

SERP-Based Conversations

Maarten de Rijke

University of Amsterdam

derijke@uva.nl



Work in progress

Joint work in progress with



Pengjie Ren
U. Amsterdam



Maarten de Rijke
U. Amsterdam



Svitlana Vakulenko
TU Wien



Nikos Voskarides
U. Amsterdam



Yangjun Zhang
U. Amsterdam

Information retrieval

- **Connecting people to information**
 - Search
 - Recommendation
 - Conversations

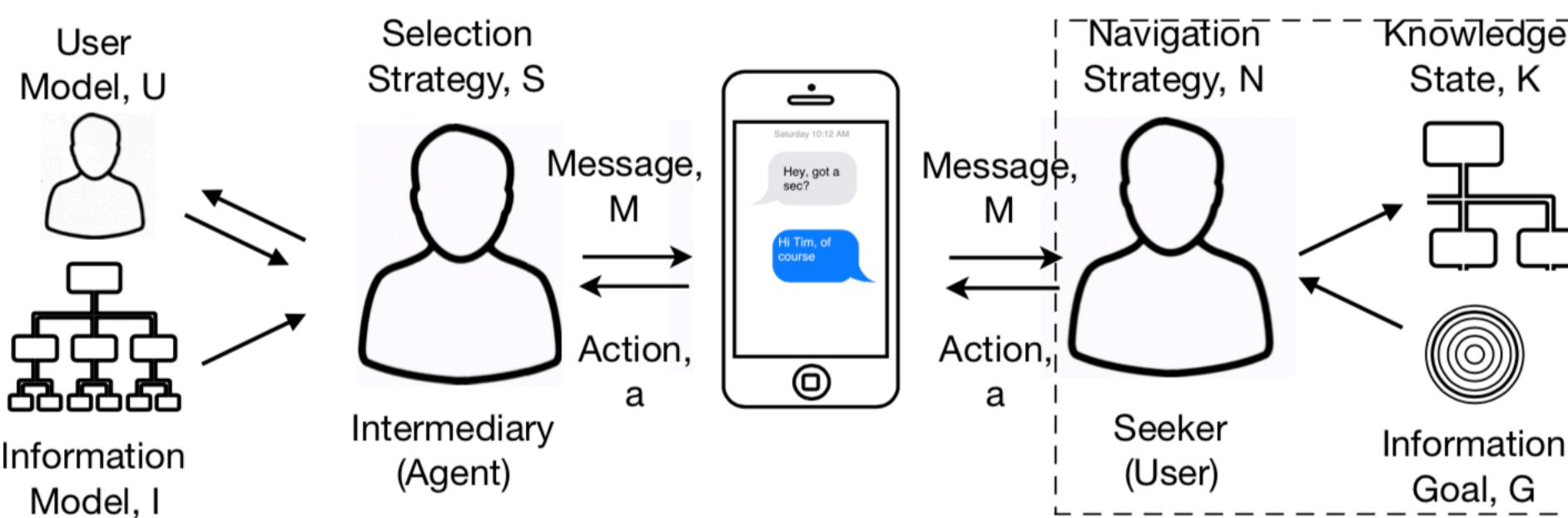
Conversational search

- Idea of **search as conversation** has been around since early 1980s (Belkin, CJIS 1980)
- Making information retrieval interfaces feel more natural and convenient for their users (Radlinski & Craswell, CHIIR 2017)
- Ongoing research and development efforts heavily skewed towards **question answering tasks**

But there's more ...

Conversational browsing

- Using conversations to **browse** large collections of information objects (Vakulenko et al, ISWC 2018)
- User model maintains knowledge state, information goal, navigation strategy



The screenshot shows the Austrian Open Data portal interface, demonstrating conversational browsing results:

Hi! Welcome to the Austrian Open Data portal!

linz senioren

There are 4 datasets

- Seniorenenzentren Standorte**
categorization: gesellschaft und soziales
organization: stadt linz
license: cc by at 30
- Städtische Seniorenenzentren**
categorization: gesellschaft und soziales
organization: stadt linz
license: cc by at 30
- Private Seniorenheime**
categorization: gesellschaft und soziales
organization: stadt linz
license: cc by at 30
- Belegung der städtischen Senioren und Pflegeheime**
categorization: gesellschaft und soziales
organization: stadt linz
license: cc by at 30

More Options

Hi! Welcome to the Austrian Open Data portal!

There are 2002 datasets

You can explore them by license:

- cc by at 30
- cc by
- other pd
- cc by sa

More Options

There are 2002 datasets

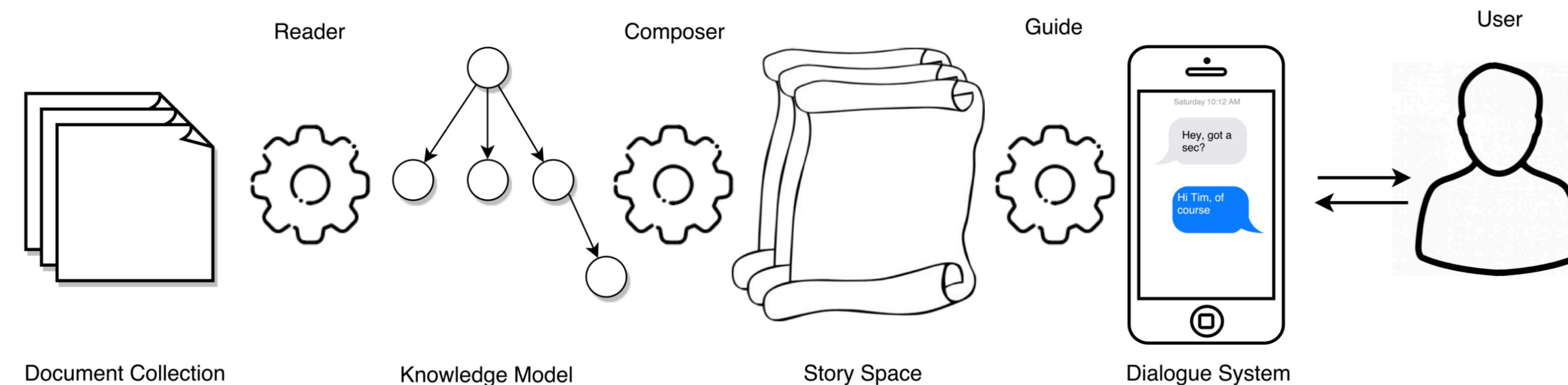
You can explore them by organization:

- stadt linz
- stadt wien
- land oberoesterreich
- land salzburg
- stadt innsbruck
- land tirol

Type and press Enter to search... Continue More Options Restart

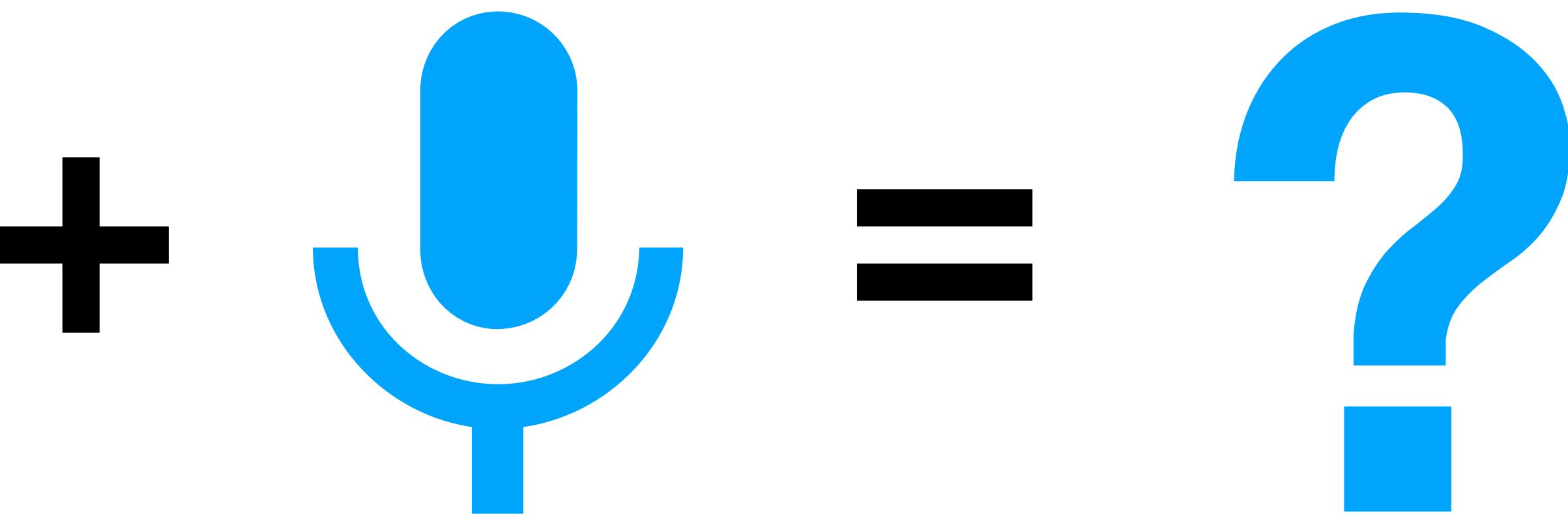
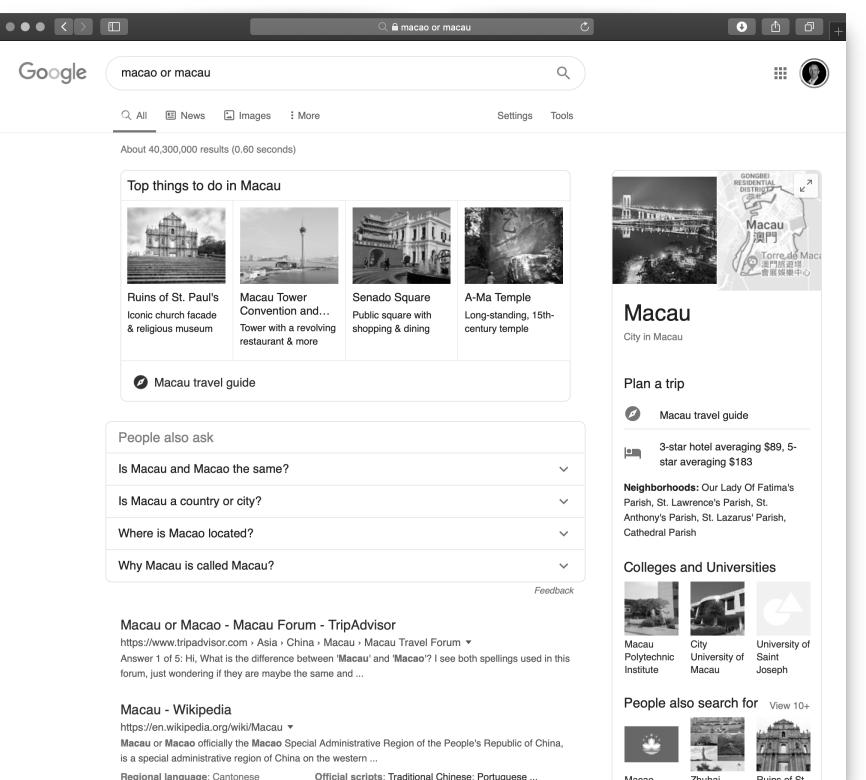
Conversations for exploratory search

- **Exploratory** search important
 - Educational purposes
 - Serendipitous discoveries of cultural artifacts – users often look for inspiration, surprises, novel ideas
 - E-commerce
- (Vakulenko et al., SCAI 2017)



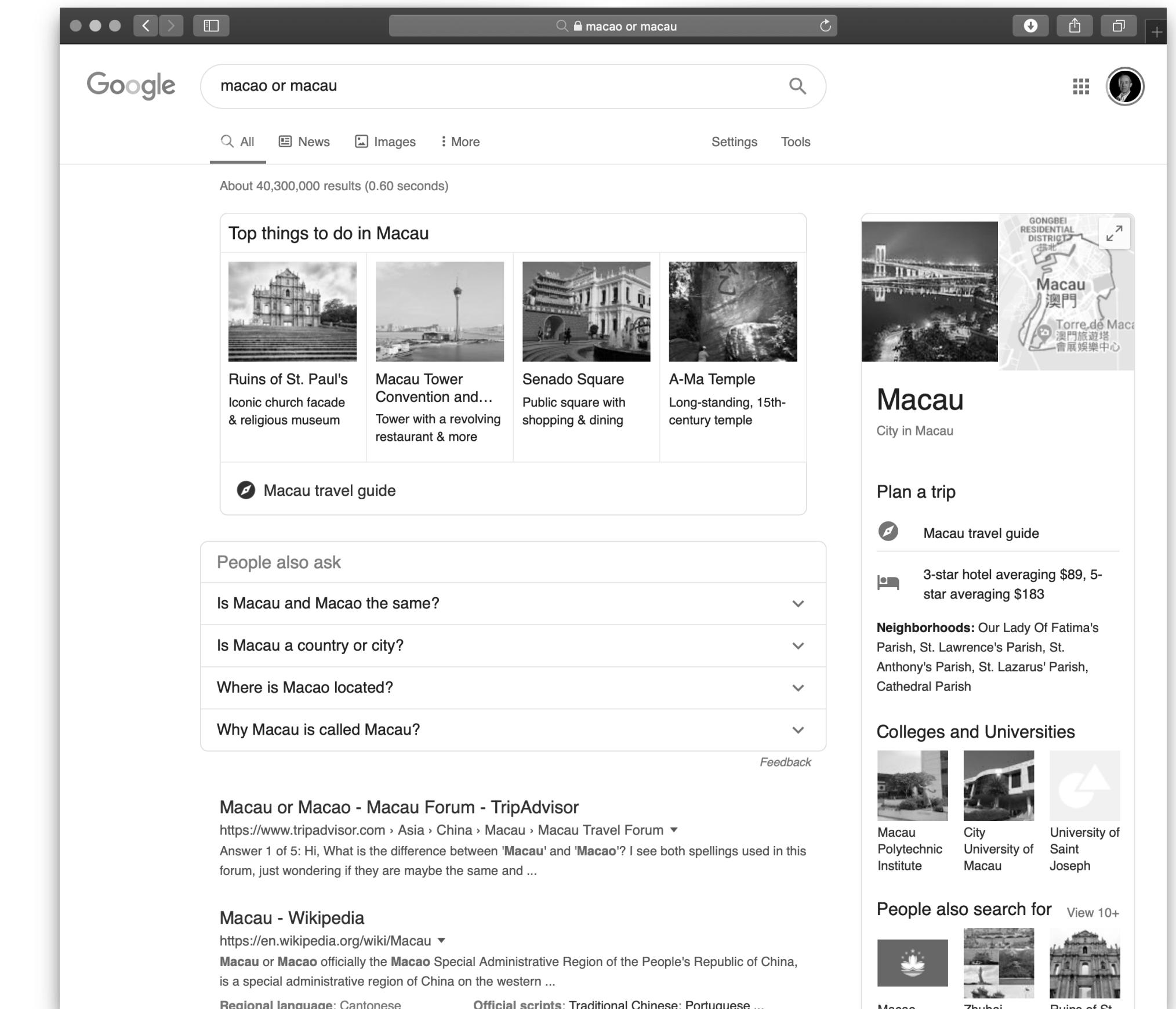
Conversational SERPs

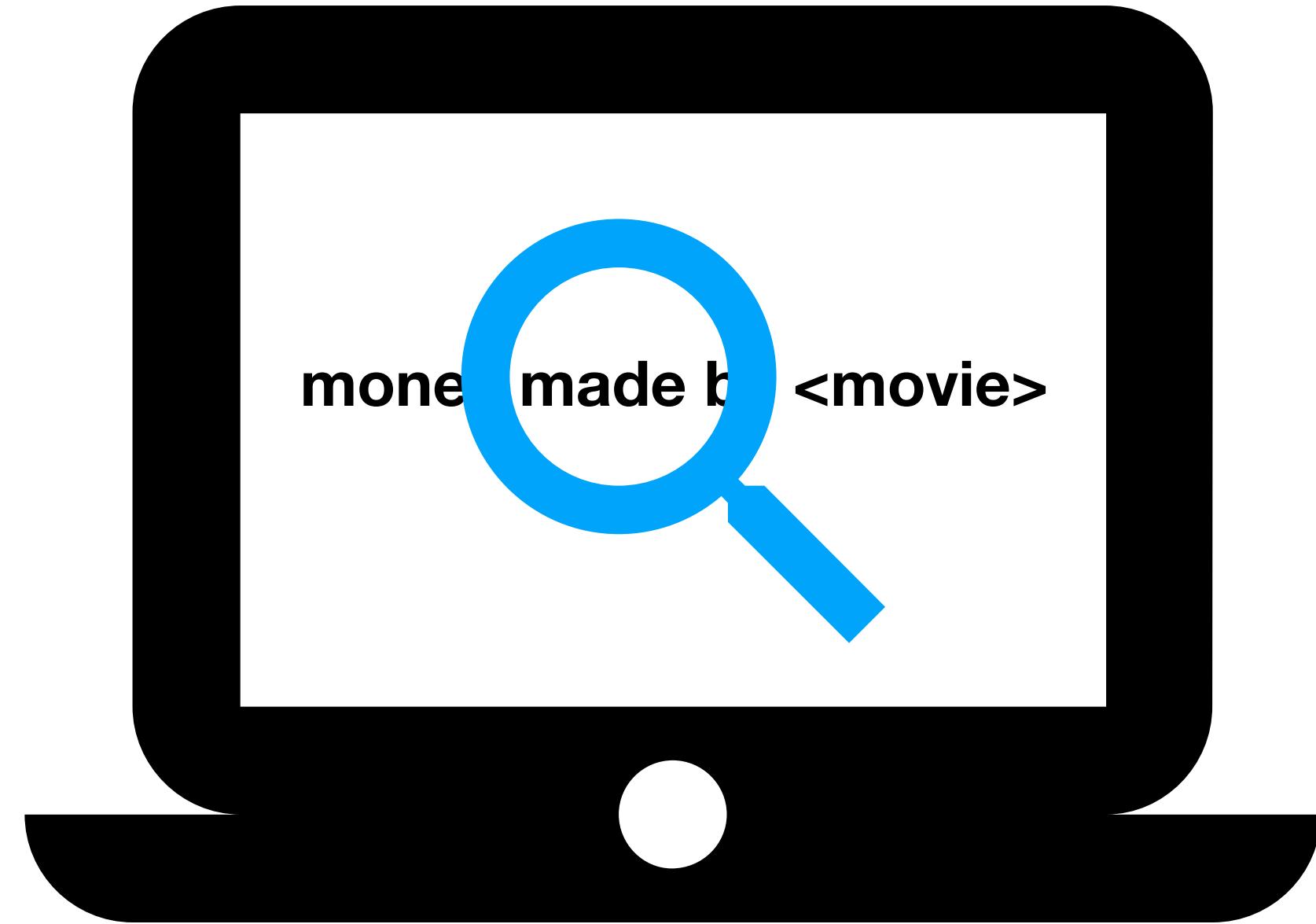
- Conversational search engine result pages



Conversational SERPs

- **Heterogeneous SERPs**
 - Dealing with multiple intents
 - Multiple answers
 - Text vs. image/video vs. knowledge cards vs. ...
 - Structured vs. unstructured information
 - Static blogs/articles vs. live news/reports
 - Closed world vs. open world
 - ...
- **But let's start a bit simpler ...**





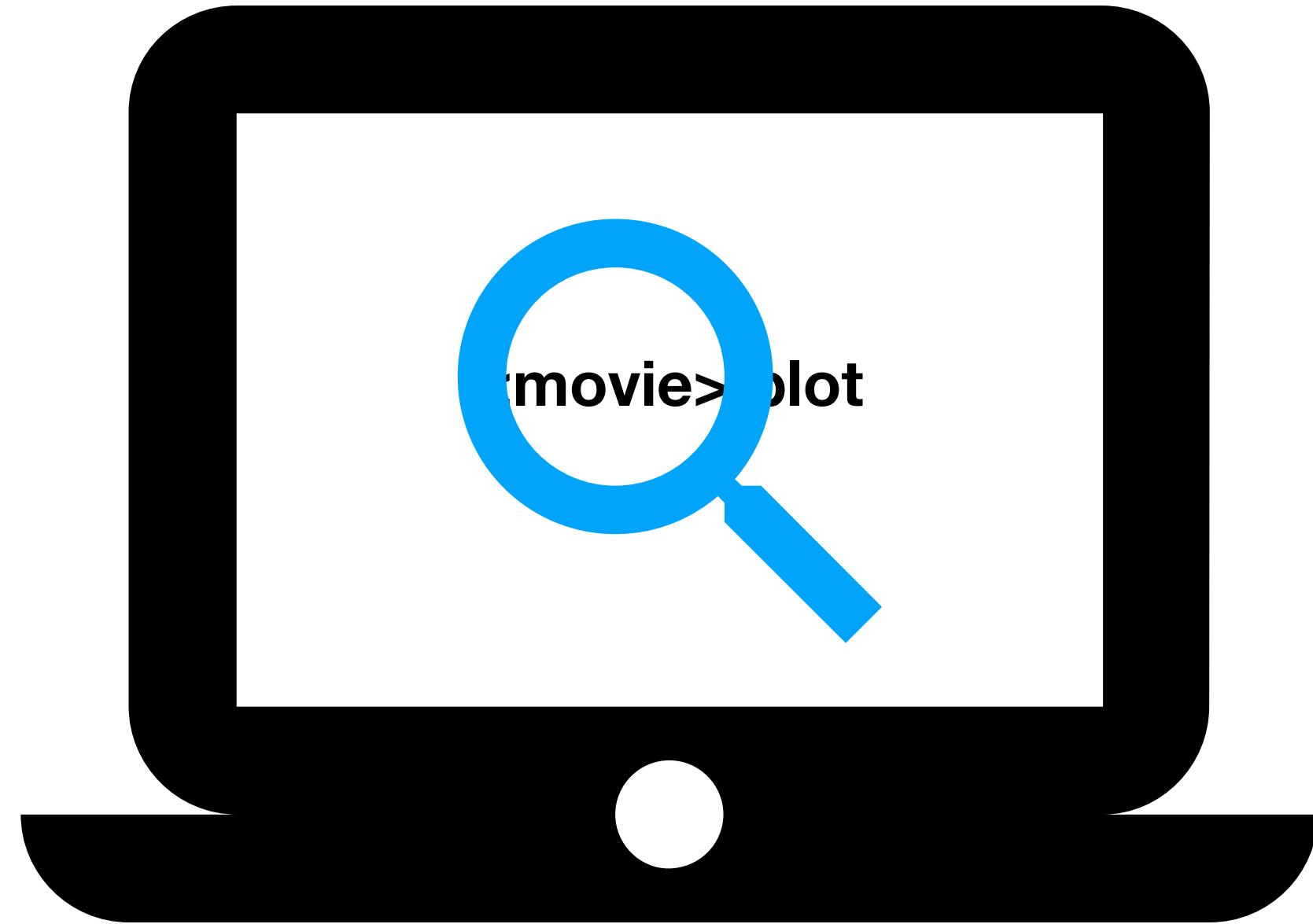
... that 's redundant because it is a ben stiller movie . clearly my expectations for this movie were not high and , maybe because of that , i found " meet the fockers " quite funny . do you remember when big box office **\$ 279,167,575** awards ascap film and television music awards 2005 top box office ...

what did you think of the title ?

the title pretty much describes the level of the humor in this ben stiller movie .

haha , i agree ! do you know if it made any money ?

yeah , it made \$ 279,167,575 . pretty good .



...being captured by boris and onatopp . bond arrives in st . petersburg and meets his cia contact , jack wade (joe don baker) . wade agrees to take bond to the hideout of a russian gangster , valentin zukovsky (robbie coltrane) , whom bond had shot in the leg and given a permanent limp years before ...

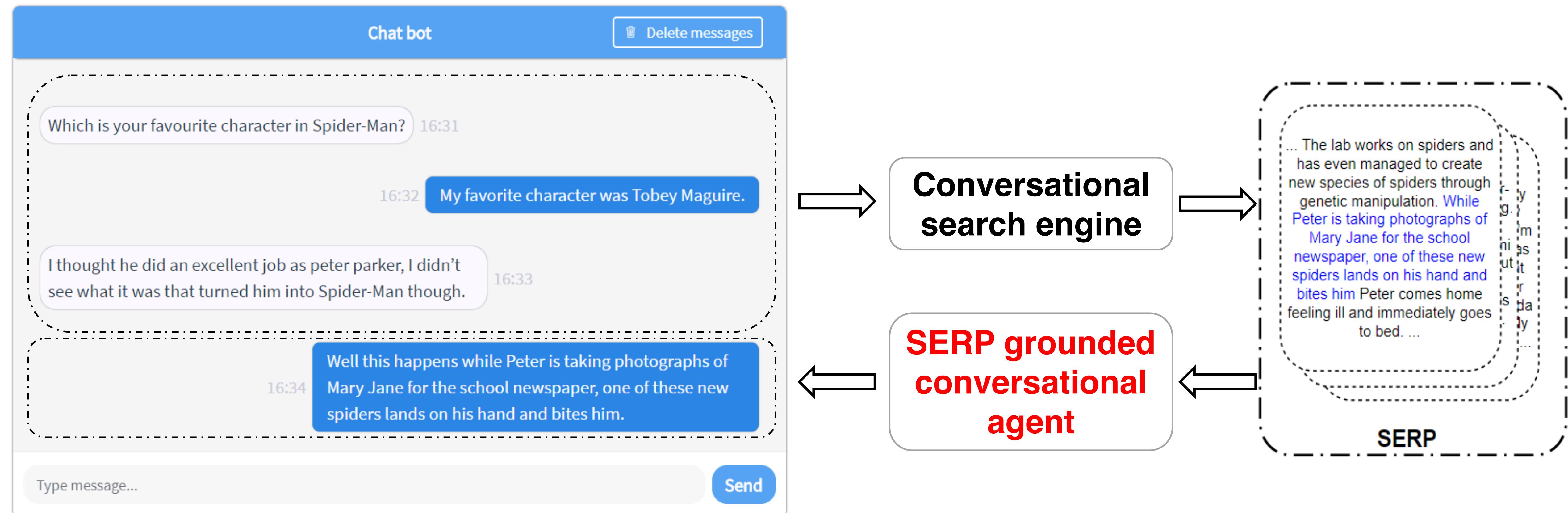
that was a good scene

what did you like about the movie ?

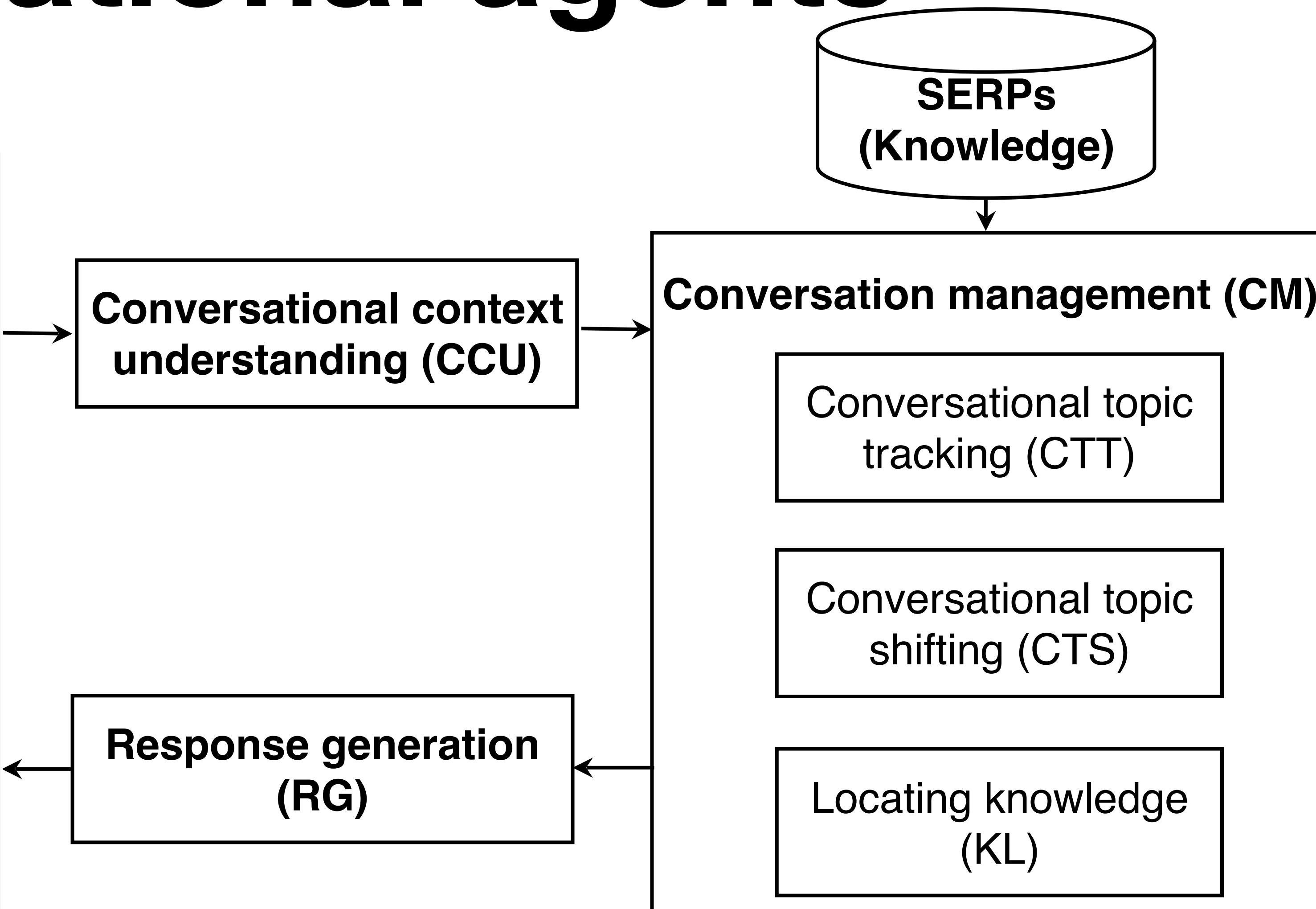
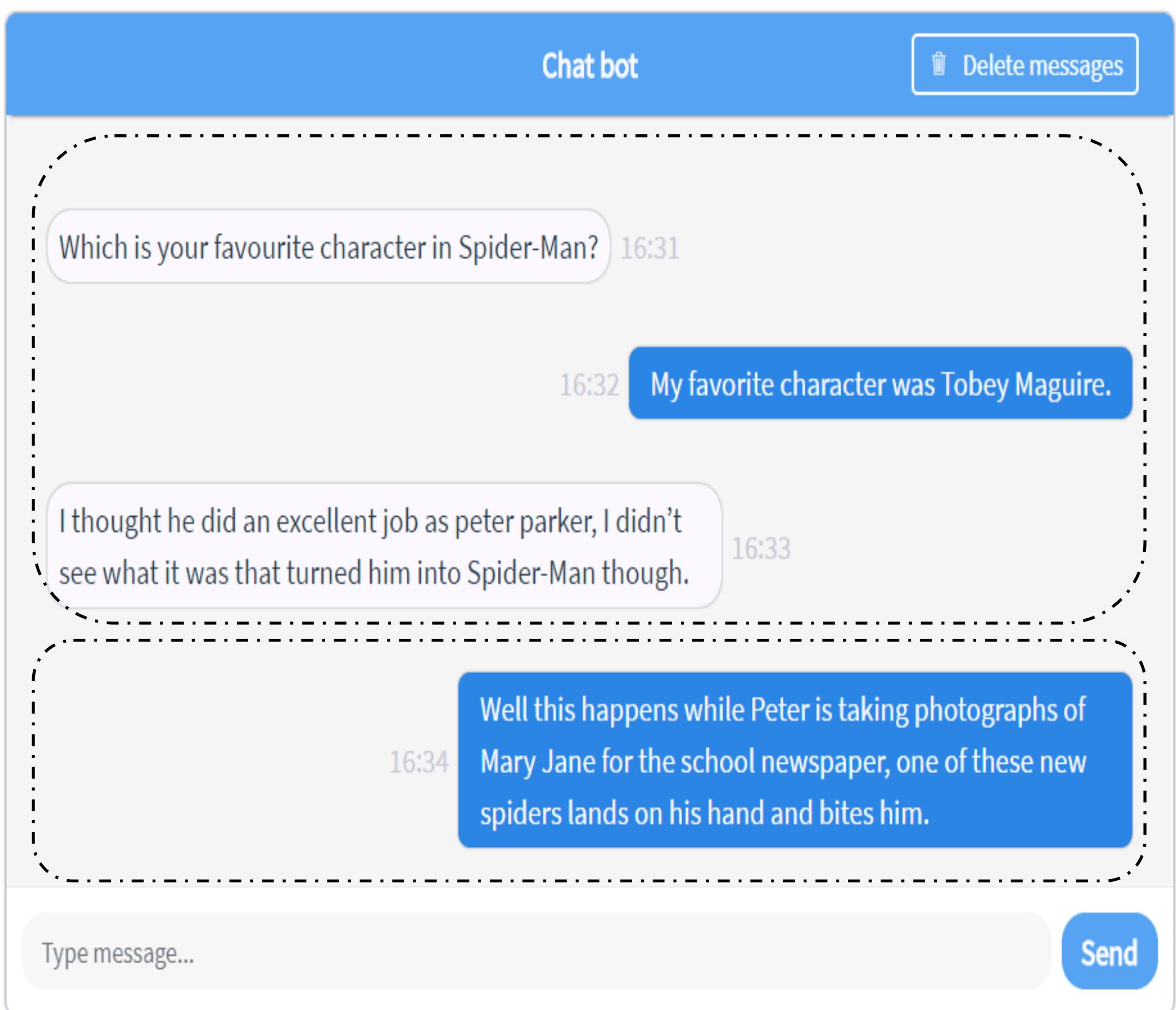
i liked his friend , jack wade .

i loved the part where bond arrives in st . petersburg and meets his cia contact , jack wade (joe don baker) .

Search as conversation



SERP grounded conversational agents



Make it more interactive.

Who shot the first cat video?

www.youtube.com/watch?v=k52pLvVmmkU

YouTube Search

Thomas Edison - 1894 Boxing cats

472,863 views 1.9K 153 SHARE SAVE ...

Seamus McGoona SUBSCRIBE 87

The image shows a YouTube video player window. The video itself is a grainy, black-and-white historical film of two cats boxing. The video player has a dark theme. At the top, there's a navigation bar with icons for back, forward, and search. The URL in the address bar is www.youtube.com/watch?v=k52pLvVmmkU. Below the video, the title "Thomas Edison - 1894 Boxing cats" is displayed in a bold, black font. Underneath the title, it says "472,863 views". To the right of the views, there are like and dislike counts (1.9K and 153), and sharing and saving options. At the bottom of the video player, the channel name "Seamus McGoona" is shown next to a red "SUBSCRIBE" button with the number "87".

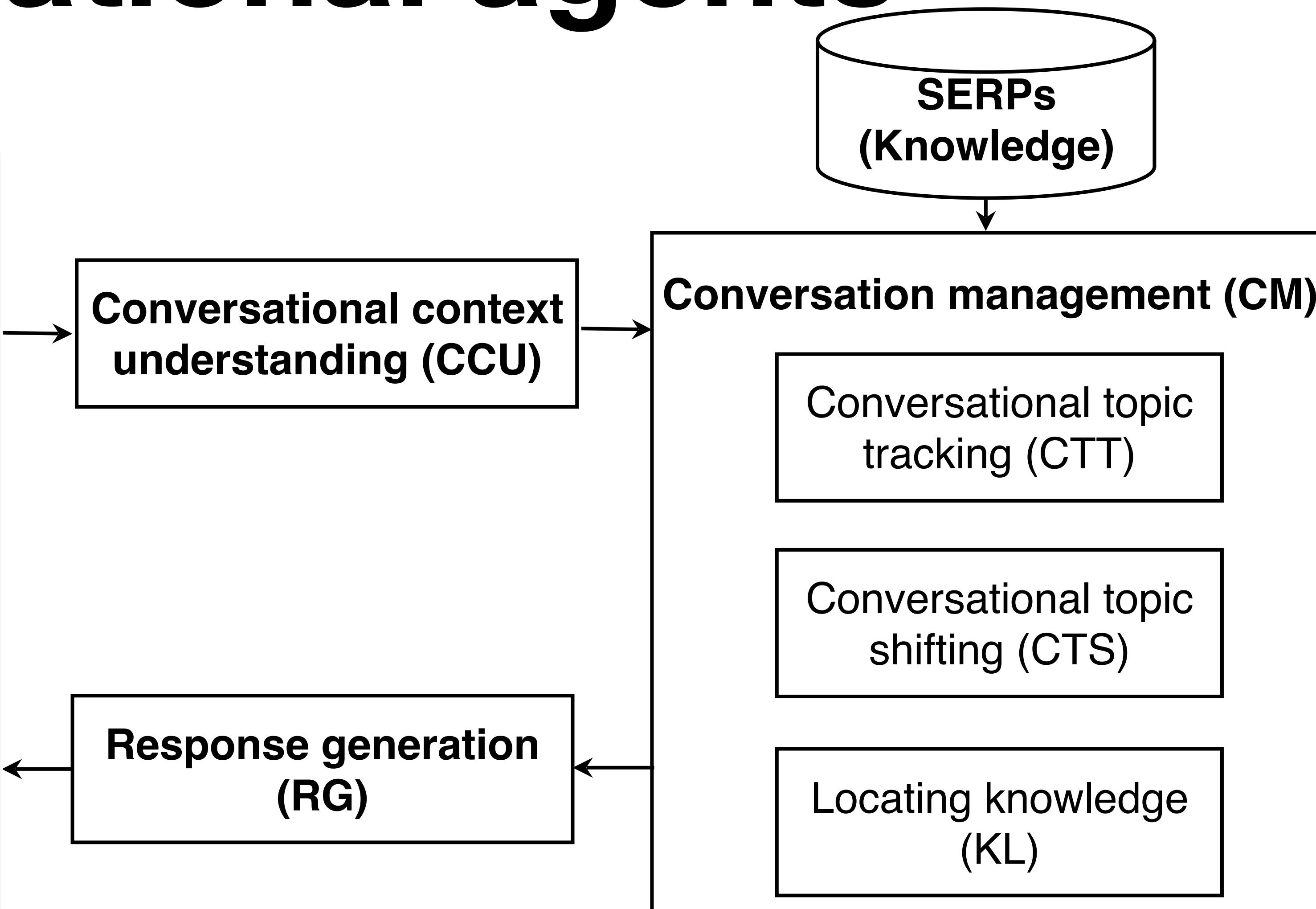
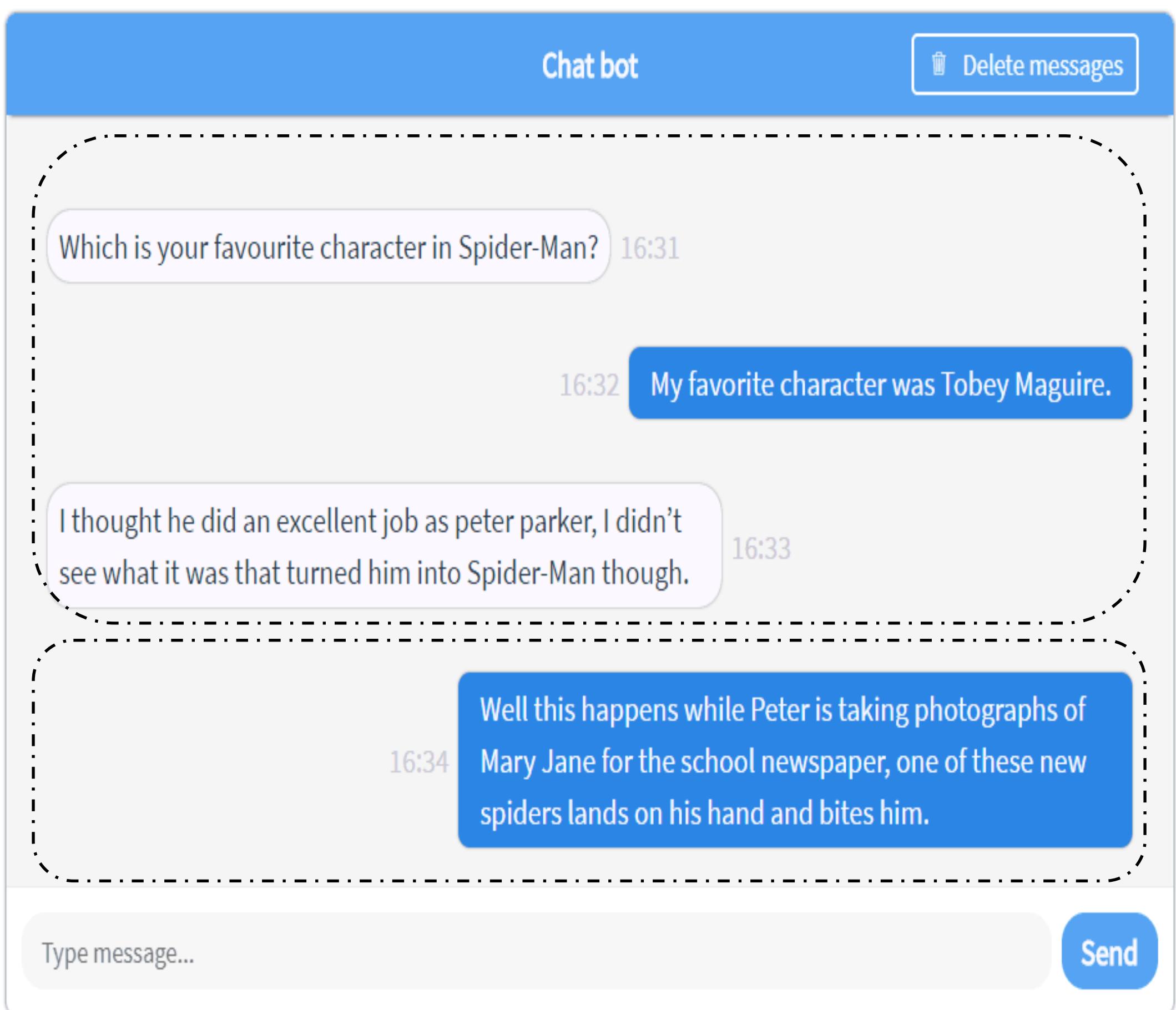
Thomas Edison, 1894

End of interaction.

Outline

- Introduction
- **Recent advances**
- Available datasets
- Challenges and ambitions

SERP grounded conversational agents

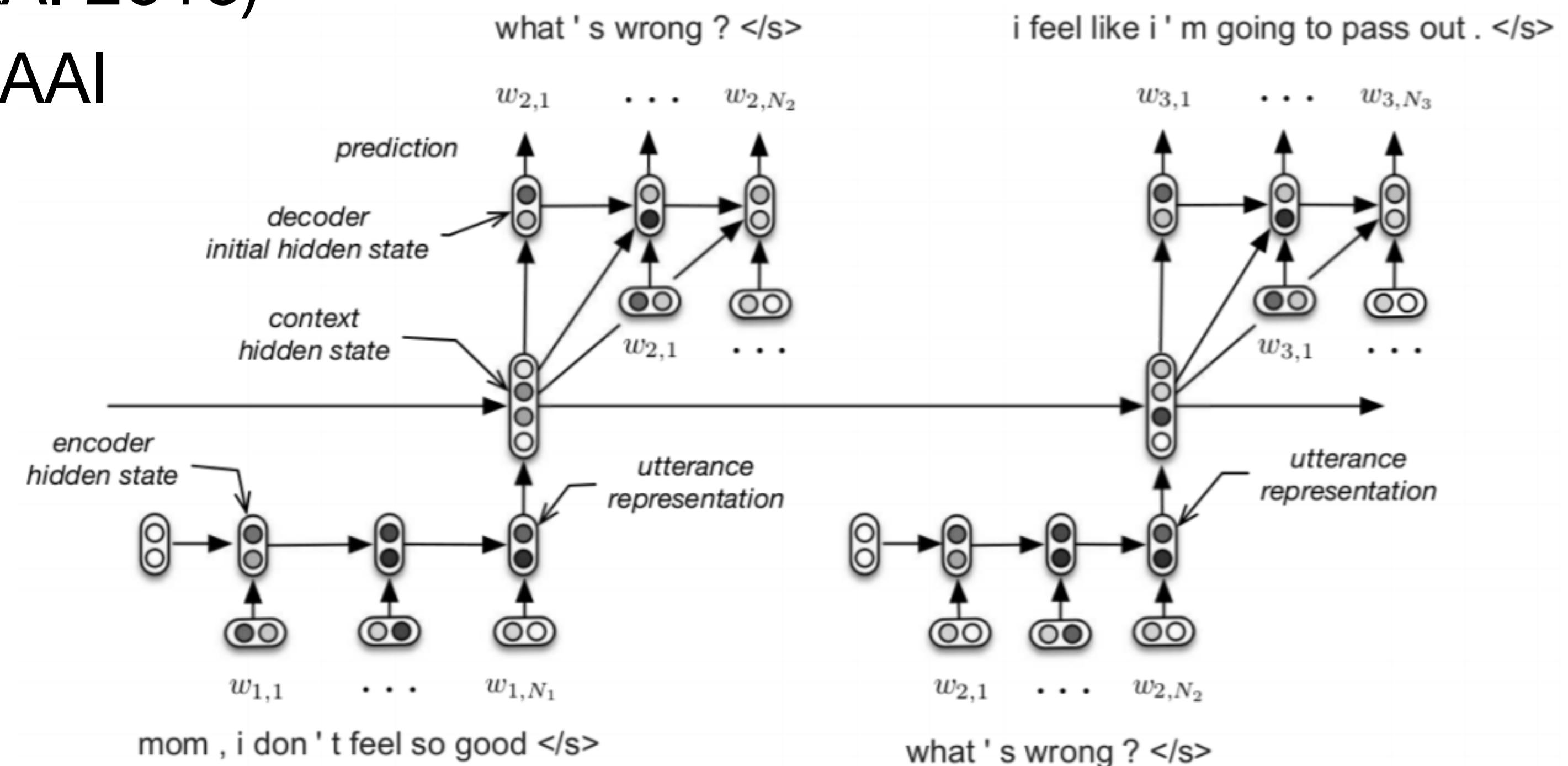


CCU: Conversational context encoding

- **Non-hierarchical context modeling**
 - Concatenate previous utterances into one sequence

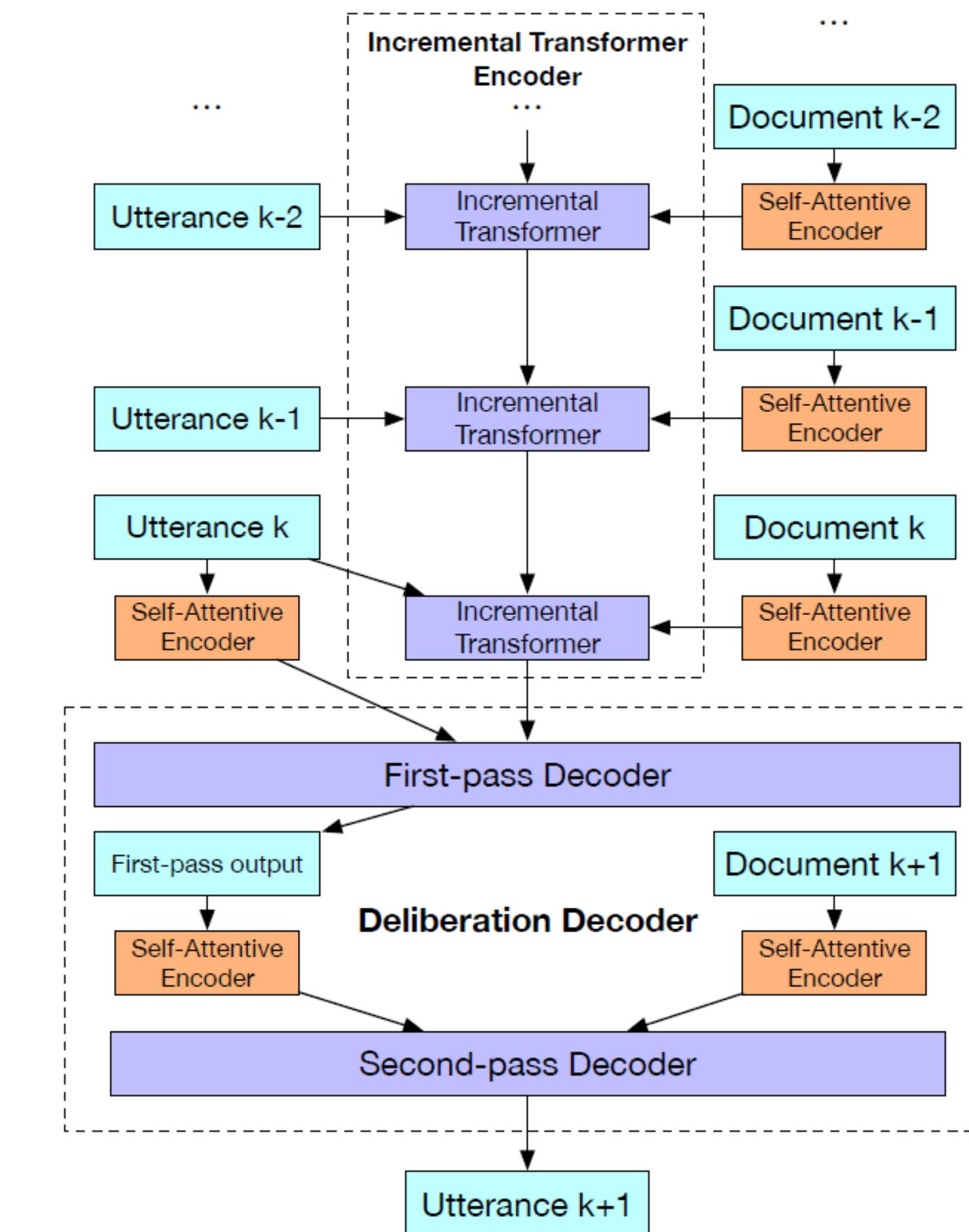
CCU: Conversational context encoding

- Hierarchical context modeling
 - HRED (Serban et al., AAAI 2016)
 - VHRED (Serban et al., AAAI 2017)



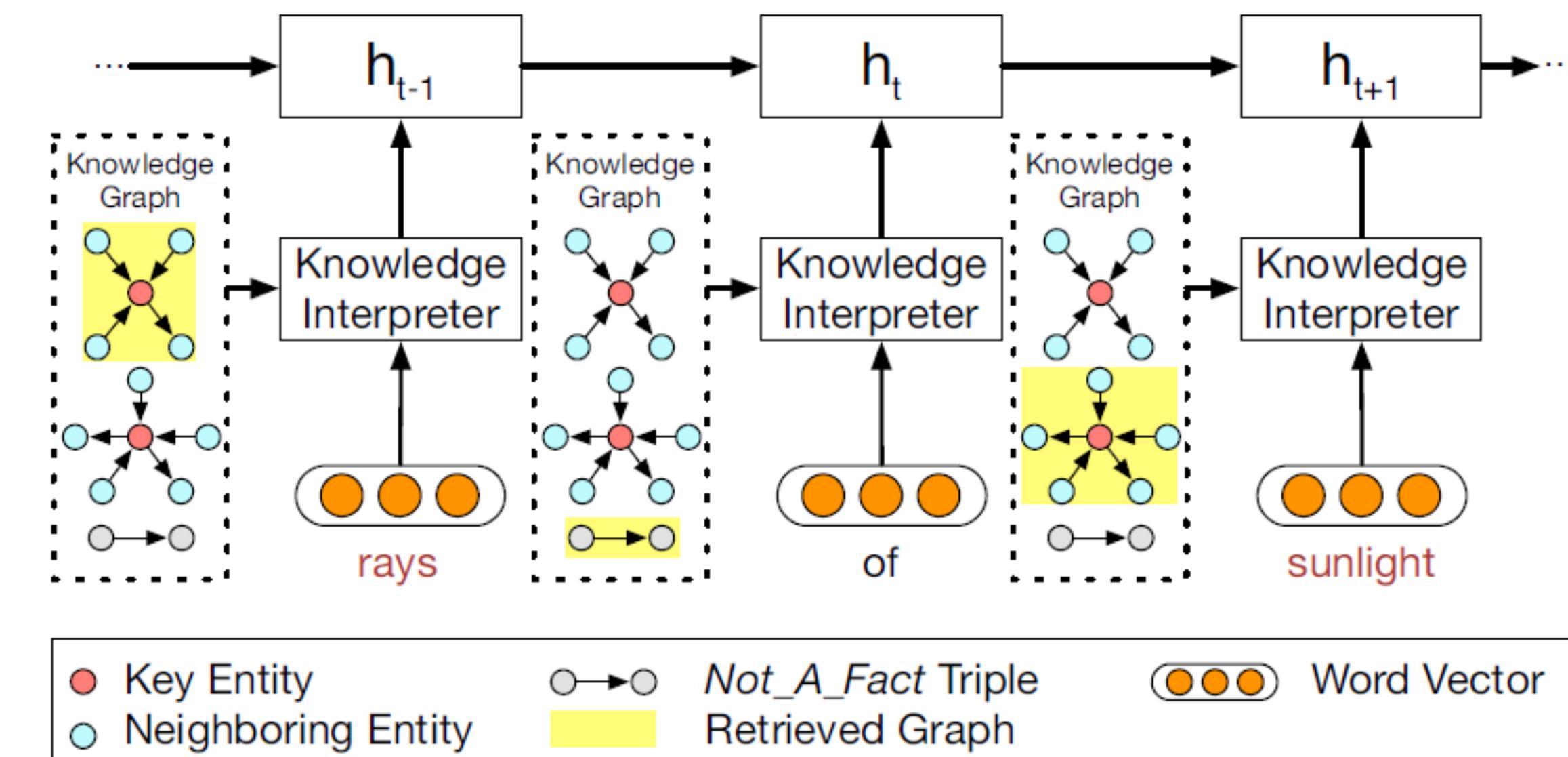
CCU: Conversational context encoding

- **Incremental context modeling**
 - Incremental Transformer Encoder (ITE)
 - (Li et al., ACL 2019)



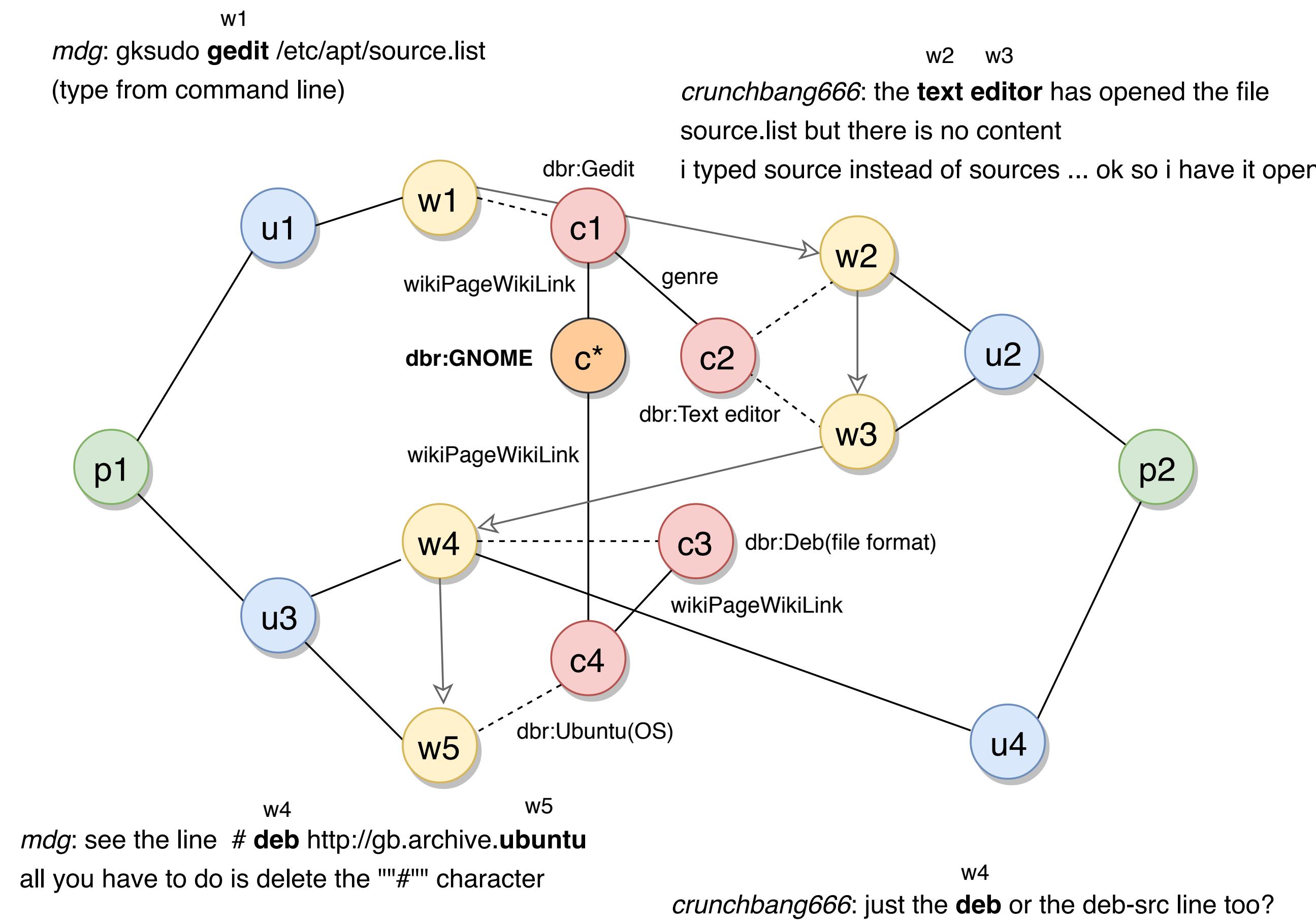
CCU: Conversational context encoding

- **Knowledge enhanced context modeling**
 - Commonsense conversational model (CCM)
 - (Li et al. ACL 2019)



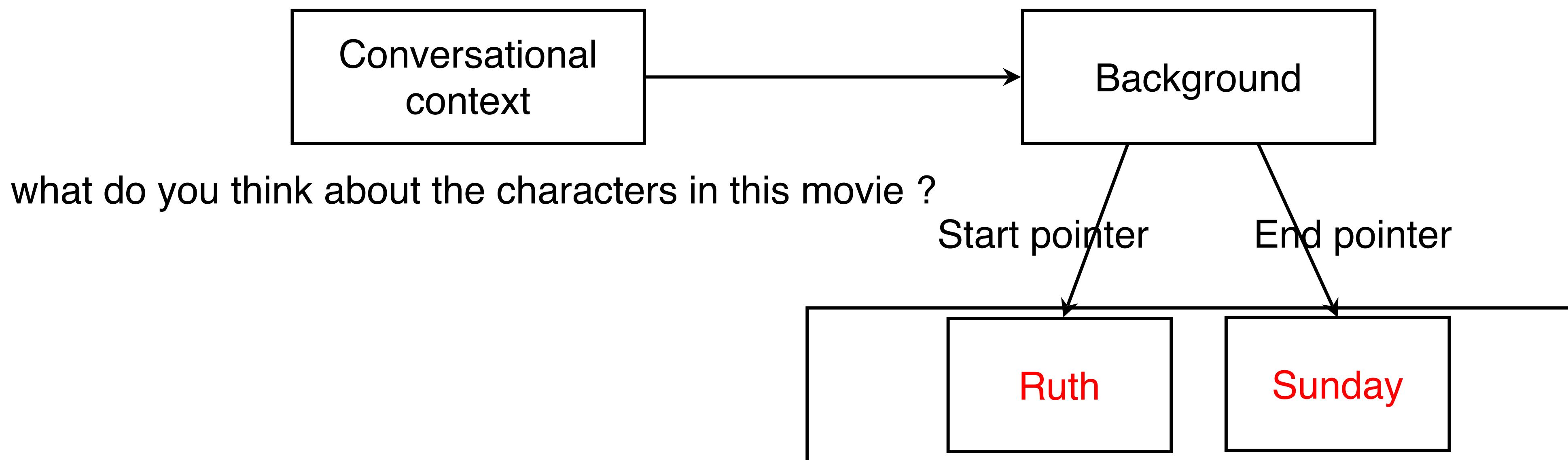
CTT: Conversational topic tracking

- Use a dialogue graph representation
 - Capture relation within dialogue corpus using semantic relations from background knowledge
- Semantic coherence measuring as a binary classification task
- Top- k shortest path induced subgraphs
- (Vakulenko et al., ISWC 2018)



KL: Knowledge selection

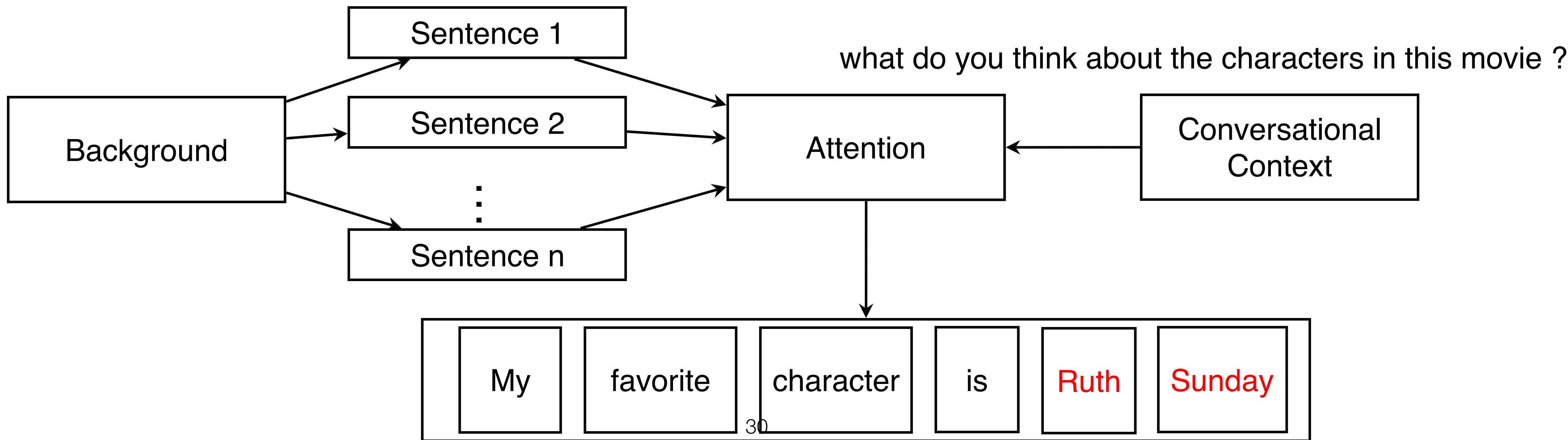
- **Span level selection**
 - Reading comprehension models, e.g., BiDAF
 - (Seo et al., ICLR 2017)



KL: Knowledge selection

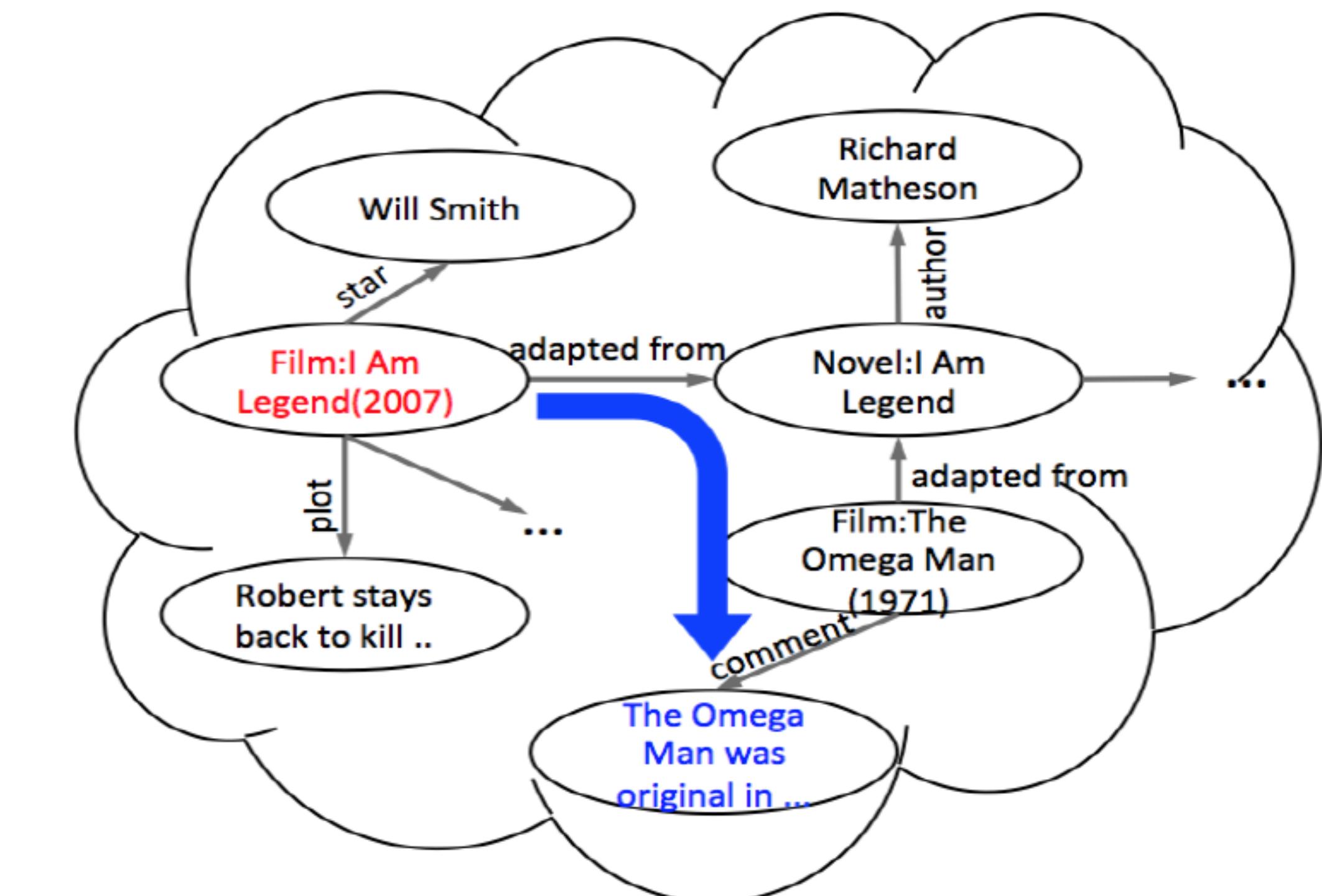
- **Sentence level selection**

- Sentence ranking → response generation
- (Dinan et al., ICLR 2019)
- (Lian et al., arXiv 2019)



KL: Knowledge selecting → reasoning

- Multi-hop walking on knowledge graph
 - (Liu et al., arXiv 2019)
 - (Moon et al., ACL 2019)



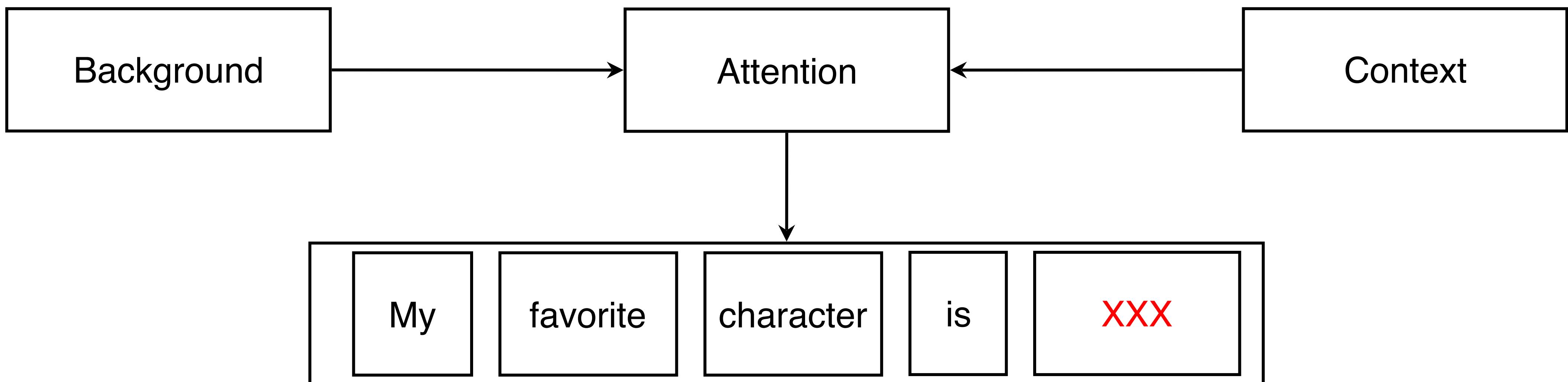
A: I prefer the ending in
“I Am Legend” directed
by Francis Lawrence.



B: Three movie attempts essentially
blew it. The Omega Man was far
more original in execution.

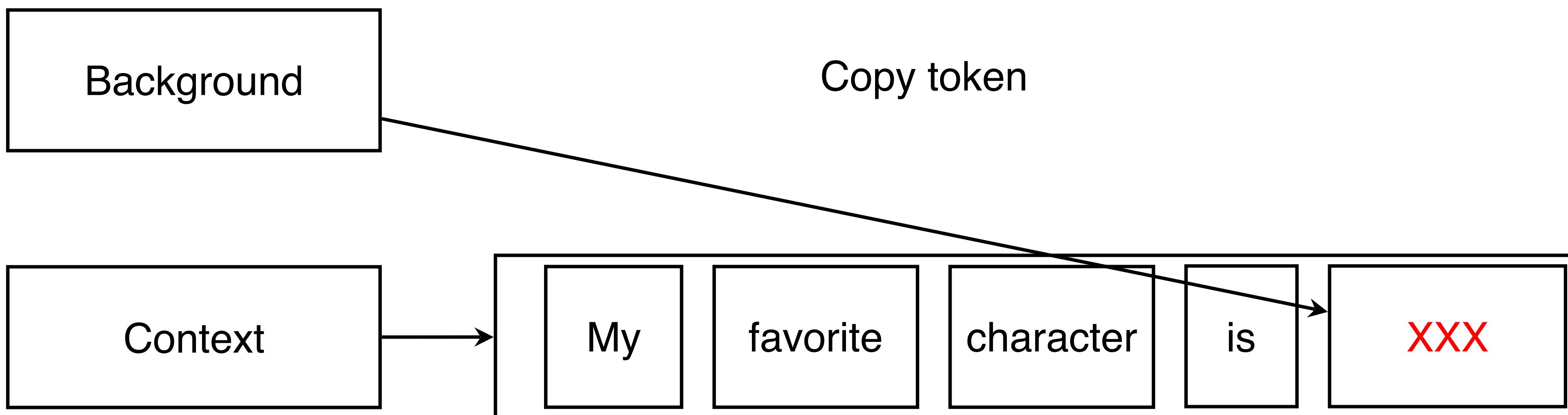
RG: Knowledge enhanced response generation

- Attentive generation



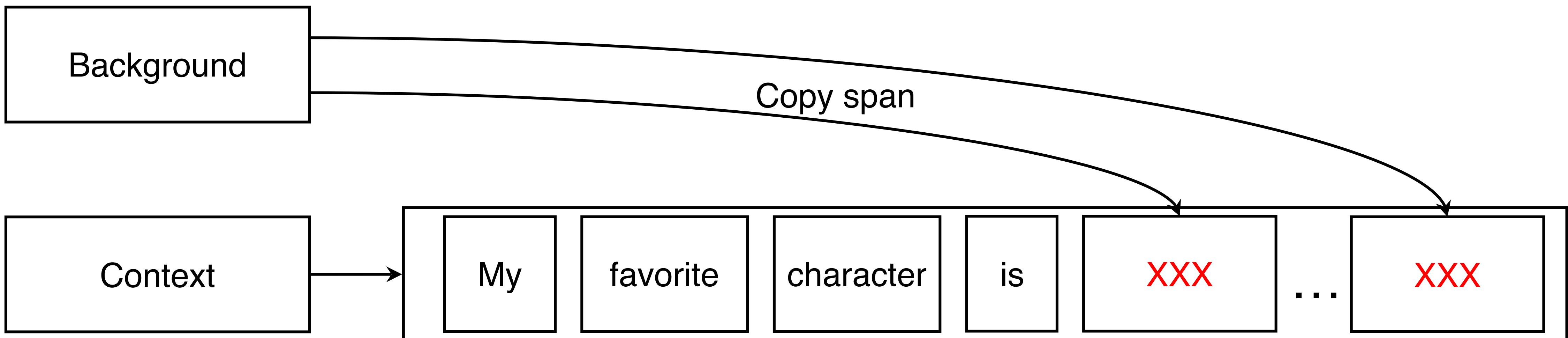
RG: Knowledge enhanced response generation

- **Token copying generation**
 - Pointer network (See et al., ACL 2017)
 - CaKe (Zhang et al., SCAI 2019)



RG: Knowledge enhanced response generation

- **Span copying generation**
 - RefNet (Meng et al., arXiv 2019)

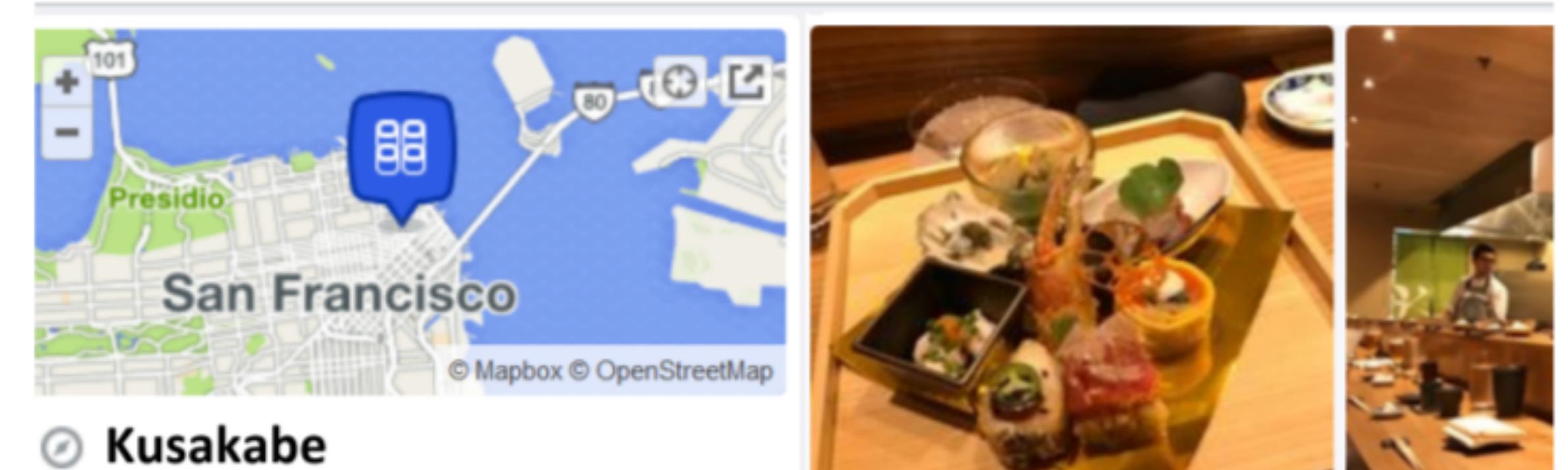
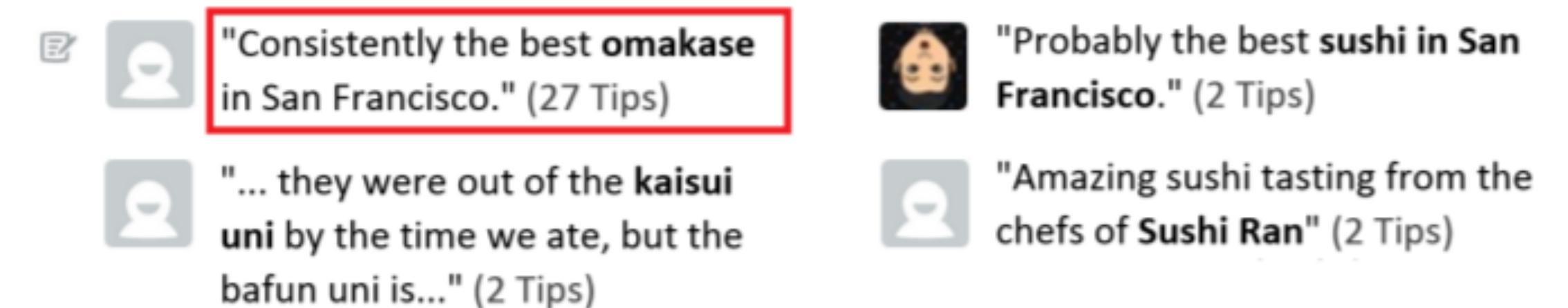


Outline

- Introduction
- Recent advances
- **Available datasets**
- Challenges and ambitions

Dataset

- User reviews as knowledge
- (Ghazvininejad et al., AAAI 2018)

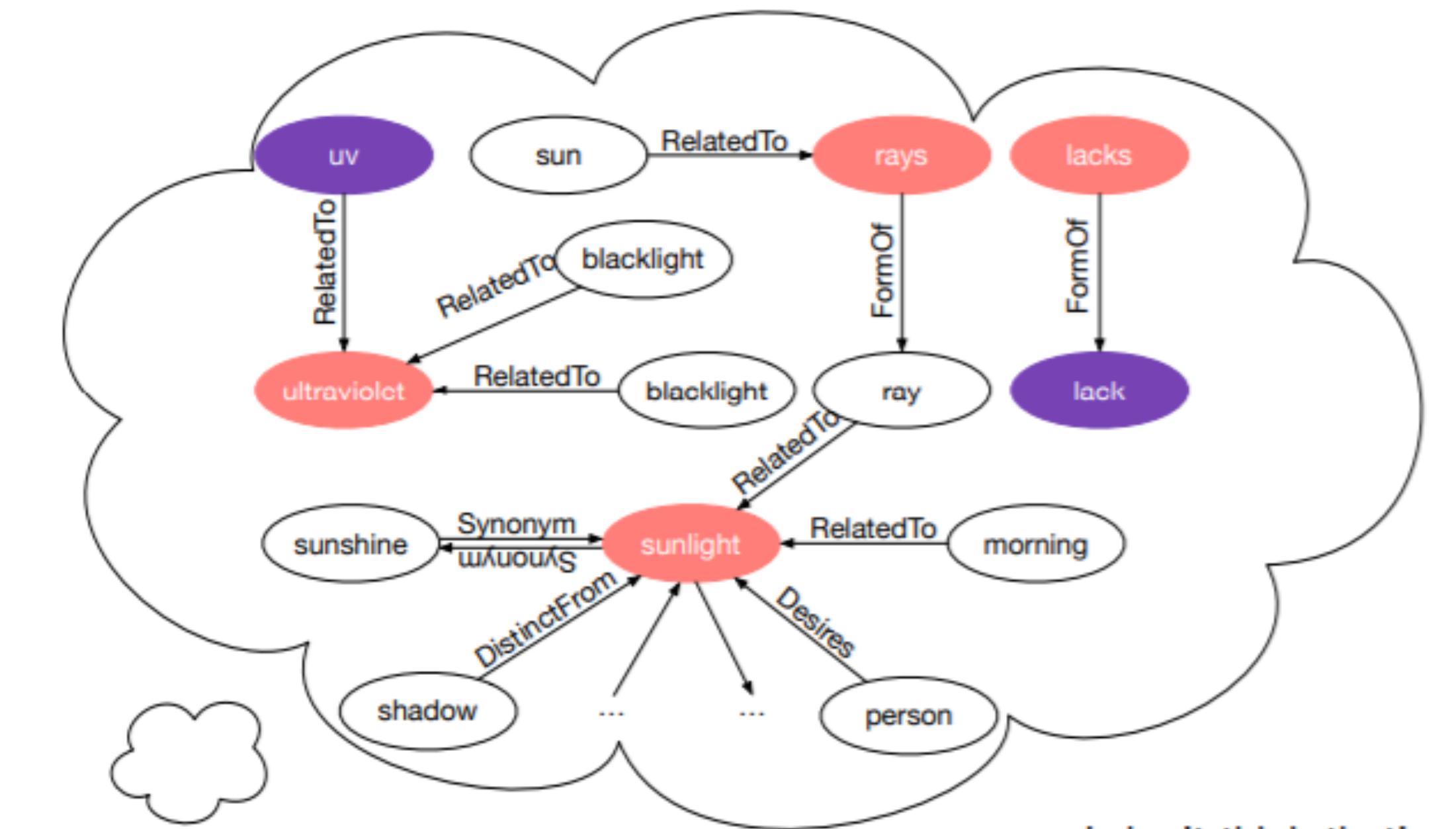


Kusakabe

User input: Going to Kusakabe tonight.
Neural model: Have a great time!
Human: You'll love it! Try omasake, the best in town.

Dataset

- Common sense as knowledge
- (Zhou et al., IJCAI 2018)



Moonlight **lacks** the **ultraviolet rays** of **sunlight**. → I don't think that's a **lack** of **uv**.

Moonlight **lacks** the **ultraviolet rays** of **sunlight**. → I'm not sure what you're saying.

Dataset

- User persona as knowledge
- (Zhang et al., ACL 2018)

Persona 1	Persona 2
I like to ski My wife does not like me anymore I have went to Mexico 4 times this year I hate Mexican food I like to eat cheetos	I am an artist I have four children I recently got a cat I enjoy walking for exercise I love watching Game of Thrones

[PERSON 1:] Hi
[PERSON 2:] Hello ! How are you today ?
[PERSON 1:] I am good thank you , how are you.
[PERSON 2:] Great, thanks ! My children and I were just about to watch Game of Thrones.
[PERSON 1:] Nice ! How old are your children?
[PERSON 2:] I have four that range in age from 10 to 21. You?
[PERSON 1:] I do not have children at the moment.
[PERSON 2:] That just means you get to keep all the popcorn for yourself.
[PERSON 1:] And Cheetos at the moment!
[PERSON 2:] Good choice. Do you watch Game of Thrones?
[PERSON 1:] No, I do not have much time for TV.
[PERSON 2:] I usually spend my time painting: but, I love the show.

Dataset

- Wikipedia movie articles as knowledge
- (Zhou et al., EMNLP 2018)

Name	The Shape of Water
Year	2017
Director	Guillermo del Toro
Genre	Fantasy, Drama
Cast	Sally Hawkins as Elisa Esposito, a mute cleaner who works at a secret government laboratory. Michael Shannon as Colonel Richard Strickland, a corrupt military official, Richard Jenkins as Giles, Elisa's closeted neighbor and close friend who is a struggling advertising illustrator. Octavia Spencer as Zelda Delilah Fuller, Elisa's co-worker and friend who serves as her interpreter., Michael Stuhlbarg as Dimitri Mosenkov, a Soviet spy working as a scientist studying the creature, under the alias Dr. Robert Hoffstetler.
Critical Response	one of del Toro's most stunningly successful works, also a powerful vision of a creative master feeling totally, joyously free. Even as the film plunges into torment and tragedy, the core relationship between these two unlikely lovers holds us in thrall. Del Toro is a world-class film artist. There's no sense trying to analyze how he does it. The Shape of Water has tenderness uncommon to del Toro films. While The Shape of Water isn't groundbreaking, it is elegant and mesmerizing. refer Sally Hawkins' mute character as 'mentally handicapped' and for erroneously crediting actor Benicio del Toro as director.
Introduction	The Shape of Water is a 2017 American fantasy drama film directed by Guillermo del Toro and written by del Toro and Vanessa Taylor. It stars Sally Hawkins, Michael Shannon, Richard Jenkins, Doug Jones, Michael Stuhlbarg, and Octavia Spencer. Set in Baltimore in 1962, the story follows a mute custodian at a high-security government laboratory who falls in love with a captured humanoid amphibian creature.
Rating	Rotten Tomatoes: 92% and average: 8.4/10 Metacritic Score: 87/100 CinemaScore: A
Conversation	
user1:	Hi
user2:	Hi
user2:	I thought The Shape of Water was one of Del Toro's best works. What about you?
user1:	Did you like the movie?
user1:	Yes, his style really extended the story.
user2:	I agree. He has a way with fantasy elements that really helped this story be truly beautiful.
user2:	It has a very high rating on rotten tomatoes, too. I don't always expect that with movies

Dataset

- Wikipedia movie articles and IMDb movie reviews as knowledge
- (Moghe et al., EMNLP 2018)

Plot	Movie: Spider-Man	Comments						
<p>... The lab works on spiders and has even managed to create new species of spiders through genetic manipulation. While Peter is taking photographs of Mary Jane for the school newspaper, one of these new spiders lands on his hand and bites him Peter comes home feeling ill and immediately goes to bed. ...</p>	<p>Speaker 1(N): Which is your favourite character?</p> <p>Speaker 2(C): My favorite character was Tobey Maguire.</p> <p>Speaker 1(N): I thought he did an excellent job as peter parker, I didn't see what it was that turned him into Spider-Man though.</p> <p>Speaker 2(P): Well this happens while Peter is taking photographs of Mary Jane for the school newspaper, one of these new spiders lands on his hand and bites him.</p> <p>Speaker 1 (N): I see. I was very excited to see this film and it did not disappoint!</p> <p>Speaker 2(R): I agree, I thoroughly enjoyed "Spider-Man"</p> <p>Speaker 1(N): I loved that they stayed true to the comic.</p> <p>Speaker 2(C): Yeah, it was a really great comic book adaptation</p> <p>Speaker 1(N): The movie is a great life lesson on balancing power.</p> <p>Speaker 2(F): That is my most favorite line in the movie, "With great power comes great responsibility."</p>	<p>... Crazy attention to detail. My favorite character was Tobey Maguire. I can't get over the "I'm gonna kill you dead" line. It was too heavily reliant on constant light-hearted humor. However the constant joking around kinda bogged it down for me. A really great comic book adaptation.</p>						
Review	Fact Table							
<p>... I thoroughly enjoyed "Spider-Man" which I saw in a screening. I thought the movie was very engrossing. Director Sam Raimi kept the action quotient high, but also emphasized the human element of the story. Tobey was brilliant as a gawky teenager...</p>	<table border="1"><thead><tr><th>Awards</th><th>Golden Trailer Awards 2002</th></tr></thead><tbody><tr><td>Taglines</td><td>With great power comes great responsibility. Get Ready For Spidey !</td></tr><tr><td>Similar Movies</td><td>Iron Man Spider-Man 2</td></tr></tbody></table>	Awards	Golden Trailer Awards 2002	Taglines	With great power comes great responsibility. Get Ready For Spidey !	Similar Movies	Iron Man Spider-Man 2	
Awards	Golden Trailer Awards 2002							
Taglines	With great power comes great responsibility. Get Ready For Spidey !							
Similar Movies	Iron Man Spider-Man 2							

Dataset

- Wikipedia articles as knowledge
- (Dinan et al., ICLR 2019)

Topic:	Lifeguard
Apprentice:	So I am a lifeguard. Know anything about saving lives in water?
Wizard:	I'm impressed! It's a big responsibility to supervise other people's safety in the water! Tell me more.
Apprentice:	Well, I help make sure people do not drown or get injured while in or near the water!
Knowledge:	A lifeguard is a rescuer who supervises the safety and rescue of swimmers, surfers, ... Lifeguards are strong swimmers and trained in CPR/AED first aid, certified in water
	In some areas, the lifeguard service also carries out mountain rescues, or may function as the primary EMS provider.
Wizard:	I've heard that in some places, lifeguards also help with other sorts of emergencies, like mountain rescues! Is that part of your job too?
Apprentice:	I have! I feel like you know much about this! What brings you to know so much?
Wizard:	Oh, that's about the extent of my knowledge. I've just been around beaches and I've always admired lifeguards. I'm not a super strong swimmer myself.

Dataset

- Wikipedia articles as knowledge grounded to Reddit conversations
- (Qin et al., ACL 2019)

A woman fell **30,000 feet** from an airplane and **survived**.

The page states that a **2009 report** found the plane only fell **several hundred meters**.

Well if she only fell **a few hundred meters** and survived then I'm not impressed at all.

Still pretty incredible, but quite a bit different than **10,000 meters**.

She holds the Guinness world record for **surviving** the highest fall without a parachute: **10,160 metres (33,330 ft)**.

In 2005, Vulović's fall was recreated by the American television MythBusters. Four years later, [...] two Prague-based journalists, claimed that Flight 367 had been mistaken for an enemy aircraft and shot down by the Czechoslovak Air Force at an altitude of **800 metres** (2,600 ft).

Vesna Vulović

Vesna Vulović (Serbian Cyrillic: Весна Вуловић; pronounced [v̞e̞sn̞a v̞ulo̞vi̞t̞]; born 3 January 1958 – 23 December 2016) was a Serbian flight attendant. She holds the Guinness World Record for surviving the highest fall without a parachute. She was a passenger on Pan Am Flight 103, the Boeing 747 that exploded over Lockerbie, Scotland, killing all 259 people on board. She was the sole survivor of the crash that air safety investigators attributed to a terrorist bomb. The Nigerian authorities suspected that Croatian nationalists were to blame, but no one was ever arrested.

Following the crash, Vulović spent days in a coma and was hospitalized for several months. She suffered a fractured skull, three broken vertebrae, two broken legs, broken ribs and a fractured pelvis. These injuries resulted in her being temporarily paralyzed from the waist down. She made an almost complete recovery but continued to walk with a limp. Vulović maintained that she had no memory of the incident and thus had no qualms about flying in the aftermath of the crash. Despite her willingness to resume working as a flight attendant, she was unable to do so due to her physical condition.

Celebrities who took up the balcony of Belgrade's city hall to make victory witnessess.^[1] She later campaigned on behalf of the Bosnian Serb minority and advocated for Serbia's entry into the European Union, which she believed would bring economic prosperity.^[2]

Deteriorating health and death

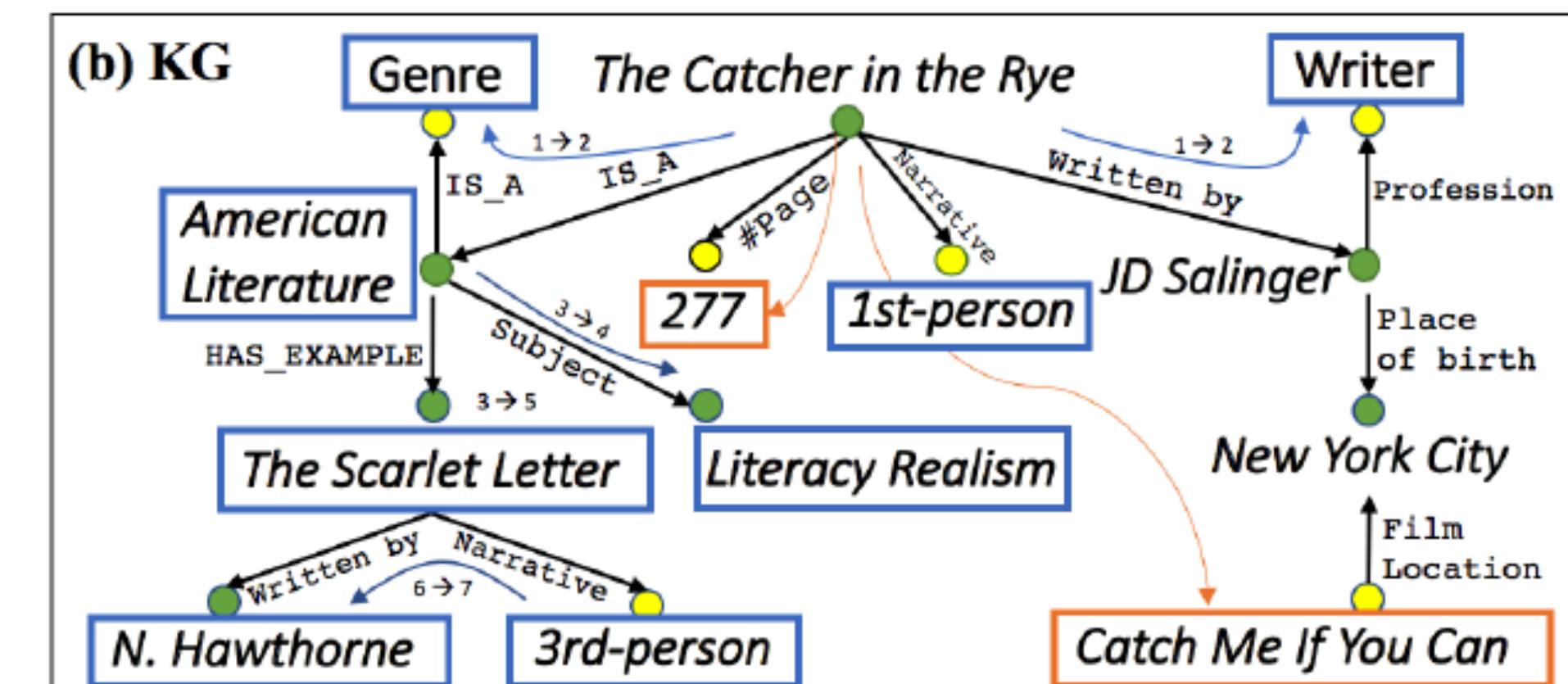
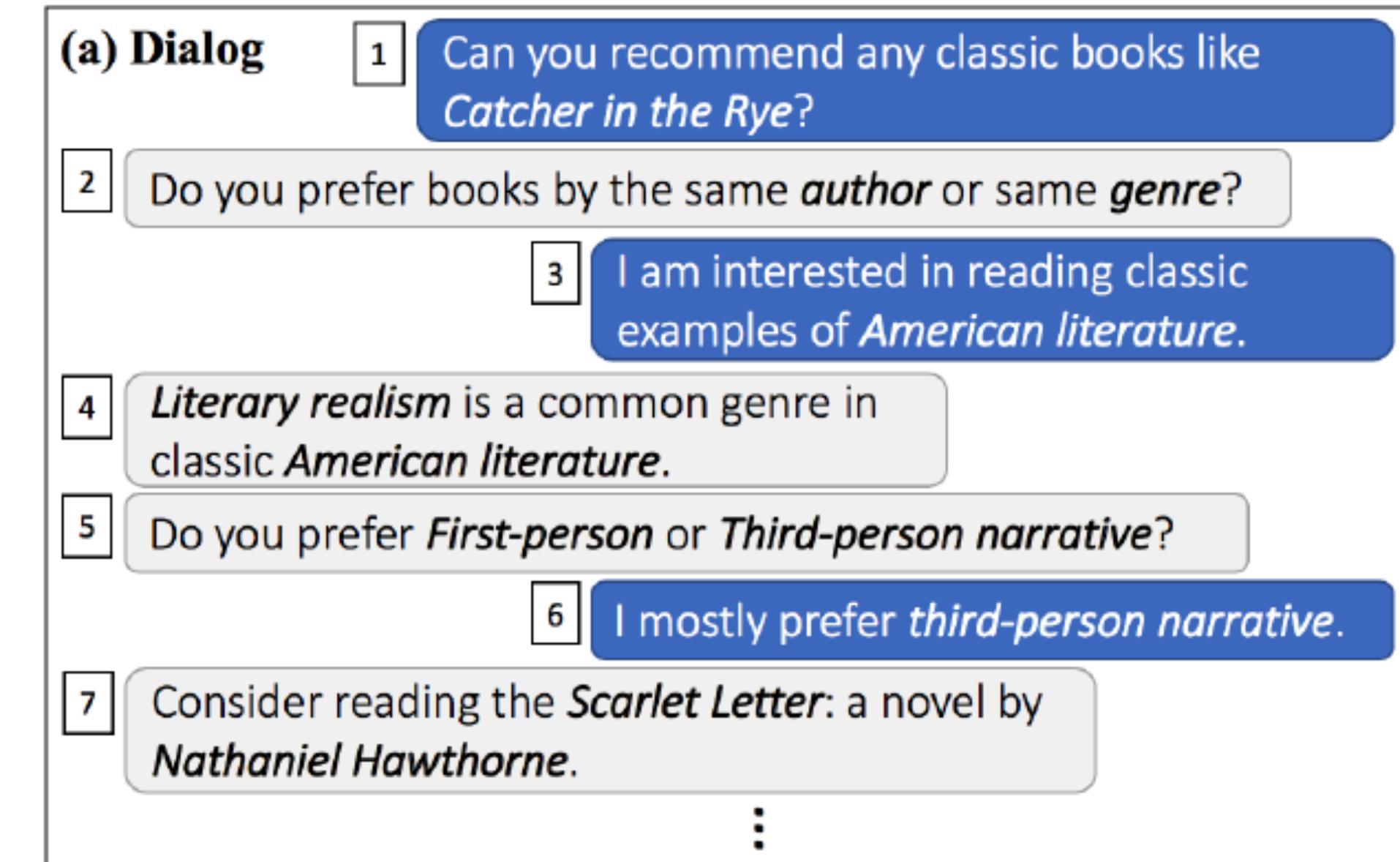
Vulović told reporters that she did not think of her fall every day, but admitted to struggling with survivor's guilt.^[3] "What I feel is that I have a guilty conscience, grave feelings of guilt for surviving it and I cry... Then I think maybe I should not have survived at all."^[4] She declined therapy to help cope with her experiences and instead turned to religion, becoming a devout Orthodox Christian. She stated that her ordeal had turned her into an optimist. "If you can survive what I survived," she said, "you can survive anything."^[5]

In 2005, Vulović's fall was recreated by the American television program *MythBusters*.^[6] Four years later, Peter Herring-Jensen and his team, two Prague-based journalists, claimed that Flight 367 had been mistaken for an enemy aircraft and shot down by the Czechoslovak Air Force at an altitude of 800 metres (2,600 ft). They also claimed that the Czech Civil Aviation Authority dismissed the journalists' claims, calling it a conspiracy theory.^[7] Herring-Jensen conceded that the pair's evidence was only circumstantial.^[8] Vulović said that she was aware of the journalists' claims, but stated that because she had no memory of the event, she could not confirm or deny the allegation.^[9] She recently continues to list her as the recordholder for surviving the highest fall without a parachute.^[10]

In the last years of her life, Vulović lived on a pension of €100 per month in her dilapidated Belgrade apartment.^[11] "I don't know what to say when people say I was lucky," she said. "I'm not lucky. I'm not good. I'm not bad. I'm just here."^[12] Vulović survived that fall because she may not have died immediately had she not been aboard Flight 103, stating that the incident only ruined her life, but also that of her parents.^{[13][14]} She gave numerous requests, most notably from Oprah Winfrey and the BBC,^[15] saying that she was "afraid" of discussing her fall.^[16] By the time she had reached her sixties, Vulović's deteriorating healths prevented her from taking part in

Dataset

- Knowledge graph as knowledge
- (Moon et al., ACL 2019)



Dataset

The screenshot shows a web browser window displaying the TREC Conversational Assistance Track (CAsT) website. The title bar reads "Niet veilig — www.treccast.ai". The main header is "The TREC Conversational Assistance Track (CAsT)" with the subtitle "Conversational search benchmark at TREC". A yellow navigation bar contains a "View On GitHub" button and a GitHub icon. The left sidebar lists "TREC Conversational Assistance Track (CAsT)" sections: Year 1 Task Guidelines, Year 1 Submission, Data (Topics, Resolved Topic Annotations, Baselines, Collection, Document ID format, Duplicate handling, Code and tools, Year 1 Planning slides), News, Contact, Important Dates, Evaluation, Organizers, and Advisory Committee. The main content area starts with a section titled "TREC Conversational Assistance Track (CAsT)" which describes the track's goal of advancing research on conversational search systems. It mentions the track will run in 2019 and establish a concrete collection of data. The "Year 1 Task Guidelines" section links to "Year 1 task guidelines" and notes that comments and feedback are welcome. The "Year 1 Submission" section links to the "submission form" and provides instructions for checking validity using a script and verifying submission of the dissemination form. The "Data Topics" section links to "Training topics year 1 V1.0" and "Training judgments". The footer credits the project to "daltonj" and "mattgraham".

The TREC Conversational Assistance Track (CAsT)

Conversational search benchmark at TREC

View On GitHub

TREC Conversational Assistance Track (CAsT)

- Year 1 Task Guidelines
- Year 1 Submission
- Data**
 - Topics
 - Resolved Topic Annotations
 - Baselines
 - Collection
 - Document ID format
 - Duplicate handling
 - Code and tools
 - Year 1 Planning slides
- News**
- Contact
- Important Dates
- Evaluation
- Organizers
- Advisory Committee

Project maintained by [daltonj](#)

Hosted on GitHub Pages — Theme by [mattgraham](#)

TREC Conversational Assistance Track (CAsT)

There are currently few datasets appropriate for training and evaluating models for Conversational Information Seeking (CIS). The main aim of TREC CAsT is to advance research on conversational search systems. The goal of the track is to create a reusable benchmark for open-domain information centric conversational dialogues.

The track will run in 2019 and establish a concrete and standard collection of data with information needs to make systems directly comparable.

This is the first year of TREC CAsT, which will run as a track in [TREC](#). This year we aim to focus on candidate information ranking in context:

- Read the dialogue context: Track the evolution of the information need in the conversation, identifying salient information needed for the current turn in the conversation
- Retrieve Candidate Response Information: Perform retrieval over a large collection of paragraphs (or knowledge base content) to identify relevant information

Year 1 Task Guidelines

- [Year 1 task guidelines](#)
- Comments and feedback are welcome.

Year 1 Submission

- The [submission form](#) is now available!
- The [Script](#) is available to check the validity of your runs.
- Note: If you registered, but your name is not in the list, please verify that you have submitted the dissemination form.

Data

Topics

- [Training topics year 1 V1.0](#) – 30 example training topics
- [Training judgments](#) – We provide limited (incomplete) training data for 5 topics (approximately 50 turns). These are judged from the baseline retrieval run (below). The

<http://www.treccast.ai>

Make it more interactive.

What is CatVideoFest?

Niet veilig — www.catvideofest.com



Bringing the joy of cat videos
to the masses and raising
money for cats in need.

CAT {VIDEO} FEST



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End of interaction.

Outline

- Introduction
- Recent advances
- Available datasets
- **Challenges and ambitions**

Challenges and ambitions

- **Conversational topic shifting**
 - What to talk about next?
 - Different from web search, user inputs are conversational, support exploration, serendipity
 - No single correct answer
 - Different from machine reading comprehension, user inputs are not always questions with definitive answers.

New challenges for modeling as well as evaluation

Challenges and ambitions

- **Heterogeneous SERPs**
 - Dealing with multiple intents
 - Text vs. image/video vs. knowledge cards vs. ...
 - Structured vs. unstructured
 - Static blogs/articles vs. live news/reports

New challenges for knowledge locating (selecting and reasoning) across heterogeneous resources

Challenges and ambitions

- **Interpretable conversations**
 - Explainable for developers
 - Failure analysis
 - Identifying influential (online) training instances
 - Reasoning path on knowledge graph as explanations (Moon et al., ACL 2019, Liu et al., arXiv 2019)
 - Explainable for users
 - Response/answer explanation
- Human: which is your favorite character in this ?**
- Bot: my favorite character was obviously the main character because through his perseverance he was able to escape a dangerous situation .**

Wrap-up

- SERP-grounded conversations
- General idea, recent advances, challenges and ambitions
- **Work in progress**

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