Exploiting Code Generation for Efficient LIKE Pattern Matching

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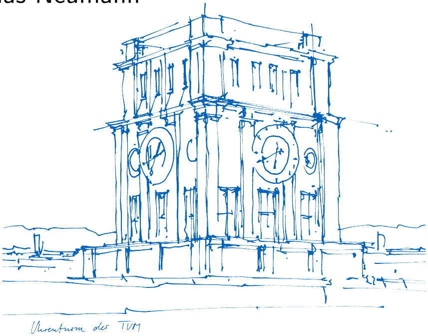
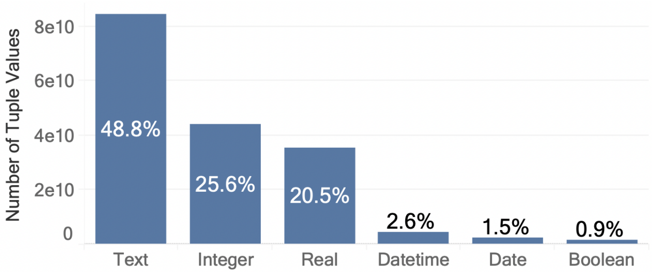
ADMS @ VLDB 2023



Strings are everywhere

➔ Require efficient text operations



From: Vogelsgesang et al., "Get Real: How Benchmarks Fail to Represent the Real World"

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- ⚠ Expensive string conversions due to DBMS specific format
- ⚠ Per-tuple overhead causes significant performance loss

➔ **We need to integrate text operations better!**

Approaches

```sql
select count(*) from uni where name like '%TUM%';
```

Tuple
Stream

Result

Approaches

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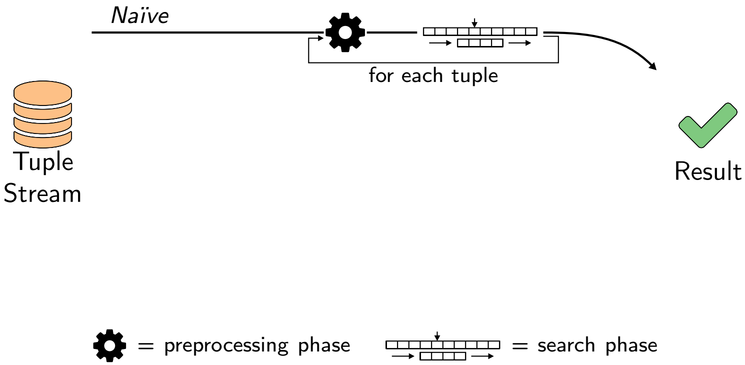

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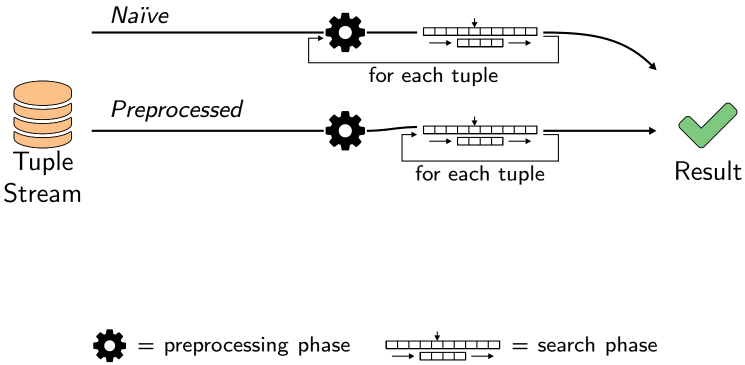

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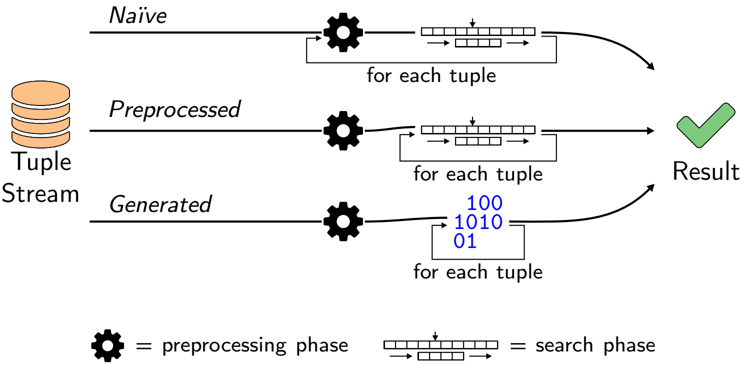

Knuth-Morris-Pratt Algorithm

From Naïve to Preprocessed

Naïve approach

```
KMP(text, pattern):
  lpsTable = preprocess(pattern);
  pPos = 0;
  pSize = pattern.size();
  tPos = 0;
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  while (tPos - pPos + pSize <= tSize)
    if (pattern[pPos] == text[tPos])
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Extract pre-processing →

Preprocessed approach

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KMP(text, pattern, lpsTable):

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Specialize →

Generated approach

whileLoopHeader:
check tPos - pPos + 3 $\leq$ text.size()

`return false`

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UMBRA

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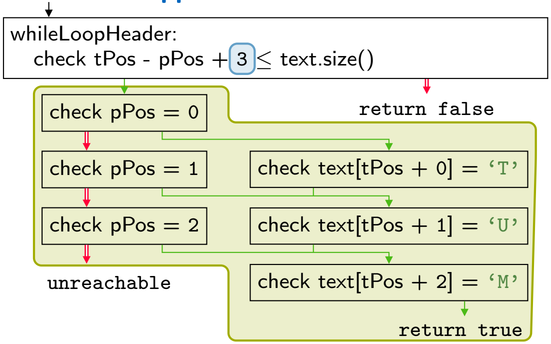

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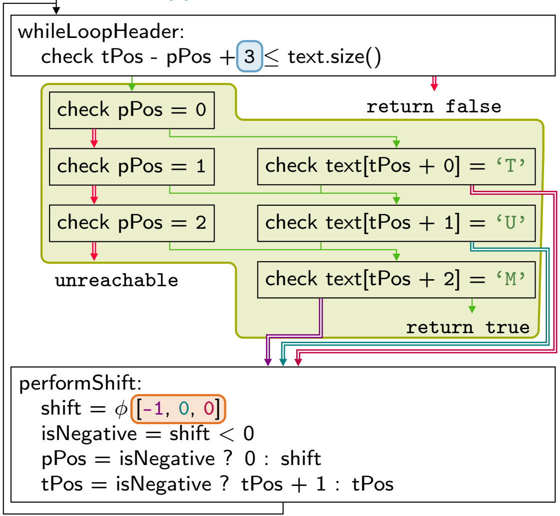

Evaluation

Multi-threaded performance on Clickbench: `url like '%google%'`

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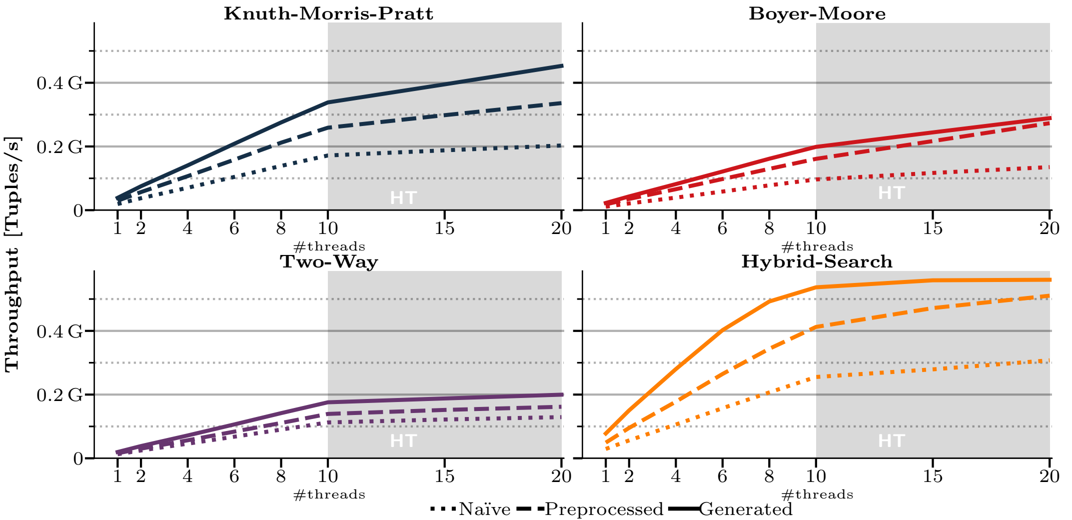

Hybrid-Search

UMBRA TUM

- Uses SSE instruction: `pcmpistri`

```
HS(text, pattern):
  if (pattern.size() <= 16 && text.size() >= 16)
    iter = text.begin(), end = text.end();
    safeMatch = 17 - pattern.size();
    pattern16 = load16(pattern);
    while ((iter + 16) < end)
      match = pcmpistri(pattern16, load16(iter));
      if (match < safeMatch) return true;
      iter += safeMatch;
    if (iter < end)
      match = pcmpistri(pattern16, load16(end - 16));
      return match < safeMatch;
    return false;
  return fallback(text, pattern);
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→ **Code generation allows to generate code specifically for longer patterns**

SSE Search

Example: `'%Technical University of Munich%'`

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whileLoopHeader:
check tPos + $\boxed{30}$ $\leq$ text.size()

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data = load16(text, tPos)
match = $\boxed{\text{pcmpistri('Technical Univer', data)}}$
check match == 0

SSE Search

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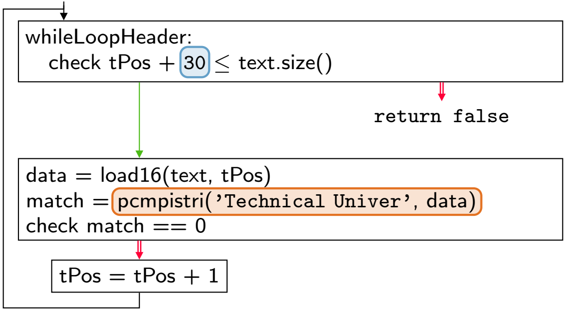

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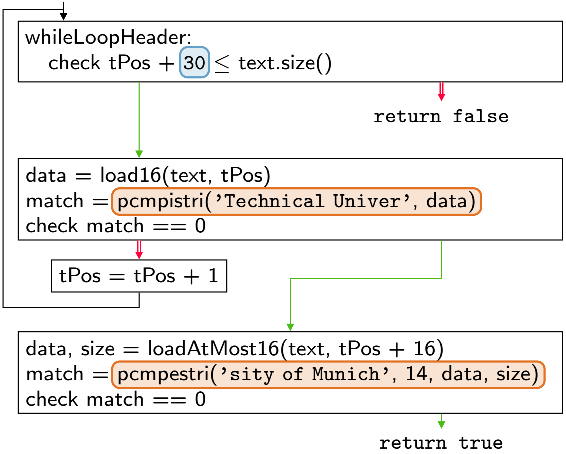

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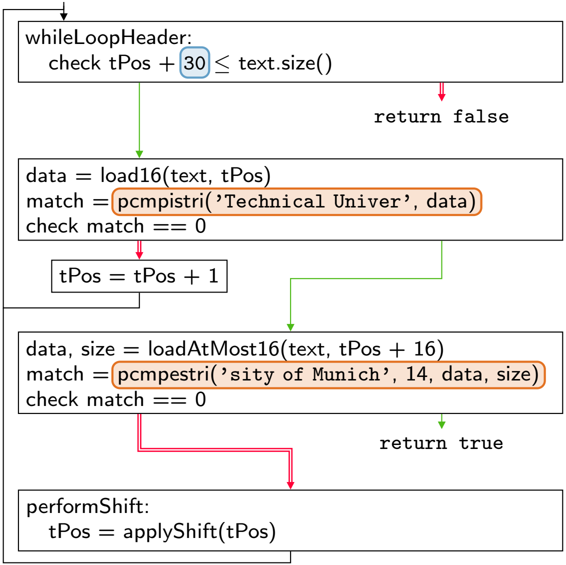
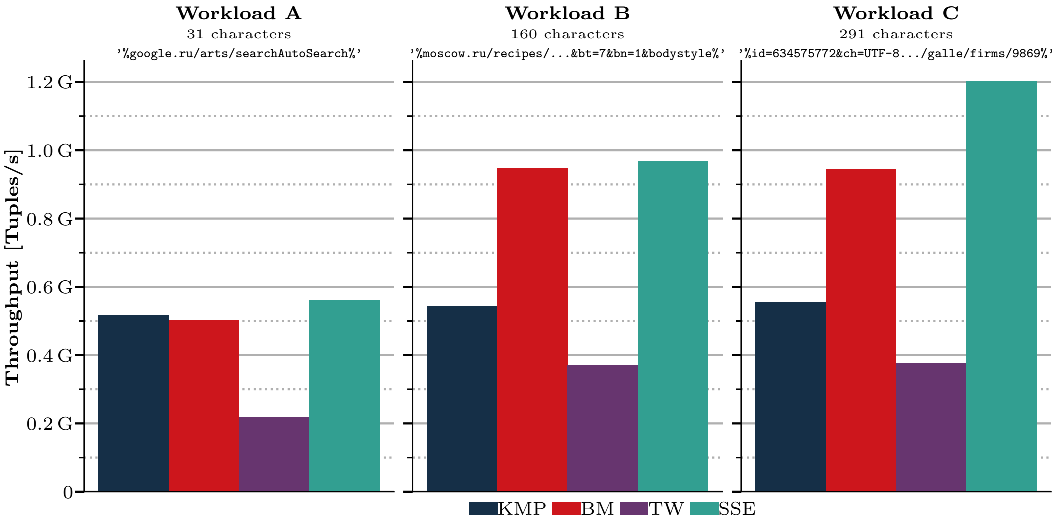


Evaluation

Long patterns



Exploiting Code Generation for Efficient LIKE Pattern Matching

➔ Replacing generic function calls with pattern-specific code

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Exploiting Code Generation for Efficient LIKE Pattern Matching

- ➔ Replacing generic function calls with pattern-specific code
- ➔ Throughput improvement by up to 2.5×

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Exploiting Code Generation for Efficient LIKE Pattern Matching

- Replacing generic function calls with pattern-specific code
- Throughput improvement by up to 2.5$\times$
- Generating specialized code with SSE instructions for longer pattern

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