

Multi-hop QA

- ▶ Very few SQuAD questions require actually combining multiple pieces of information — this is an important capability QA systems should have
- ▶ Several datasets test *multi-hop reasoning*: ability to answer questions that draw on several sentences or several documents to answer
- ▶ WikiHop: annotators given multiple documents

The Hanging Gardens, in **[Mumbai]**, also known as Pherozeshah Mehta Gardens, are terraced gardens ... They provide sunset views over the **[Arabian Sea]** ...

Mumbai (also known as Bombay, the official name until 1995) is the capital city of the Indian state of Maharashtra. It is the most populous city in **India** ...

The **Arabian Sea** is a region of the northern Indian Ocean bounded on the north by **Pakistan** and **Iran**, on the west by northeastern **Somalia** and the Arabian Peninsula, and on the east by **India** ...

Q: (Hanging gardens of Mumbai, country, ?)

Options: {Iran, **India**, Pakistan, Somalia, ...}

HotpotQA

Question: *What government position was held by the woman who portrayed Corliss Archer in the film Kiss and Tell ?*

Doc 1 *Shirley Temple* Black was an American actress, businesswoman, and singer ...
As an adult, *she* served as *Chief of Protocol* of the United States

Same entity

Same entity

Doc 2 *Kiss and Tell* is a comedy film in which 17-year-old *Shirley Temple* acts as *Corliss Archer*.

Doc 3 *Meet Corliss Archer* is an American television sitcom that aired on CBS ...

Multi-hop Reasoning

Question: *The Oberoi family* is part of a hotel company that has a head office in what city?

Same entity

Doc 1

The Oberoi family is an Indian family that is famous for its involvement in hotels, namely through *The Oberoi Group* ...

Same entity

Doc 2

The Oberoi Group is a hotel company with its head office in *Delhi*.
...

This is an idealized version of multi-hop reasoning. Do models **need** to do this to do well on this task?

Multi-hop Reasoning

Question: *The Oberoi family is part of a hotel company that has a head office in what city?*

Doc 1

The Oberoi family is part of a hotel company that is famous for its involvement in hotels, namely through the Oberoi Group ...

High lexical overlap

Doc 2

The Oberoi Group is a hotel company with its head office in Delhi.

...

Model can ignore the bridging entity and directly predict the answer

Multi-hop Reasoning

Question: What government position was held by the woman who portrayed **Corliss Archer** in the film *Kiss and Tell* ?

Doc 1 **Shirley Temple** Black was an American actress, businesswoman, and singer ...
As an adult, **she** served as **Chief of Protocol** of the United States

Same entity

Same entity

Doc 2 *Kiss and Tell* is a comedy film in which 17-year-old **Shirley Temple** acts as **Corliss Archer**.

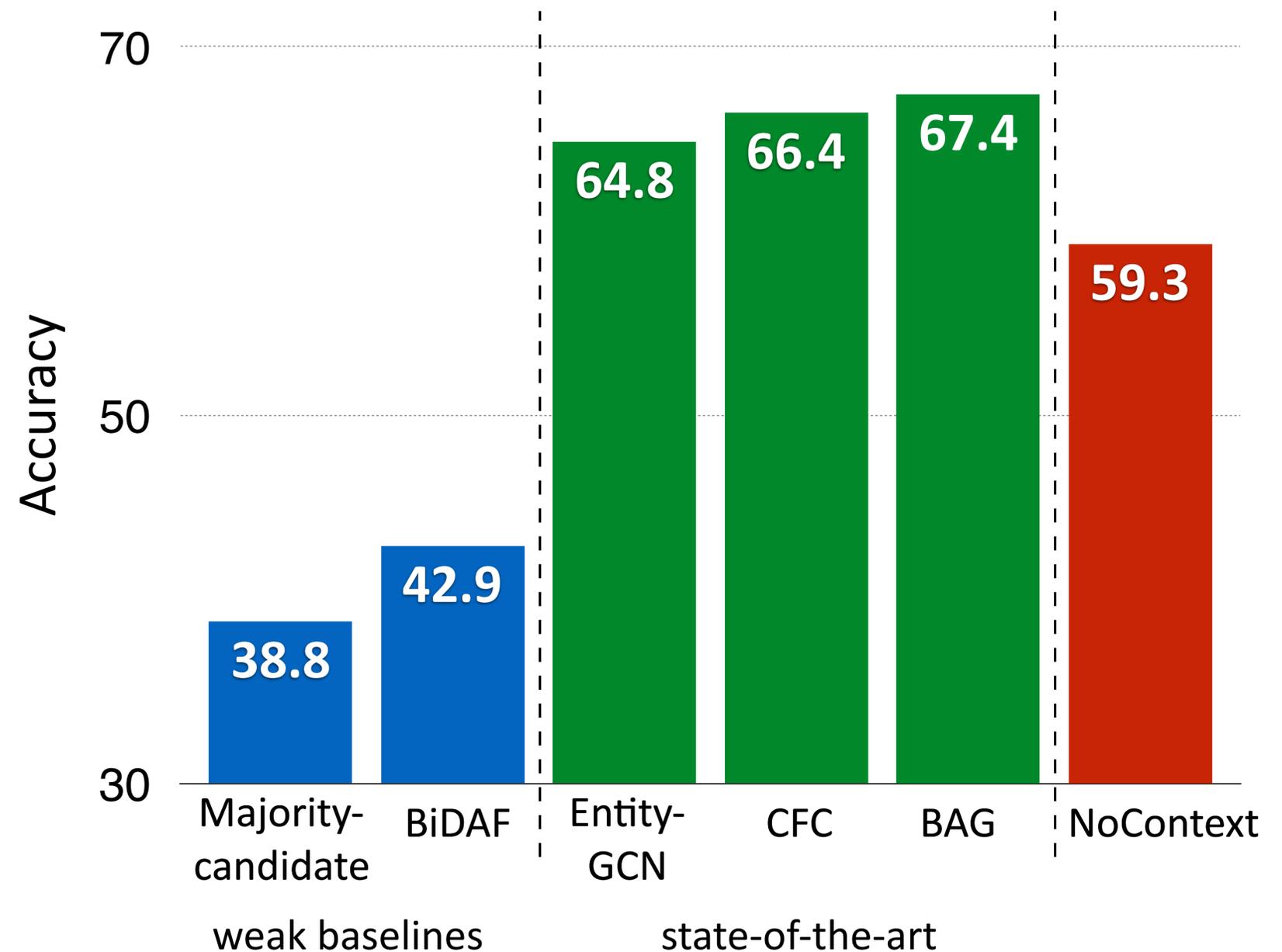
Doc 3 *Meet Corliss Archer* is an American television sitcom that aired on CBS ...

No simple lexical overlap.

...but only one government position appears in the context!

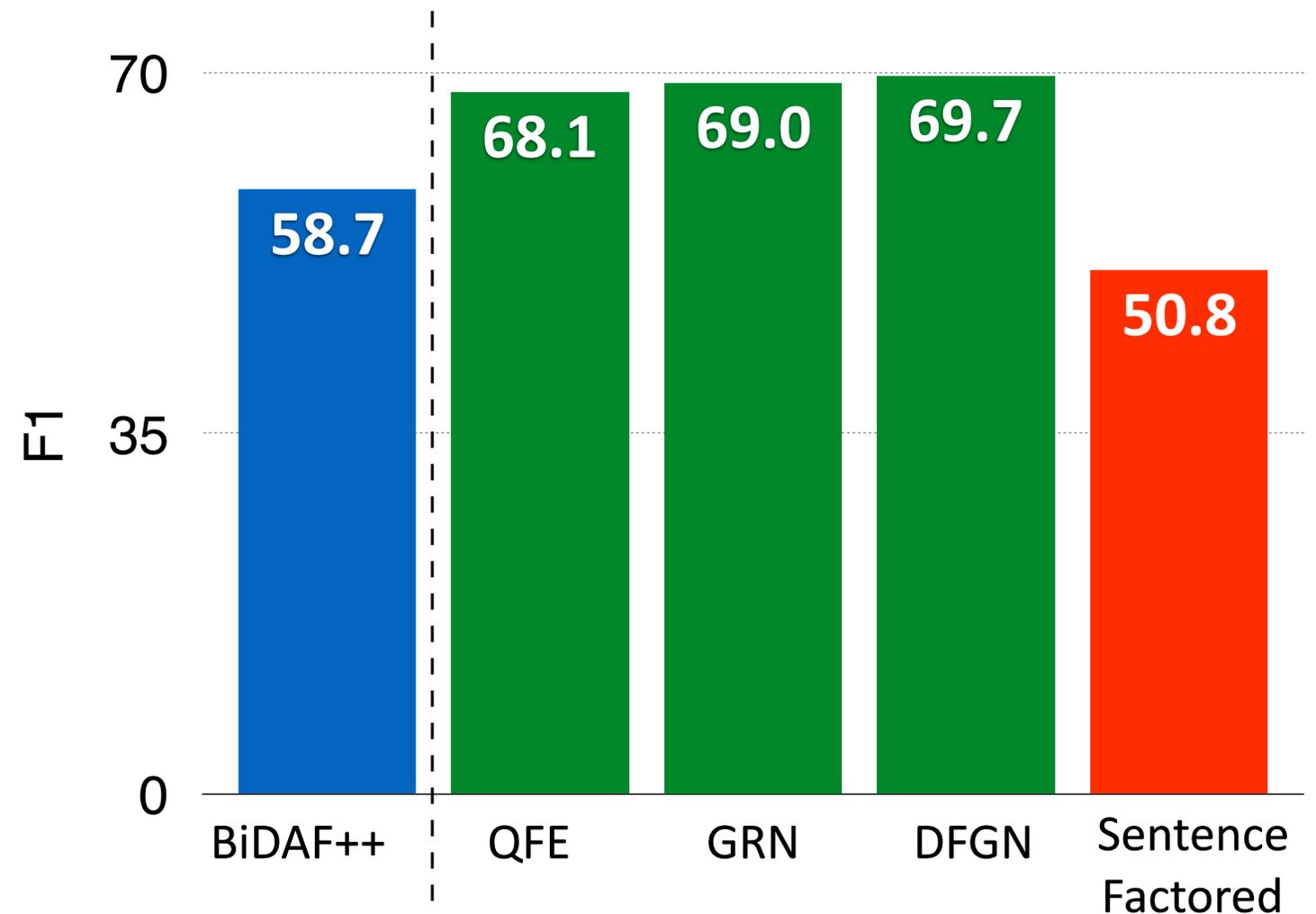
Weaknesses of Multi-hop Reasoning

- ▶ Can get >60% accuracy on a multiple choice task *without using the context*

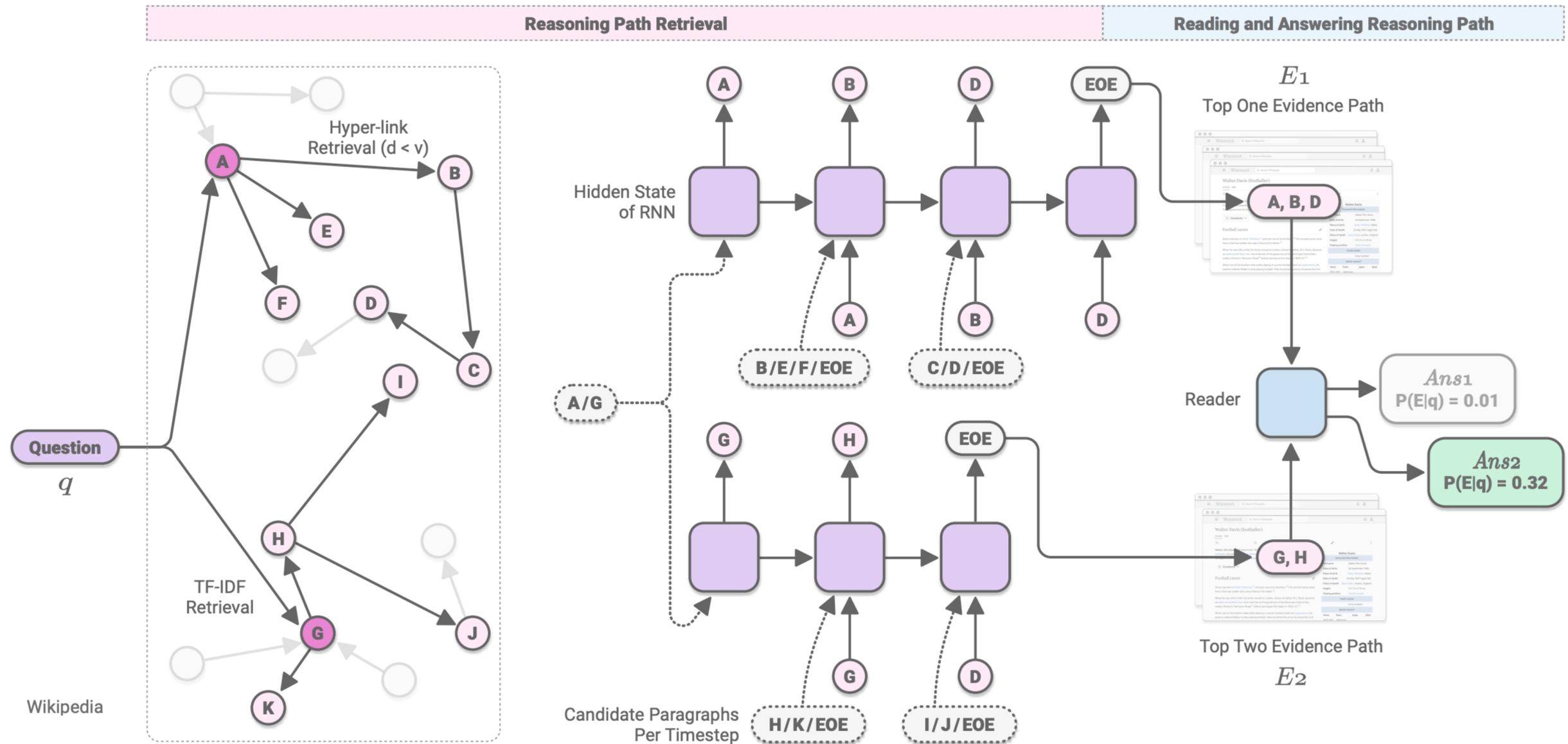


Weaknesses of Multi-hop Reasoning

- ▶ Can get >50% accuracy on a tougher task *looking at sentences in isolation*



State-of-the-art Models



- ▶ Best systems: use hyperlink structure of Wikipedia and a strong multi-step retrieval mode built on BERT