

Question Answering over Curated and Open Web Sources

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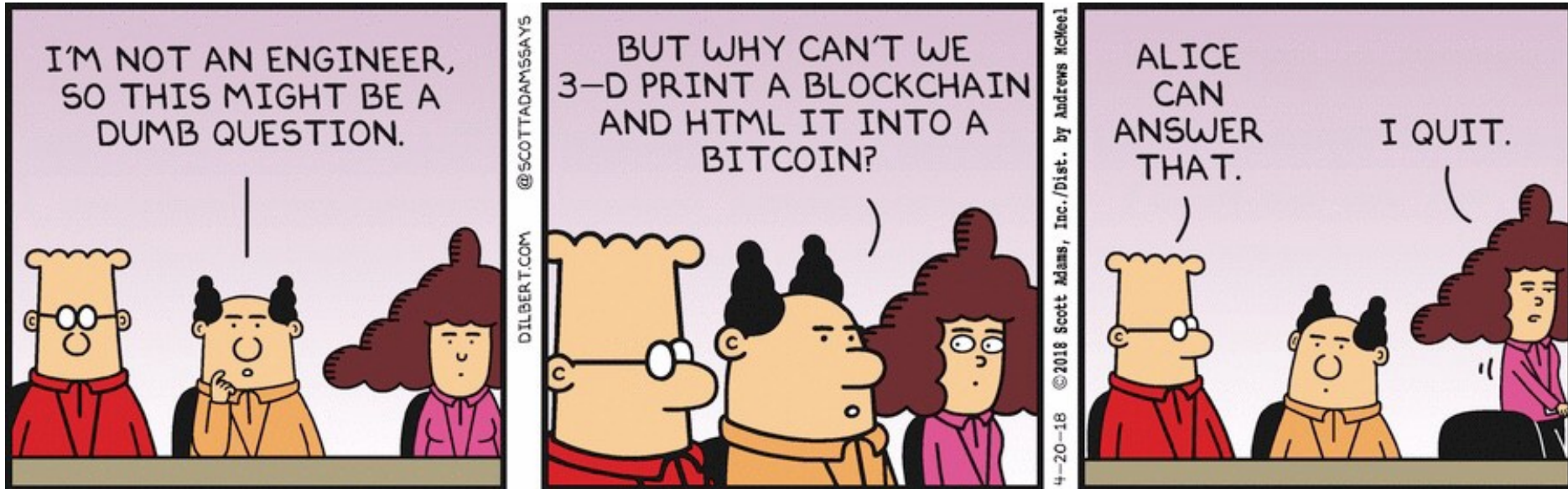
L3S Research Center, Germany



SIGIR 2020 Tutorial

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Question Answering is AI complete



- To perfectly solve QA
 - Involves world-knowledge
 - Linguistics: co-ref, pragmatics, high-level reasoning tasks such as natural language inference
 - Common sense reasoning

Question Answering is AI complete

Passage: *Anita was stung by a bee and left the garden.*

Question: **Why did Anita leave the garden ?**

- A) Because she was in pain
- B) Because it was time for a TV show she didn't want to miss
- C) Because its common practice to leave the garden after being stung by a bee
- D) Because the bee needed some peace

- Simple questions that are hard for the machine
- Need Pragmatics

Question Answering is AI complete



Question Answering is AI complete

- In its full glory, it is indeed hard
- But there has been a lot of progress
 - Knowledge-driven Question Answering
 - Reading comprehension

The AI in this sci-fi movie owed its intelligence to a massive cache of search engine data.

This movie has the plot adapted from this famous play..and has 3 of its main characters named after all biblical characters

— Eve, Nathan and Caleb

Lots of Success



Lots of Applications

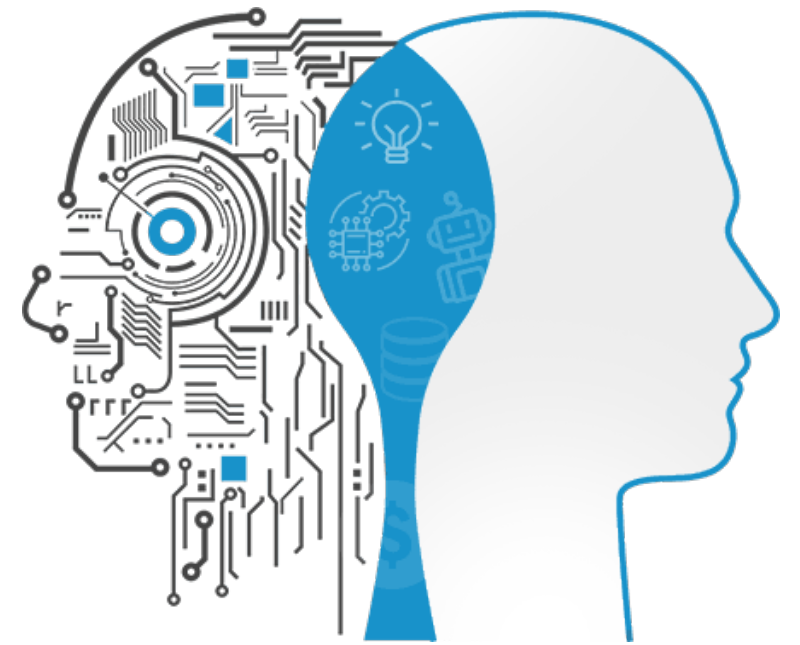
It is automated extracting structured information from defining objects, their relations, and characteristics in documents in natural language, extract required info can extract from text events, terminology, emotional organizations, locations) and other data.



Problems in NLP, Dialog and Search can be formulated as QA

In this part of the tutorial...

- We focus on where progress has been made
- What tasks are out there
 - Reading comprehension, Open-domain QA, Conversational QA
- What models are usually used to solve them
 - Neural, neural, neural
- Challenges and design decision



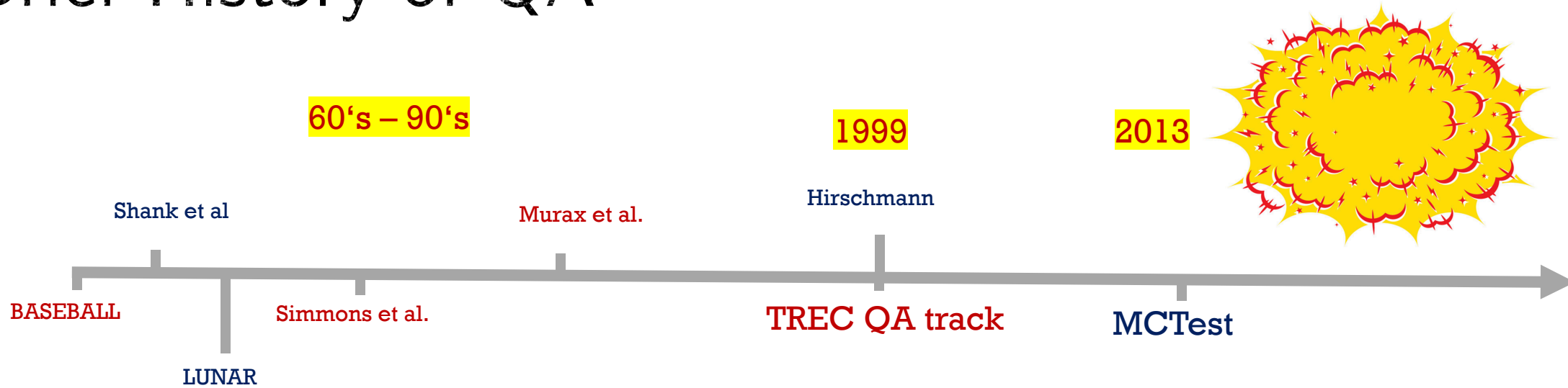
What we do not cover

- Approaches pre 2016
- Other related QA tasks
 - MCQ
 - Visual QA
 - Complex QA requiring selection, aggregation ...
- Model details

We will miss many QA approaches and many QA tasks....



Brief History of QA



NLP interfaces to databases

- Precursors to the modern open-domain QA
- Mostly structured knowledge and limited domain

Story Comprehension

- Precursors to Modern RC tasks
- Shank et al. (1977) – Yale AI Project
- Hirschman (1999)

QA @ TREC

- **Goal**

- Encourage research in information retrieval based on large-scale collections

- **Types of Questions:**

Fact-based, short answers

- How many feet in a mile ?
- Name a food high in zinc.
- When was the first stamp issued ?

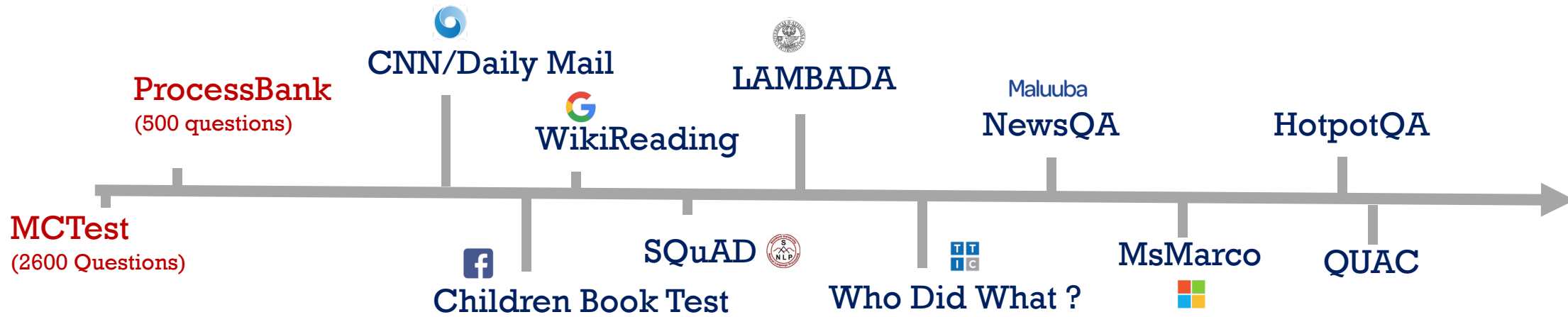
Definition questions

- Who was Galileo ?
- What is an atom ?
- What is lymphosarcoma ?

Reformulation questions

- What attracts tourists in Reims ?
- What are tourist attractions in Reims ?

Modern History of Text QA



- Started with CNN/Daily Mail and popularized with SQUAD
- Benchmarks ranging from
 - Simple to complex questions
 - Realistic to synthetically generated questions
 - Crowdsourced to extractive answers

SQUAD

Question: Which team won Super Bowl 50?

Passage

Super Bowl 50 was an American football game to determine the champion of the National Football League (NFL) for the 2015 season. The American Football Conference (AFC) champion **Denver Broncos** defeated the National Football Conference (NFC) champion Carolina Panthers 24–10 to earn their third Super Bowl title. The game was played on February 7, 2016, at Levi's Stadium in the San Francisco Bay Area at Santa Clara, California.

- Extractive answers, span extraction
- > 100k examples
- Deep learning wave

SQUAD v1, v2

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Question: Which team won Quiz Bowl 50 ?

Version 1

- All answers in the context
- Evaluation – Exact Match
- Evaluation – F1
 - Partial match assuming BoW

Version 2

- Open world assumption
- 1/3 training instances have no answer
- 1/2 dev/test instances have no answer

Cloze tests

Context: the *ent381* producer allegedly struck by *ent212* will not press charges against the “*ent153*” host, his lawyer said Friday. *ent212*, who hosted one of the most-watched television shows in the world, was dropped by the *ent381* Wednesday after an internal investigation by the *ent180* broadcaster found he had subjected producer *ent193* “to an unprovoked physical and verbal attack.”

Question: producer X will not press charges against *ent212*, his lawyer says.

Answer: *ent193*

Span Extraction

Context:	Computational complexity theory is a branch of the theory of computation in theoretical computer science that focuses on classifying computational problems according to their inherent difficulty , and relating those classes to each other. A computational problem is understood to be a task that is in principle amenable to being solved by a computer, which is equivalent to stating that the problem may be solved by mechanical application of mathematical steps, such as an algorithm.
Question:	By what main attribute are computational problems classified using computational complexity theory?
Answer:	inherent difficulty



SQuAD

Multiple Choice Answers

Context: If you have a cold or flu, you must always deal with used tissues carefully. Do not leave dirty tissues on your desk or on the floor. Someone else must pick these up and viruses could be passed on.

Question: Dealing with used tissues properly is important because _____.

Options: A. it helps keep your classroom tidy
B. people hate picking up dirty tissues
C. it prevents the spread of colds and flu
D. picking up lots of tissues is hard work

Answer: C

Free form Answers

Context 1:	Rachel Carson's essay on The Obligation to Endure, is a very convincing argument about the harmful uses of chemical, pesticides, herbicides and fertilizers on the environment.
.....	
Context 5:	Carson believes that as man tries to eliminate unwanted insects and weeds; however he is actually causing more problems by polluting the environment with, for example, DDT and harming living things
.....	
Context 10:	Carson subtly defers her writing in just the right writing for it to not be subject to an induction run rampant style which grabs the readers interest without biasing the whole article.

Question:	Why did Rachel Carson write an obligation to endure?
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Answer:	Rachel Carson writes The Obligation to Endure because believes that as man tries to eliminate unwanted insects and weeds; however he is actually causing more problems by polluting the environment.
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Outline: QA over Text

- **Background:** History, Tasks
- **Machine Comprehension:** Neural models, attention
- **Open Domain QA:** QA over a text corpus
- **Feedback and Interpretability**
- **Conversational QA:** Implicit context in multi-turn setup
- **Take-home:** Summary and insights

Representative methods from each task

Families of algorithms to build up repertoire for text

Focus on methods (and not evaluation)

Design decisions and challenges