Towards Mixed-Initiative Conversational Information Seeking

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Why Conversational Information Seeking?

- Recent advances in automatic speech recognition
- Popularity of devices with limited bandwidth interfaces
- Recent advances in neural models
- Information access is an important service.
What is conversational search?
Is This Conversational Search?

Mitsuku, how did you become a good conversationalist?

Yep, Do you really think I am a good conversationalist? Mousebreaker programmed me to be a good conversationalist.

How are you programmed?

I read what you say and then I compose the best reply I can think of.

How does that actually work though?

Oh. I think it might be a trade secret.

You're so sassy 😛
Is This Conversational Search?
Why does the phrase "to be or not to be" is so famous?

It is the opening phrase of a soliloquy uttered by Prince Hamlet, in the play Hamlet.

Who is the playwright?

William Shakespeare

Tell me more about him

William Shakespeare was an English poet, playwright, and actor, widely regarded as the greatest writer in the English language and the world's greatest dramatist.

What was the last play he wrote?

Shakespeare's last play is believed to be "The Two Noble Kinsmen," a tragicomedy co-written with John Fletcher in 1613, three years before Shakespeare's death.

At what age did he die?

52

What are his other plays?

See the list of Shakespeare's plays here: https://www.opensourceshakespeare.org/views/plays/plays.php

tell me about US tax documents

Retrieved document list (click to see the document content):

FT942-9915

FT941-10815

FBIS3-29324

Macaw heard: when is the due date for filing tax return documents

The due date is April 15. If it falls on a weekend or legal holiday, you have until midnight the next business day following April 15.

Macaw heard: what are the forms

IRS tax forms: https://en.wikipedia.org/wiki/IRS_tax_forms
Conversations can be complex!

I want to stain my fence. How dry does the weather need to be before I do that?

Happy to help! I found some information on the Web! Is it a latex stain or a waterborne stain?

I have waterborne!

According to the Family Handyman website, it is best if the wood is completely dry before a stain is applied. It needs to be dry for 48 hours. If the wood is not dry, I suggest pausing this conversation and continuing in 48 hours.

OK, I think it’s a bit damp. I’ll be back!

After 48 hours...

Hey, I want to paint my fence.

I see we started working on painting 48 hours ago. Would you like to continue with waterborne staining?

Yes! The wood is dry. Now what?

Great. According to WikiHow, first protect your garden plants and bushes with a drop cloth, and then clean your fence to remove any dirt and grime.

Sure!

After some steps...

Use a natural bristle brush to apply fence stain from top to bottom and from left to right.

I’m not sure what that means. Can you show me an image?

Like this:

I see! Sure, that makes sense. some more steps...
Definitions

**Conversation** is *interactive* communication for exchanging information between two or more participants (i.e., humans or machines) that involves a sequence of interactions. While *natural language* is considered as prerequisite for conversational interactions, conversations can also exhibit *other types of interaction* with different characteristics and modalities (e.g., click, touch, and gestures).
Information seeking conversation is a conversation in which the goal of information exchange is satisfying the information needs of one or more participants.

A Conversational Information Seeking (CIS) system is a system that satisfies the information needs of one or more users by engaging in information seeking conversations. CIS responses are expected to be concise, fluent, stateful, mixed-initiative, context-aware, and personalized.
Conversational Search has roots in early IR research!
Five general types of information necessary to get the desired state:

• Determination of subject
• Objective and motivation
• Personal characteristics of the inquirer
• Relationship of inquiry description to file organization
• Anticipated or acceptable answers
Intermediary-based Online IR

Nature of interaction between user and intermediary, in both cognitive and affective senses, is a key factor in search satisfaction.

User-Intermediary Interactions


I: Alright. Right. The form ... err, what we got on the form just U:

I: says community education in developing countries. That's U: Yeah

I: approximately yeah/1/ Can you tell me, sort of quite a lot U: yeah well (illeg.) /2/

I: more about what it is you're going to do-/3a/ it is your disser- U:

I: tation/3b/ Yeah yeah. Tell me what sorts of U: Yeah, M.A. dissertation/4/

I: things you're going to do in your dissertation,/5a/ and then the U:

I: sorts of things you want to rea::d./5b/ U: That's my sort of, uhm, plan,

I = Intermediary U = User /n/ = utterance number

Figure 3. Example span of user-intermediary pre-search interaction.
User-Intermediary Interactions

The THOMAS System

THOMAS, THE REFERENCE RETRIEVAL PROGRAM

Help can be obtained whenever the program has displayed the start symbol by typing ‘?’ immediately after it.

Please give a short name for the search:
- Alv.Resp.

Start searching:
- pulmonary alveoli

Influence of fasting on blood gas tension, pH, and related values in dogs;

The THOMAS System

There can be three parts to your statement (all optional):
1. Your reaction to the reference just shown (if any).
   This must come first:
   “Yes” or “No”
2. A selection from the names (authors) or terms shown, by number. A “not” in
   the statement signifies rejection of all numbers that follow it.
3. New names or terms (terms preferably in quotes). The elements of the state-
   ment should be separated by commas.
Examples: ‘posture’, ‘circulatory system’
   Yes, not 11,12
   No, 7,13,4
   ‘heart rate’
   Yes
Press enter key when you are ready to proceed ▷
The I$^3$R System

More Recently

- TREC CAsT: TREC Conversational Assistance Track
- CoQA: Conversational Question Answering
- QuAC: Question Answering in Context
- ShARC: Shaping Answers with Rules through Conversation
- ConvQuestions: Conversational Question Answering over Knowledge Graphs
- ...
Section: Augusto Pinochet: Intellectual life...

STUDENT: Was he known for being intelligent?
TEACHER: No, Pinochet was publicly known as a man with a lack of culture.

STUDENT: why did people feel that way?
TEACHER: reinforced by the fact that he also portrayed himself as a common man

STUDENT: did he have any hobbies?
TEACHER: Yes, Before wresting power from Allende, Pinochet had written two books.

STUDENT: what is the name of a book written by him?
TEACHER: Geopolitica (1968) and Campana de Tarapaca (1972).

STUDENT: what were the books about?
TEACHER: Chile’s military literature.

STUDENT: was there anything noteworthy regarding his books?
TEACHER: Yes, In Geopolitica Pinochet plagiarized (...) Gregorio Rodriguez Tascon

STUDENT: did he deny those allegations?
TEACHER: No answer

STUDENT: what did he plagiarize in Geopolitica?
TEACHER: In Geopolitica Pinochet plagiarized (...) paragraphs from a 1949 presentation...
Mixed-Initiative Interactions in Human Conversation

<table>
<thead>
<tr>
<th>Mixed-initiative levels</th>
<th>Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsolicited reporting</td>
<td>Agent may notify others of critical information as it arises</td>
</tr>
<tr>
<td>Subdialogue initiation</td>
<td>Agent may initiate subdialogues to clarify, correct, and so on</td>
</tr>
<tr>
<td>Fixed subtask initiative</td>
<td>Agent takes initiative to solve predefined subtasks</td>
</tr>
<tr>
<td>Negotiated mixed initiative</td>
<td>Agents coordinate and negotiate with other agents to determine initiative</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action</th>
<th>Amount (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluating and comparing options</td>
<td>25</td>
</tr>
<tr>
<td>Suggesting courses of action</td>
<td>23</td>
</tr>
<tr>
<td>Clarifying and establishing state</td>
<td>13.5</td>
</tr>
<tr>
<td>Clarifying or confirming the communication</td>
<td>13.5</td>
</tr>
<tr>
<td>Discussing problem-solving strategy</td>
<td>10</td>
</tr>
<tr>
<td>Summarizing courses of action</td>
<td>8</td>
</tr>
<tr>
<td>Identifying problems and alternatives</td>
<td>7</td>
</tr>
</tbody>
</table>

Clarification

• Confirming or clarifying the communication
  • For example, to reduce ASR error.

• Correcting user mistakes
  • Did you mean ...?

• **Intent clarification**
Search Clarification
To generate a clarifying question, we need to identify different aspects of the query.
Query Reformulation Data

• shoes → running shoes
• shoes → shoes basketball
• shoes → formal shoes
• shoes → shoes nike
• shoes → shoes adidas
• shoes → shoes for women
• shoes → shoes for kids
• shoes → shoes sale
• shoes → shoes online
• shoes → shoes near me
• ...

Taxonomy of Search Clarification

• Disambiguation
• Preference
  • Personal information (“for whom”)
  • Spatial information (“where”)
  • Temporal information (“when”)
  • Purpose (“for what purpose”)
• Topic
  • Sub-topic information
  • Event and news
• Comparison

Zamani, Dumais, Craswell, Bennett, Lueck. “Generating Clarifying Questions for Information Retrieval”. In WWW ‘20.
Question Templates

• What do you want to know about QUERY?
• What do you want to know about this QUERY_ENTITY_TYPE?
• What ASPECT_ENTITY_TYPE are you looking for?
• Whom are you looking for?
• ...

30
**Question Generation**

**Encoder**
- **Query Encoder**
  - \( q \# et(q) \)
  - \( q\#q_1\#et(q_1) \)
  - \( q\#q_2\#et(q_2) \)
  - \( \ldots \)
  - \( q\#q_k\#et(q_k) \)

**Query Aspects Encoder**
- \( i_1 \)
- \( i_2 \)
- \( i_3 \)
- \( \ldots \)
- \( i_n \)

**Decoder (Question Generator)**
- **Decoder**
  - \( \text{encoder outputs} \)
  - \( w_1 \)
  - \( w_2 \)
  - \( w_3 \)
  - \( \ldots \)
  - \( \text{<end>} \)

**Sequence Encoder**
- \( \text{LSTM} \)
- \( \text{LSTM} \)
- \( \text{LSTM} \)
- \( \ldots \)
- \( \text{LSTM} \)

**Decoder (Question Generator)**
- **clarifying question**
- \( \text{LSTM} \)
- \( \text{LSTM} \)
- \( \text{LSTM} \)
- \( \ldots \)
- \( \text{LSTM} \)
Query Clarification Maximization Model

Zamani, Dumais, Craswell, Bennett, Lueck. “Generating Clarifying Questions for Information Retrieval”. In WWW ‘20.
Query Aspect Generation

• To generate a good clarification question, we must first identify different aspects of the query.

• We mine Bing query logs to find all possible reformulations with the form of $X \rightarrow XY$ or $X \rightarrow YX$.
  • “shoes” → “running shoes”
  • “running shoes” → “running shoes for women”

• Input: $X$
• Output: all possible $Y$s with some pre-processing (e.g., initial stopword removal, etc.)
Clarification Utility

\[ p(c = 1 \mid q, q^*, A) = \sum_{i \in I_q} p(c = 1 \mid i, q, q^*, A) p(i \mid q, q^*, A) \]

• \( I_q \) is the set of all intents for the query \( q \).
• \( I_q \) is generally unknown, but can be estimated using query reformulation data.

Zamani, Dumais, Craswell, Bennett, Lueck. “Generating Clarifying Questions for Information Retrieval”. In WWW ‘20.
Candidate Answer Generation

$$\arg \max_{A} p(c = 1 | q, q^*, A)$$

- NP-hard
- The good news is the objective is a **monotone, sub-modular** function
- There is a nice approximation guarantee for a greedy algorithm that generates answers one by one.

**Theorem (Fisher, Nemhauser, Wolsey, 1978):** if $f$ is monotone, sub-modular, and $f(\emptyset) = 0$ then the greedy algorithm return a solution that achieves:

$$f(S) > \left(1 - \frac{1}{e}\right)OPT$$

Zamani, Dumais, Craswell, Bennett, Lueck. “Generating Clarifying Questions for Information Retrieval”. In WWW ‘20.
Training

- Training is based on REINFORCE:

\[
L = - \left( r(q^*) - r(q_{ML}^*) \right) \sum_{t=1}^{T} \log p(q_t | q_1 \ldots q_{t-1})
\]

- \( q^* \) is obtained by sampling from the output distribution of the model.
- \( q_{ML}^* \) is the output of pre-trained model.
- \( r(\cdot) \) is the reward function, based on clarification utility.
<table>
<thead>
<tr>
<th>Query</th>
<th>rytary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
<td>what do you want to know about this medication?</td>
</tr>
<tr>
<td>Options</td>
<td>dosage, coupon, side effects, cost, information</td>
</tr>
<tr>
<td>Query</td>
<td>acts 17:16</td>
</tr>
<tr>
<td>Question</td>
<td>what bible translation are you looking for?</td>
</tr>
<tr>
<td>Options</td>
<td>american standard version, kjv, esv, niv, nlt</td>
</tr>
<tr>
<td>Query</td>
<td>that’s how i got to memphis</td>
</tr>
<tr>
<td>Question</td>
<td>what song information are you looking for?</td>
</tr>
<tr>
<td>Options</td>
<td>lyrics, stream, download, artist</td>
</tr>
<tr>
<td>Query</td>
<td>alan turing</td>
</tr>
<tr>
<td>Question</td>
<td>what do you want to know about this british mathematician?</td>
</tr>
<tr>
<td>Options</td>
<td>movie, suicide note, quotes, biography</td>
</tr>
</tbody>
</table>

Zamani, Dumais, Craswell, Bennett, Lueck. “Generating Clarifying Questions for Information Retrieval”. In WWW ‘20.
User Interactions with Search Clarification
Quotes from User Interviews

• “convenient and easy”
• “it saves time and steps”
• “it sometimes cues the user to things they may not have considered”
• “helped them find more relevant results”

Opinion on non-relevant and low-quality clarifications:

• “It’s like when I look at iPhones, and eBay says ‘since you looked at iPhones you may be interested in these hair curlers!’ And I’m like, well that’s weird, whatever”
• The quality of result page after using clarification is important.

Zamani, Dumais, Craswell, Bennett, Lueck. “Generating Clarifying Questions for Information Retrieval”. In WWW ‘20.
Key Findings from User Interviews

• Functional benefit:
  • “questions help guide users in the right direction”

• Emotional benefit:
  • it brings to users a sense of confidence that the search engine understands what the user wants.
  • it gives the users a sense of security and coming to the right conclusion.
  • The users pointed out that sometimes, especially when it comes to product search, they feel less stress when the search engine asks questions on different features of the product.

Zamani, Dumais, Craswell, Bennett, Lueck. “Generating Clarifying Questions for Information Retrieval”. In WWW ‘20.
A/B Test

+48% more user engagement

Zamani, Dumais, Craswell, Bennett, Lueck. “Generating Clarifying Questions for Information Retrieval”. In WWW ‘20.
Clarification is also useful for exploratory search!

Over 7% of interactions with the clarification pane lead to *exploration*!
Free-Form Clarification Responses
Information Need (Facet)
I'm looking for the Discovery Channel's dinosaur site, which has pictures of dinosaurs and games.

Are you looking for dinosaur books?
No, just the discovery channel website.

Are you looking for meat-eating or plant-eating dinosaurs?
I'm not sure. ❌ No answer

Would you like to see pictures or videos of dinosaurs?
I'd like to see pictures of dinosaurs on the discovery channels website.

Information Need (Facet)
I'm looking for a list of all (or many of) the different kinds of dinosaurs, with pictures.

Are you looking for dinosaur books?
Yes, if they contain pictures of all the different kinds of dinosaurs.

Which dinosaurs are you interested in?
I'm interested in any and all dinosaurs.

Do you want a list of dinosaurs names?
Yes, I would also like the list to include pictures of the dinosaurs.
dinosaur

Discovery channel  Dinosaur pictures  Dinosaur books
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td># topics</td>
<td>198</td>
</tr>
<tr>
<td># faceted topics</td>
<td>141</td>
</tr>
<tr>
<td># ambiguous topics</td>
<td>57</td>
</tr>
<tr>
<td># facets</td>
<td>762</td>
</tr>
<tr>
<td>Average facet per topic</td>
<td>3.85 ± 1.05</td>
</tr>
<tr>
<td>Median facet per topic</td>
<td>4</td>
</tr>
<tr>
<td># informational facets</td>
<td>577</td>
</tr>
<tr>
<td># navigational facets</td>
<td>185</td>
</tr>
<tr>
<td># questions</td>
<td>2,639</td>
</tr>
<tr>
<td># question-answer pairs</td>
<td>10,277</td>
</tr>
<tr>
<td>Average terms per question</td>
<td>9.49 ± 2.53</td>
</tr>
<tr>
<td>Average terms per answer</td>
<td>8.21 ± 4.42</td>
</tr>
</tbody>
</table>
MIMICS

query

clarifying question

candidate answers

engagement level [0, 10]

impression level (low, medium, high)

option CCTR

Zamani, Lueck, Chen, Quispe, Luu, Craswell. “MIMICS: A Large-Scale Data Collection for Search Clarification”. In CIKM ‘20.
# Data Statistics

<table>
<thead>
<tr>
<th></th>
<th>MIMICS-Click</th>
<th>MIMICS-ClickExplore</th>
<th>MIMICS-Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td># unique queries</td>
<td>414,362</td>
<td>64,007</td>
<td>2464</td>
</tr>
<tr>
<td># query-clarification pairs</td>
<td>414,362</td>
<td>168,921</td>
<td>2832</td>
</tr>
<tr>
<td># clarifications per query</td>
<td>1 ± 0</td>
<td>2.64 ± 1.11</td>
<td>1.15 ± 0.36</td>
</tr>
<tr>
<td>min &amp; max clarifications per query</td>
<td>1 &amp; 1</td>
<td>2 &amp; 89</td>
<td>1 &amp; 3</td>
</tr>
<tr>
<td># candidate answers</td>
<td>2.81 ± 1.06</td>
<td>3.47 ± 1.20</td>
<td>3.06 ± 1.05</td>
</tr>
<tr>
<td>min &amp; max # candidate answers</td>
<td>2 &amp; 5</td>
<td>2 &amp; 5</td>
<td>2 &amp; 5</td>
</tr>
<tr>
<td># query-clarification pairs with positive engagement</td>
<td>71,188</td>
<td>89,441</td>
<td>N/A</td>
</tr>
<tr>
<td># query-clarification pairs with low/medium/high impressions</td>
<td>264,908 / 105,879 / 43,575</td>
<td>52,071 / 60,907 / 55,943</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Qulac vs. MIMICS

<table>
<thead>
<tr>
<th></th>
<th>Qulac [SIGIR 2019]</th>
<th>MIMICS [CIKM 2020]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong># queries</strong></td>
<td>198</td>
<td>&gt;450,000</td>
</tr>
<tr>
<td><strong>Document type</strong></td>
<td>webpages</td>
<td>webpages</td>
</tr>
<tr>
<td><strong>Clarifying questions</strong></td>
<td>Generated through crowdsourcing</td>
<td>Generated using a machine learning model</td>
</tr>
<tr>
<td><strong>User responses to clarification</strong></td>
<td>Generated through crowdsourcing</td>
<td>Real user interaction signals</td>
</tr>
</tbody>
</table>

**MIMICS-Duo** [Tavakoli et al., SIGIR 2022] enables both offline and online evaluation for search clarification.
Bridging the Gap between IR and RecSys
Joint Modeling of Search and Recommendation

Zamani and Croft. “Joint Modeling and Optimization of Search and Recommendation”. In DESIRES ’18.
User-item interaction objective

User embedding lookup

Item embedding lookup

Query generation

Item reconstruction objective

Estimated unigram distribution

Relevance-based word embedding (pre-trained)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>fantasy</td>
<td>batman</td>
<td>documentary</td>
<td>cartoon</td>
</tr>
<tr>
<td>magic</td>
<td>character</td>
<td>film</td>
<td>parody</td>
</tr>
<tr>
<td>movies</td>
<td>superhero</td>
<td>directed</td>
<td>movie</td>
</tr>
<tr>
<td>wizard animation</td>
<td>horror</td>
<td>prize</td>
<td>black(^5)</td>
</tr>
<tr>
<td></td>
<td>thriller</td>
<td>award</td>
<td>comic</td>
</tr>
<tr>
<td>potter</td>
<td>starring</td>
<td>supporting</td>
<td>comedy</td>
</tr>
<tr>
<td>cartoon</td>
<td>fantasy</td>
<td>films</td>
<td>film</td>
</tr>
<tr>
<td>fiction</td>
<td>movie</td>
<td>movie</td>
<td>monster</td>
</tr>
<tr>
<td>classic</td>
<td>joker</td>
<td>fiction</td>
<td>thriller</td>
</tr>
<tr>
<td>novel</td>
<td>comedy</td>
<td>drama</td>
<td>shows</td>
</tr>
</tbody>
</table>

Applications of JSR

• Improving both search and recommendation performance
• Interpretable, transparent, and explainable recommendation
• User profiling
• Universal representation across domain and modality
• Conversational recommendation
Modeling and Measuring Conversational Search

With a focus on mixed-initiative interactions
Barack Obama was the President of the United States from 2009 until 2017. He is a member of the Democratic Party, and was the first African-American president of the United States.

Barack Obama - Wikipedia
Barrack Hussein Obama II is an American politician and attorney who served as the 44th president of the United States

The Office of Barack and Michelle Obama
Welcome to the Office of Barack and Michelle Obama. True democracy is a project that's much bigger than any one of us.

Would like to learn more about Barack Obama's
Family Life  Life before becoming President
Career  Time during his Presidency

Tell about his career before being president

OK, before he became president, he was visiting fellow at the University of Chicago Law School, directed Illinois' Project Vote, and then joined a law firm where he worked as a civil rights attorney.

Early Life and Career of Barack Obama - Wikipedia
Barrack Hussein Obama II is an American politician and attorney who served as the 44th president of the United States from 2009-2017. A member of the ...

Show me the early life wikipedia page
Feedback first

Query Turn
User issues query
Agent responds.

Feedback Turn
User provides Feedback
Agent responds.

Assess Turn
User assesses item

Feedback first

Feedback after

Query Turn
User issues query
Agent responds.

Barack Obama was the President of the United States from 2009 until 2017. He is a member of the Democratic Party, and was the first African-American president of the United States.

Assess Turn
User assesses item

The Office of Barack and Michelle Obama
Welcome to the Office of Barack and Michelle Obama. True democracy is a project that's much bigger than any one of us.

Feedback Turn
User provides Feedback
Agent responds.
Examples of Feedback

Query clarification

Do you have any theme in mind?

- summer
- modern
- fall
- beach
- retro

Query suggestion

Related searches for wedding dresses

- formal wedding dresses for guests
- google wedding dresses
- dillards wedding dresses
- dresses for wedding occasion
- wedding dresses for older brides
- cheap wedding dresses
- davids bridal ocala
- designer wedding gowns
Cost and Benefit (Gain) of a Conversation

\[ G(t_1, t_2, \cdots, t_T) = \sum_{i=1}^{T} g(t_i) \]

\[ C(t_1, t_2, \cdots, t_T) = \sum_{i=1}^{T} c(t_i) \]

\[ R = \frac{G(t_1, t_2, \cdots, t_T)}{C(t_1, t_2, \cdots, t_T)} \]

We can assume that the user only accumulates gain on an assessment of a relevant document.

We can consider time as a good estimator of each interaction cost.

Estimating the Cost

• Crowdsourcing using the complex TREC Web Track topics.
• Once the user submits a query, the system responds with a result snippet or document for up to five documents (one by one). Then the user can either
  • Reformulate the query, or
  • Answer clarifying questions, or
  • Select a query suggestion, or
  • “Not interested”
• 81 crowdworkers, 144 queries, 1280 snippets, and 268 feedback responses

Estimating the Cost

- The average time taken
  - to issue a query: 29.3 s
  - to assess a result snippet: 6.3 s
  - to assess a result web page: 17 s
  - to provide feedback: 8.3 s
  - …

- They can be used to estimate the cost of each interaction.

- We can then conduct some simulated analysis to explore gain ratio for each conversational strategy.

The strategies

FA-QC combination is inferior.

FF-QS leads to a small increase over the baseline but is not superior.

No dominant strategy, depends on #assessments.
Best strategies

Searcher is only willing to **examine a few items**: FA-QS

Searcher is willing to **go deeper**: FF-QC


73
Agent-Initiative Interactions
Three Major Dimensions in Agent-Initiative Interactions

• Initiation Moment (*when* to initiate a conversation?)
  • Instant initiation
  • Opportune moment initiation

• Initiation purpose (*why* to initiate a conversation?)
  • Filtering streaming information based on user profile
  • Recommendation
  • Following up a past conversation
  • Contributing to a multi-party human conversation
  • Feedback request

• Initiation means (*how* to initiate a conversation?)
  • Device
  • Interaction Modality

Initiation Purposes: Contributing to a multi-party human conversation

• Example:
  • Monitoring factual accuracy of human conversations.
  • Introducing opposing views on the topic being discussed.

Initiation Purposes: Following up a Past User-System Conversation

• Based on new information or new deployment of models

• Example:
  • CIS systems are not by any means perfect and they make mistakes in responding to user's requests. Based on new information or new models deployed in the system, a CIS system may initiate a conversation at an opportune moment to accept and correct its mistakes that was made in the past.

Open Problems and Future Directions

- Evaluating mixed-initiative conversational search systems
- Studying other types of mixed-initiative interactions
- Search result list explanation
- Integrating chit-chat into conversational search and recommendation
- Generating clarifying questions with no access to query logs
- Preference elicitation
- Joint conversational search and recommendation
“Conversational Information Seeking”

“Generating Clarifying Questions for Information Retrieval”

“Analyzing and Learning from User Interactions with Search Clarification”

“MIMICS: A Large-Scale Data Collection for Search Clarification”

“Learning a Joint Search and Recommendation Model from User-Item Interactions”

“Asking Clarifying Questions in Open-Domain Information Seeking Conversation”
by Aliannejadi, Zamani, Crestani, Croft. In SIGIR ‘19.

“Analyzing Mixed Initiatives and Search Strategies during Conversational Search”

“Joint Modeling and Optimization of Search and Recommendation”
by Zamani and Croft. In DESIRES ‘18.

“Towards System-Initiative Conversational Information Seeking”

“MIMICS-Duo: Enabling Both Offline & Online Evaluations for Search Clarification”
by Tavakoli, Trippas, Zamani, Scholer, Sanderson. In SIGIR ‘22.
Thank you!
Macaw

https://github.com/microsoft/macaw

December 18

Why does the phrase "to be or not to be" is so famous?

1:08 PM

It is the opening phrase of a soliloquy uttered by Prince Hamlet, in the play Hamlet.

1:09 PM

Who is the playwright?

1:13 PM

William Shakespeare

1:14 PM

Tell me more about him

1:14 PM

William Shakespeare was an English poet, playwright, and actor, widely regarded as the greatest writer in the English language and the world's greatest dramatist.

1:15 PM

What was the last play he wrote?

1:17 PM

Shakespeare's last play is believed to be "The Two Noble Kinsmen," a tragicomedy co-written with John Fletcher in 1613, three years before Shakespeare's death.

1:18 PM

At what age did he die?

1:19 PM

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1:20 PM

What are his other plays?

1:23 PM

See the list of Shakespeare's plays here: https://www.opensourceshakespeare.org/views/plays/plays.php

1:25 PM

tell me about US tax documents

7:21 PM

Retrieved document list (click to see the document content):

7:21 PM

FT942-9915

FT941-10815

FBIS3-29324

Macaw heard: when is the due date for filing tax return documents

7:23 PM

The due date is April 15. If it falls on a weekend or legal holiday, you have until midnight the next business day following April 15.

7:24 PM

Macaw heard: what are the forms

7:26 PM

IRS tax forms: https://en.wikipedia.org/wiki/IRS_tax_forms
Action 1 & 2: Search and QA
Other Actions

• Action 4: Clarification
• Action 5: Recommendation
• Action 6: ...