SERP-Based Conversations

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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
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

Chat bot

Which is your favourite character in Spider-Man? 16:31

16:32 My favorite character was Tobey Maguire.

I thought he did an excellent job as Peter Parker, I didn’t see what it was that turned him into Spider-Man though. 16:33

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. 16:34

Conversational search engine

Conversational agent

SERP grounded conversational agent

SERP

...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. ...
SERP grounded conversational agents

Conversational context understanding (CCU)

Conversation management (CM)
  - Conversational topic tracking (CTT)
  - Conversational topic shifting (CTS)
  - Locating knowledge (KL)

Response generation (RG)
Make it more interactive.
Who shot the first cat video?
Thomas Edison, 1894
End of interaction.
Outline

• Introduction

• Recent advances

• Available datasets

• Challenges and ambitions
SERP grounded conversational agents

Conversational context understanding (CCU)

Response generation (RG)

Conversation management (CM)

- Conversational topic tracking (CTT)
- Conversational topic shifting (CTS)
- Locating knowledge (KL)

Chatbot conversation:

16:31 Which is your favourite character in Spider-Man?
16:32 My favorite character was Tobey Maguire.
16:33 I thought he did an excellent job as Peter Parker, I didn’t see what it was that turned him into Spider-Man though.
16:34 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.
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)

```
what do you think about the characters in this movie?

Conversational context → Background

Start pointer  End pointer

Ruth        Sunday
```
KL: Knowledge selection

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

Background

Sentence 1

Sentence 2

...  

Sentence n

Attention

Conversational Context

what do you think about the characters in this movie?

My favorite character is Ruth and Sunday.
KL: Knowledge selecting → reasoning

- Multi-hop walking on knowledge graph
  - (Liu et al., arXiv 2019)
  - (Moon et al., ACL 2019)
RG: Knowledge enhanced response generation

- Attentive generation

```
Background  ➔  Attention  ➔  Context
```

```
My  favorite  character  is  XXX
```
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)
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• Introduction
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Dataset

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

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

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

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

[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)
Dataset

• Wikipedia movie articles and IMDb movie reviews as knowledge

• (Moghe et al., EMNLP 2018)
Dataset

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

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

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

The TREC Conversational Assistance Track (CAst)

Conversational search benchmark at TREC

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 1-7/6 - 30 example training topics
- Training judgments - We provide limited (incomplete) training data for 5 topics (approximately 90 turns). These are judged from the baseline retrieval run (below).

http://www.treccast.ai
Make it more interactive.
What is CatVideoFest?
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
References

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