CausalBridgeQA: A Causal Inference-Based Approach for Robust Enhancement of Multi-Hop Question Answering

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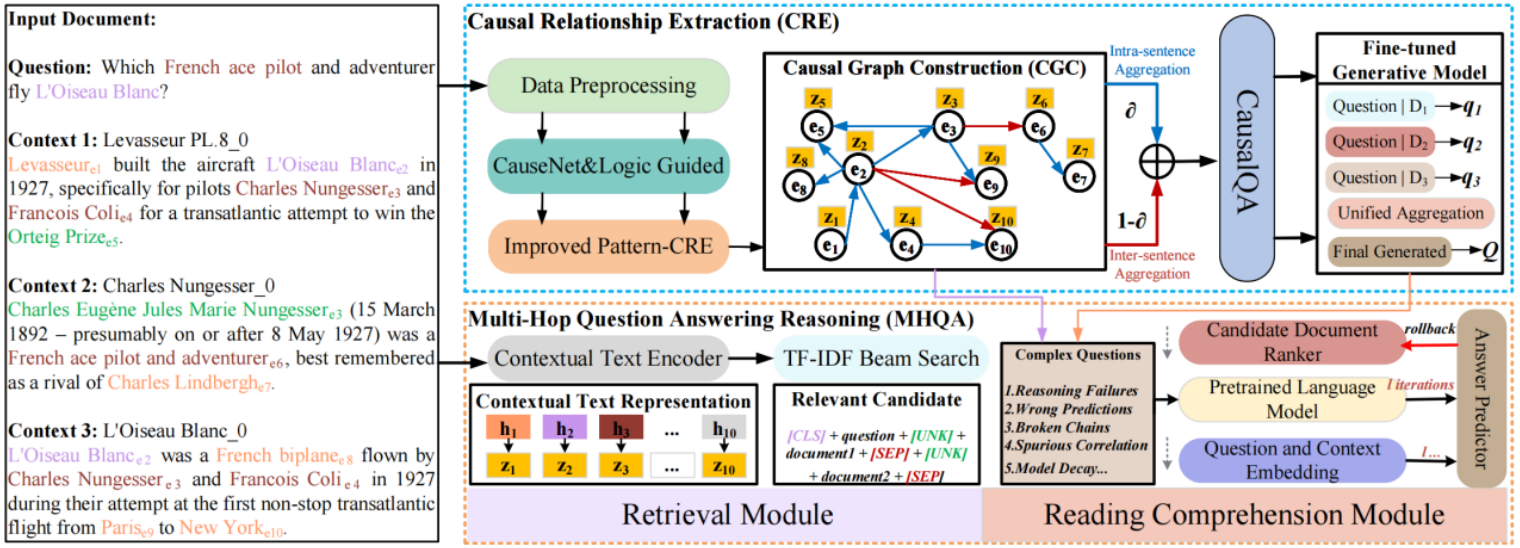
Problems & Ideas

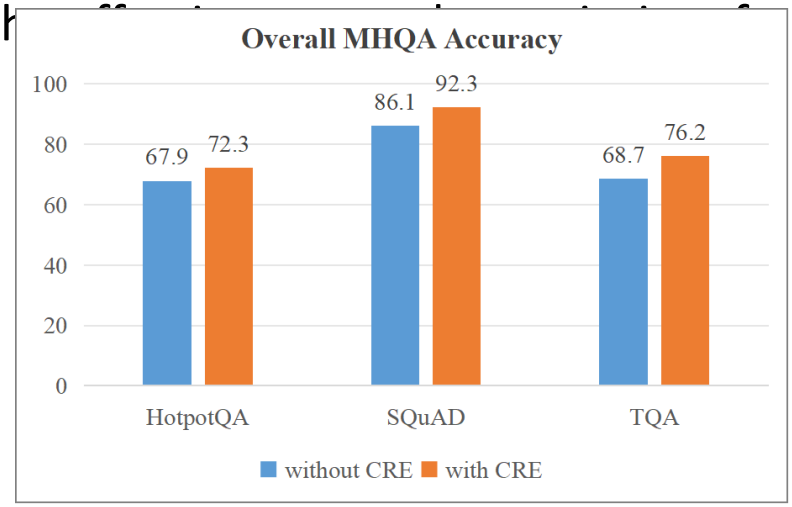
- Problems of existing model work and methods:
  - Lack of true multi-hop reasoning capability, relying only on a single fact or entity.
  - Easily disturbed by feature spurious correlations and miscellaneous information, leading to broken reasoning chains or incorrect answers.
- Ideas: Integrating causal reasoning with MHQA involves extracting implicit causal relationships from the text and incorporating them into the MHQA training process for learning, thereby alleviating model deficiencies.

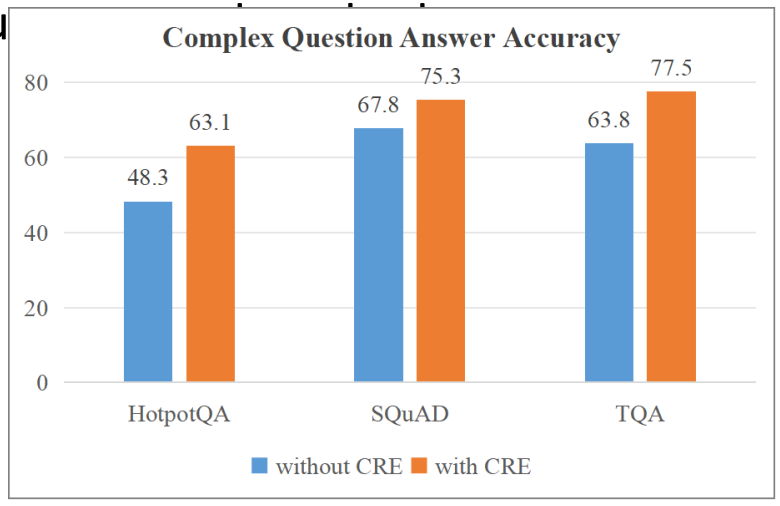


Overall CausalBridgeQA framework: the input document is on the left, and the Causal Relationship Extraction (CRE) and Multi-hop Question Answering (MHQA) phases are on the right, marked with blue and orange dashed lines. The input document first goes through CRE to extract causal knowledge and reformulate the question, then in the MHQA phase, it supplements the training process to improve performance.

Main Contributions

- Contributions:
  - A novel approach named CausalBridgeQA to address the issues of reasoning chain breaks and feature spurious correlations in MHQA task.
  - A “knowledge compensation” mechanism specifically designed to address complex questions that can easily lead the model to make errors or struggle.
  - A series of experiments on three real and effective datasets: HotpotQA, SQuAD, and TQA. The experimental results demonstrate th[illegible]u[illegible]





The left figure shows the accuracy of correctly answering questions tested on multiple question-and-answer datasets, with and without the causal relationship extraction process in the CausalBridgeQA method. The right figure illustrates the overall performance of the model on complex questions, with and without the incorporation of causal knowledge and transformation of advanced semantic information.