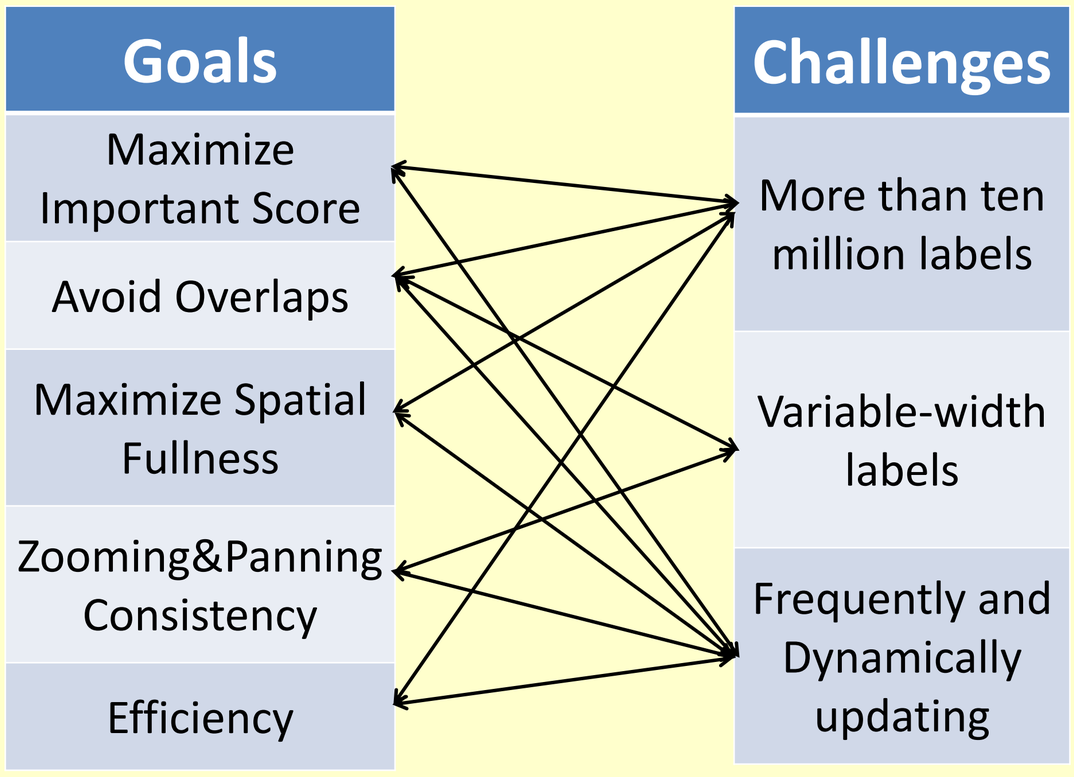
Introduction

Addressing a write-many read-many label placement problem, instead of the conventional paper maps with a write-once read-many setting.



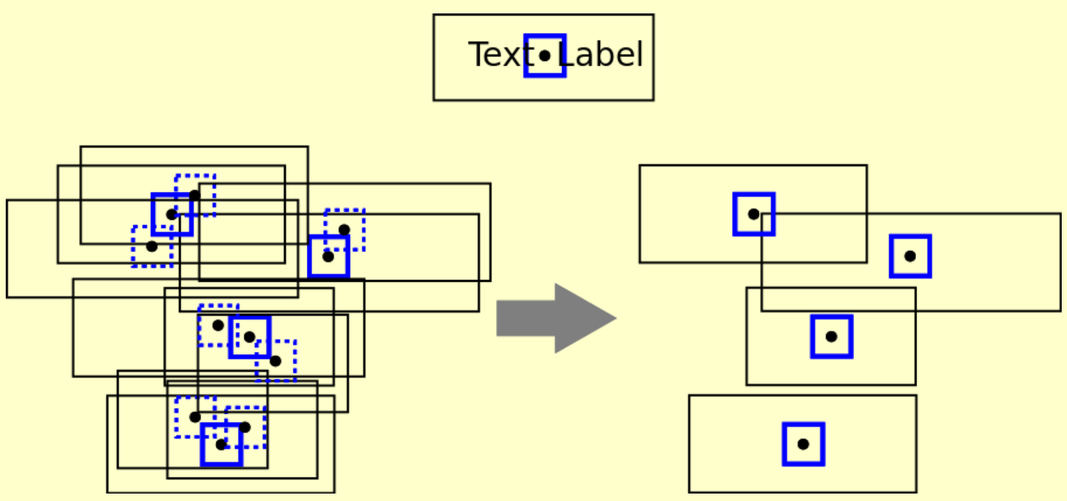
Application

1. NewsStand: A system for displaying news articles geographically, where labels can be names of people, keywords, locations, or brand names appearing in the news articles.
2. Disease report browser: Plot the names of diseases at locations where the diseases have been reported.

Approach

Morton Index Filter (MIF): Two phases

1. Filter: Find the most important labels within an $(\epsilon \times \epsilon)$ square.
2. Intersection testing: Ensure that displayed objects do not overlap.



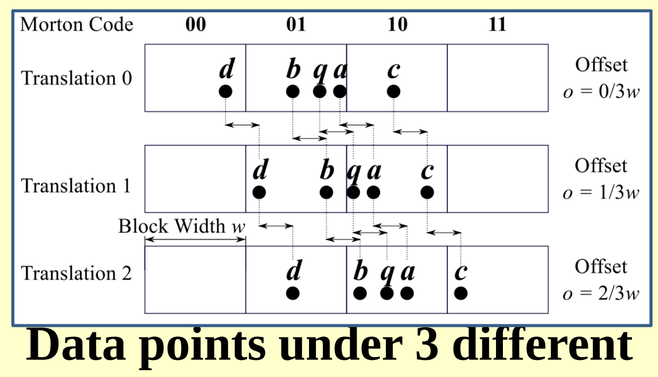
Filter Phase Example

Example: The small blue squares are the same size for all text labels. After the filtering phase, each remaining text label is the most important one within its blue square.

Morton Index Translation

Basis of the filter phase: Two points that are in proximity are likely to be in the same Morton block.

1D: 3 translations
2D: 9 translations



Data points under 3 different translations in 1D

Example

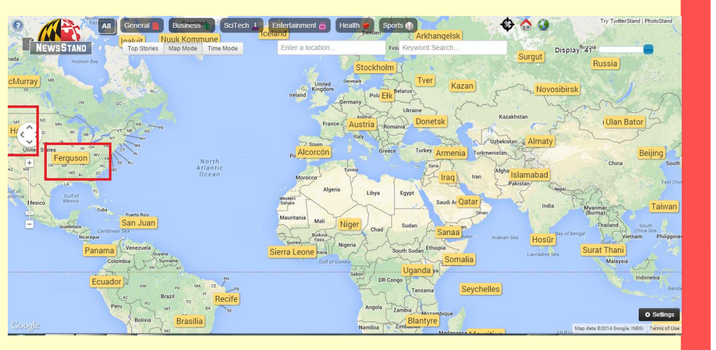
NewsStand implementation of MIF method: Result differs totally from version with greedy algorithm.
Red rectangles show satisfaction of zooming and panning consistency criteria.

Greedy Algorithm Version at Zoom Level 3

(Few of labels appear in Africa.)

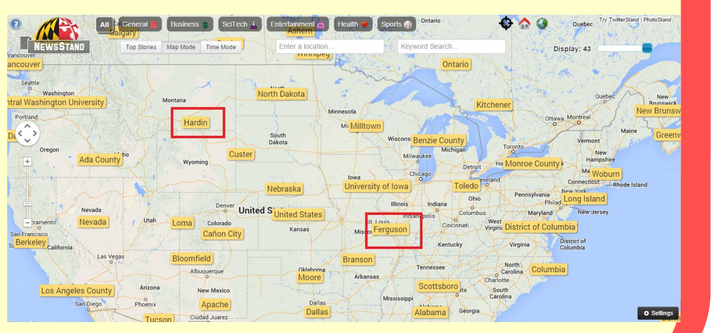
MIF Algorithm Version at Zoom Level 3

(Labels are present uniformly.)



MIF Algorithm Version at Zoom Level 5

(Labels are consistent in zooming or panning operations.)



Performance

Compared three text label layout methods:

- Our Morton Index Filter method (MIF)
- The $O(nm)$ brute-force method (Basic)
- The PR-CIF quadtree based method (Quad)

Query: 5475 query windows from *newsstand.umiacs.umd.edu* query logs.