**FAITH is a faithful system for temporal QA providing explanatory evidence for answers**

- **Lookups of dates**
  - When was Bohemian Rhapsody recorded? → 1975

- **Questions with explicit temporal constraints**
  - Record company of Queen in 1975? → EMI
  - Record company of Queen in 1990? → Parlophone

- **Questions with implicit temporal constraints**
  - Queen’s record company when recording Bohemian Rhapsody? → EMI
  - Queen’s record company after Freddie Mercury’s death? → Parlophone

⇒ Many QA systems falsely reply EMI by their popularity prior, being unfaithful to the temporal constraint in the question
⇒ Answer should satisfy temporal constraints

**LIMITATIONS OF THE STATE-OF-THE-ART**

- Temporal constraints matched solely in latent space
- Answer derivation not explainable for end users
- Operate only over a single information source, KB or text, inherently limiting the answer coverage of the QA system

**FAITH**

- Faithful answering of temporal questions with time constraints, using novel mechanism for handling challenging implicit questions
- First temporal QA system tapping into heterogeneous sources (Wikidata KB, Wikipedia text, tables, and infoboxes)
- Explainable answer derivations and explanatory evidence for answers: answer traceable through entire system

**FAITHFULNESS**

- Structured modelling of temporal information need
- Transforming implicit temporal constraints into explicit conditions via the implicit question resolver
- Dedicated temporal pruning of temporally incompatible evidence via temporal rules

**FAITH outperforms state-of-the-art on implicit questions, providing more faithful answers**

**TIQ Benchmark Construction**

- Automatic construction of implicit questions
- Questions derived from multiple sources: Wikipedia text, infoboxes, and Wikidata KB
- Configurable among various dimensions

**TIQ Benchmark Characteristics**

- 10,000 implicit questions
- 2,542 long-tail entities (>20 KB-facts)
- 2,613 prominent entities (>500 KB-facts)
- 2.45 question entities per question
- 17.96 words per question

**Faithfulness Evaluation**

Comparing the faithfulness of FAITH and Un-FAITH for correct answers, and how often temporal constraints are violated or ignored.

<table>
<thead>
<tr>
<th>Benchmark →</th>
<th>TIQ</th>
<th>TimeQuestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>Faithful</td>
<td>Temporally Unfaithful</td>
</tr>
<tr>
<td>FAITH ½</td>
<td>0.95</td>
<td>0.00</td>
</tr>
<tr>
<td>Un-FAITH ½</td>
<td>0.90</td>
<td>0.08</td>
</tr>
</tbody>
</table>

**Example:**

- What movie starring Taylor Lautner in 2017?
- **Evidence provided by FAITH**:
  - “Taylor Lautner, Year is 2017, Title is Abduction, Role is Nathan Hayes” [Wikipedia facts]
- **Evidence provided by Un-FAITH**:
  - “Abduction, cast member, Taylor Lautner” [Wikidata KB]

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After managing FC Nantes, which football club did Antoine Raab take on next?

**Understanding**

- Model for Time-aware Structured Frame
  - for generating question entity, question relation, expected answer type, temporal category, and temporal signal
  - Explicit Temporal Annotation
    - to identify explicit temporal values

**Implicit Question Resolver**

- generating intermediate question(s) and recursively calling FAITH for answering them
- Intermediate questions for resolving implicit constraint
  - “When Antoine Raab managed FC Nantes start date?”
  - “When Antoine Raab managed FC Nantes end date?”
- Explicit temporal values
  - 1946
  - 1949

**Retrieval**

- Heterogeneous Retrieval
  - from Wikidata KB, Wikipedia text, tables, and infoboxes

**Answering**

- Top-1 Faithful Evidences
  - Graph Construction
  - GNN
  - Iteration 1
  - Iteration 4
  - Iteration 1

**Stade Lavallois**

Supporting evidence for answers of intermediate questions (1946 and 1949)

- “Antoine Raab, after the liberation of Nantes in 1944, Raab joined FC Nantes and played for the club until 1949” [Wikipedia text]

Supporting evidence for final answer (Stade Lavallois)