M2TQA:A Metacognitive Framework for Multi-Table Question Answering

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Abstract

A Metacognitive Framework for Multi-Table Question Answering Processing structured data is critical in finance, healthcare, and science. While single-table question answering has advanced, multi-table QA remains challenging due to schema understanding, cross-table reasoning, and complex natural language queries. We propose M2TQA , a novel framework inspired by human cognitive and metacognitive mechanisms. M2TQA integrates metadata extraction, query decomposition, and a metacognitive module to enable interpretable, robust solutions for MTQA. It dynamically simulates human-like reasoning through feedback loops, bridging gaps between natural language understanding and structured data processing. Experiments on four benchmarks show M2TQA outperforms baselines by 94.54% and 33.24% in F1 scores. This work advances MTQA and highlights metacognition's role in AI, fostering interdisciplinary connections between cognitive science and artificial intelligence.

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