Band Joins for Interval Data

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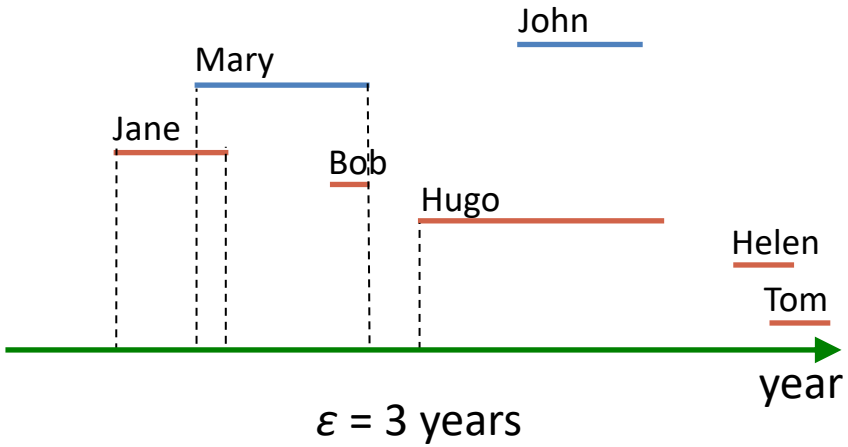
Joining Interval Data

employee	start	end
John	1999	2002
Mary	1992	1996

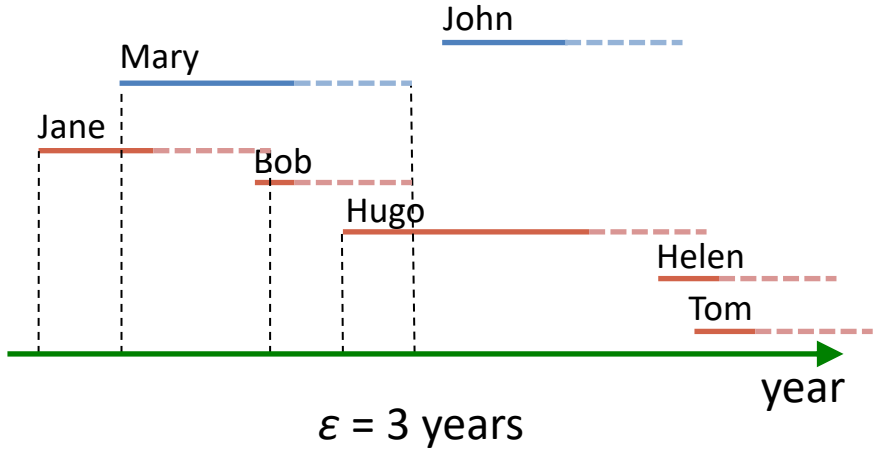
employee	start	end
Jane	1990	1993
Bob	1995	1996
Hugo	1997	2003
Helen	2005	2007
Tom	2006	2008



- Overlap joins
  - Find all pairs of employees whose period of work overlaps
- Band joins
  - Find all pairs of employees whose period of work has an at most ε gap
  - Overlap joins, special case with ε set to 0
- Applications
  - Temporal data, uncertain data, XML query processing, streaming data

Baseline

- A straightforward approach
  - Expand every interval in both inputs by ε
  - Compute a traditional overlap join
  - Directly apply domain-based partitioning from [Bouros and Mamoulis, PVLDB 2017]



Pros

✓ Simple and straightforward

✓ Capitalize on overlap join methods and optimizations

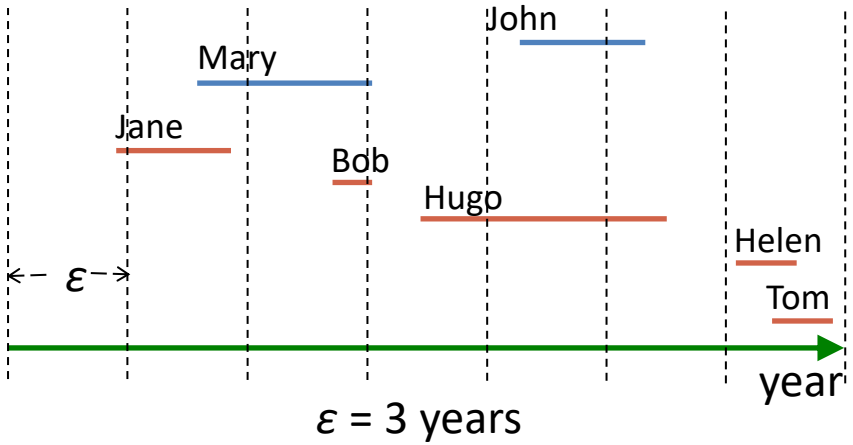
Cons

✗ Data replication increases, cost for partition-to-partition join higher

✗ Evaluation agnostic to parameter ε, unnecessary comparisons

Evaluation on ε-wide Partitioning

- Principles
  - Divide domain in ε-wide stripes
  - Replicate intervals spanning multiple stripes
  - Every partition is joined with exactly two partitions, e.g., for R_i from R
    - With S_i in a cross product
    - With S_{i+1}



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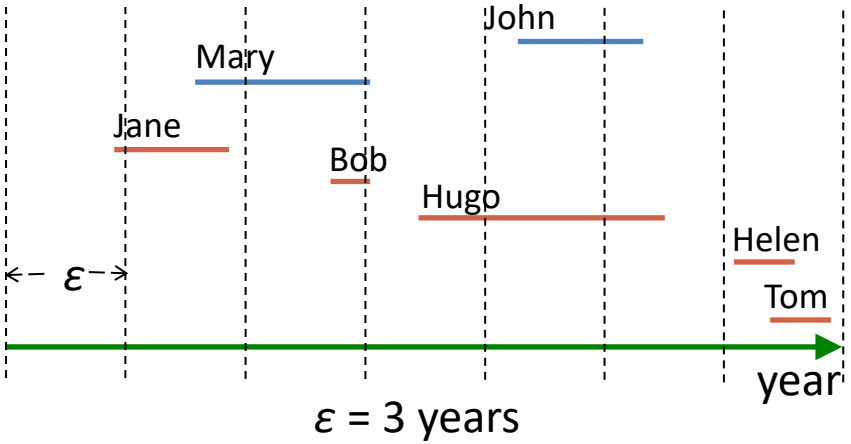
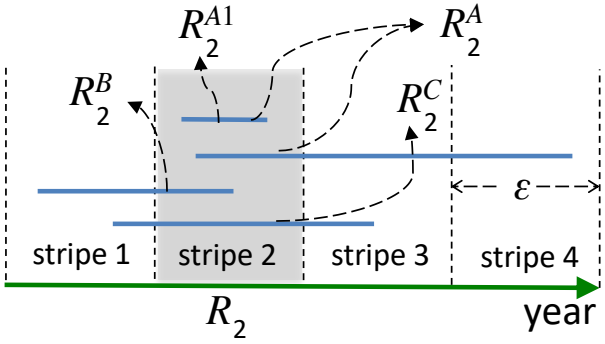
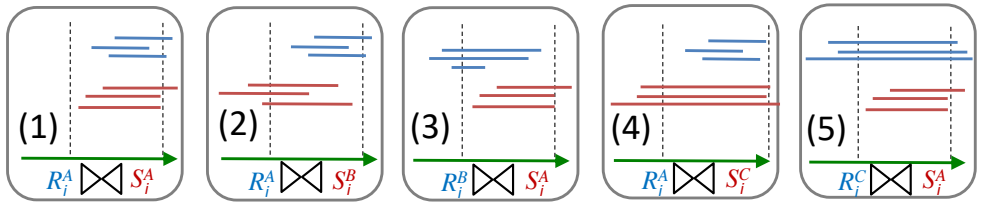
  - Divide partition contents to define mini-join tasks

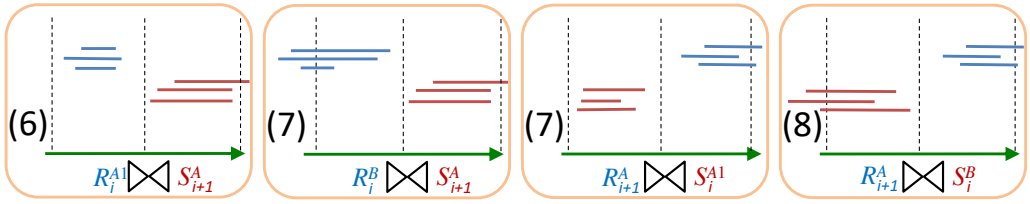


Mini-partitions

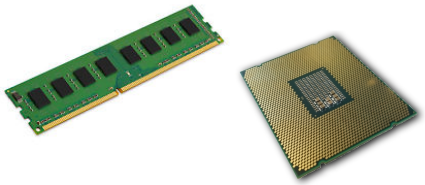


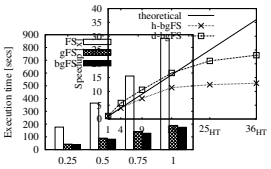
Mini-joins





Experimental Analysis





- Setup
  - In-memory, parallel processing
  - C++ with OpenMP for multi-threading
- Methods
  - BSL
  - ε-BSL, i.e., BSL with ε-wide stripes
  - ε-WIDE
- Experiments
  - 4 real-world datasets
  - Vary threshold ε, number of threads, input size ratio $|R|/|S|$
- Key finding
  - ε-WIDE most efficient method, unless ε too small compared to the domain

Thank you

Q & A