

Understanding Comparative Questions and Retrieving Argumentative Answers

The oral exam of
Alexander Bondarenko

Friedrich-Schiller-Universität Jena

June 29, 2023

Motivation



Should I put on a blue or a white shirt for my defense?

Motivation



Should I put on a blue or a white shirt for my defense?

Maybe a “small” decision ...

Motivation



Is buying a house better than renting?

Big, life-changing decision ...

Motivation



- ❑ Decision making involves:
Collecting information about the alternatives.
Weighing pro and con arguments.

Is buying a house better than renting?

Big, life-changing decision ...


Motivation

Is buying a house better than renting?

× | 📷 🔍

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About 60.700.000 results (0,30 seconds)

 Investopedia
https://www.investopedia.com › ... › Renting ⋮

Renting vs. Owning a Home: What's the Difference?

There is no definitive answer as to whether renting or owning a home is better. The answer depends on your own personal situation—your finances, lifestyle, and ...


Is It Better to Rent or Own a Home? ▼

Is Renting Cheaper Than Owning a Home? ▼

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10 Reasons Why Renting Could Be Better Than Buying

One of the major benefits of renting versus owning is that **renters don't have to pay property taxes**. Real estate taxes can be a hefty burden for homeowners ...

 Business Insider
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8 Reasons Why Buying a Home Is Better Than Renting

30 Aug 2019 — 8 reasons why buying a house is better than renting, according to people who have done it · **Owning a home allows you to build wealth to purchase ...**


- ❑ Decision making involves:
 - Collecting information about the alternatives.
 - Weighing pro and con arguments.
- ❑ 80% prefer online research over asking friends [Turner and Rainie; Pew Research Center 2020].

Motivation

Is **buying a house** better than **renting**? × 📷 🔍

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About 60.700.000 results (0,30 seconds) **neutral: 42%** **pro renting: 33%** **pro buying: 25%**

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- ❑ Decision making involves:
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- ❑ 80% prefer online research over asking friends [Turner and Rainie; Pew Research Center 2020].
- ❑ Additional support for users:
 - Identify comparative questions and components.
 - Identify arguments and their pro/con stance.
 - Inform about the number pro/con arguments.

Motivation

The screenshot shows a Google search for "Is buying a house better than renting?". The search bar highlights "buying a house" in green and "renting" in red. Below the search bar, the results show "About 60.700.000 results (0,30 seconds)" with sentiment analysis: "neutral: 42%", "pro renting: 33%", and "pro buying: 25%". The first result is from Investopedia, titled "Renting vs. Owning a Home: What's the Difference?", with a "neutral" sentiment tag. The second result is from Business Insider, titled "8 Reasons Why Buying a Home Is Better Than Renting", with a "pro buying" sentiment tag. The third result is from Business Insider, titled "10 Reasons Why Renting Could Be Better Than Buying", with a "pro renting" sentiment tag.

Is **buying a house** better than **renting**?

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Inform about the number pro/con arguments.

Contributions

1. Understanding Comparative Questions.

“Towards Understanding and Answering Comparative Questions” (full paper at WSDM 2022).

“Comparative Web Search Questions” (full paper at WSDM 2020).

2. Stance Detection for Answers.

“Towards Understanding and Answering Comparative Questions” (full paper at WSDM 2022).

3. Retrieving Argumentative Answers.

“Overview of Touché 2020–2022: Argument Retrieval” (overview papers at CLEF 2020–2022).

4. Clarifying Comparative Questions.

“A User Study on Clarifying Comparative Questions” (short paper at CHIIR 2022).

Understanding Comparative Questions

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Identifying Comparative Questions

Is buying a house better than renting? vs. How to rent a house?

Understanding Comparative Questions

Identifying Comparative Questions

Is buying a house better than renting? vs. How to rent a house?

Annotated data:

50 000 questions from Yandex (Russian; 3% comparative).

31 000 from Bing, Google, Stack Exchange (English; 10% comparative).

Understanding Comparative Questions

Identifying Comparative Questions

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High-precision classifier (precision is 1.0).

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High-precision classifier (precision is 1.0) that combines:

Rules (patterns)

$[is] \wedge RBR \wedge [than] \rightarrow$ Is buying a house better/RBR than renting? \rightarrow Recall: 0.44.

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Feature-based classifiers

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+ Logistic regression → probability of being comparative → combined Recall: 0.54.

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Neural classifiers.

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+ Logistic regression → probability of being comparative → combined Recall: 0.54.

+ BERT → probability of being comparative → combined Recall: 0.60.

Understanding Comparative Questions

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$[is] \wedge RBR \wedge [than]$ → Is buying a house better/RBR than renting? → Recall: 0.44.

+ Logistic regression → probability of being comparative → combined Recall: 0.54.

+ BERT → probability of being comparative → combined Recall: 0.60.

Recall: 0.60 (Russian), 0.71 (English); precision is 1.0 (of being comparative).

Understanding Comparative Questions

Taxonomy of Comparative Questions (Yandex)

Factual 35% Who is richer Jeff Bezos or Elon Musk?

Understanding Comparative Questions

Taxonomy of Comparative Questions (Yandex)

Subjective 65% Is buying a house better than renting?


The screenshot shows a Yandex search engine interface. The search bar contains the query "Is buying a house better than renting?". Below the search bar, there are tabs for "All", "Images", "News", "Videos", "Books", and "More". The search results show "About 60.700.000 results (0,30 seconds)". Sentiment analysis results are displayed in colored boxes: "neutral: 42%" (yellow), "pro renting: 33%" (red), and "pro buying: 25%" (green). The first search result is from Investopedia, titled "Renting vs. Owning a Home: What's the Difference?", with a "neutral" sentiment label. The snippet states: "There is no definitive answer as to whether renting or owning a home is better. The answer depends on your own personal situation—your finances, lifestyle, and ...". Below the snippet, there are two expandable sections: "Is It Better to Rent or Own a Home?" and "Is Renting Cheaper Than Owning a Home?".

Is buying a house better than renting?

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Understanding Comparative Questions

Taxonomy of Comparative Questions (Yandex)

Direct

43% Is buying a house better than renting?

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Is buying a house better than renting?

Search filters: All, Images, News, Videos, Books, More, Tools

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Understanding Comparative Questions

Taxonomy of Comparative Questions (Yandex)

Indirect 57% What is the best housing option?

Understanding Comparative Questions

Taxonomy of Comparative Questions (Yandex)

Indirect 57% What is the best housing option?

Housing option (clarify)



Which options do you want to compare?

Buy a house vs. rent a house

Buy a flat vs. rent a flat

A house vs. a flat

I don't care

Understanding Comparative Questions

Taxonomy of Comparative Questions (Yandex)

With aspect 22% Is buying a house more risky than renting?

Understanding Comparative Questions

Taxonomy of Comparative Questions (Yandex)

Without aspect 78% Is buying a house better than renting?

Understanding Comparative Questions

Taxonomy of Comparative Questions (Yandex)

Without aspect 78% Is buying a house better than renting?

Better (clarify)



Over which aspect do you want to compare?

Risks

Flexibility

Monthly payments

I don't care

Understanding Comparative Questions

Question Parsing for Answering Comparative Questions

Is buying a house more risky than renting?

Understanding Comparative Questions

Question Parsing for Answering Comparative Questions

Is `buying{a house}` more risky than `renting`?
object 1 object 2

- What should be compared?

Buying a house involves more substantial financial risks than renting a house.

Understanding Comparative Questions

Question Parsing for Answering Comparative Questions

Is buying{a house} more **risky** than renting?
object 1 aspect object 2

- ❑ What should be compared?
- ❑ Should a particular shared property be emphasized?

Buying a house involves more substantial financial risks than renting a house.

Understanding Comparative Questions

Question Parsing for Answering Comparative Questions

Is buying{a house} **more** risky than renting?
object 1 predicate aspect object 2

- ❑ What should be compared?
- ❑ Should a particular shared property be emphasized?
- ❑ Guide the direction of the answer composition (e.g., a “more” or a “less” option).

*Buying a house involves **more** substantial financial **risks** than renting a house.*

Understanding Comparative Questions

Question Parsing for Answering Comparative Questions

Is **buying a house** **more** **risky** than **renting**?

object 1 predicate aspect object 2

- ❑ 3 500 comparative questions labeled with objects, aspects, and predicates.
- ❑ Baseline: BiLSTM with 300-dimensional GloVe embeddings [Arora et al.; CIKM 2017].
- ❑ Our: Fine-tuned RoBERTa [Liu et al.; arXiv 2019].

Classifier	F1 scores			
	Predicate	None	Object	Aspect
BiLSTM	0.85	0.98	0.80	0.52
RoBERTa	0.98	0.94	0.93	0.80

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- ❑ “Pre-classifying” questions with an aspect (F1: 0.80 → 0.90).

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Stance Detection for Answers

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Is **buying a house** better than **renting**?
object 1 object 2

Stance Detection for Answers

Is **buying a house** better than **renting**?
object 1 object 2

Pro object 1: Owning your own house is better than renting, because ...

Pro object 2: Although not ideal, renting does have its advantages like ...

Neutral: Both options have their advantages and disadvantages ...

No stance: Rent (definition): an agreement where a payment is made for ...

Stance Detection for Answers

Is **buying a house** better than **renting**?
object 1 object 2

- 950 answers from Stack Exchange labeled with 4 stance classes.

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Stance Detection for Answers

Is `[OBJECT_1]` better than `[OBJECT_2]`?

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 1. Comparison objects masked in questions and answers.
 2. Add a sentiment prompt: `[OBJECT_1] is better.`
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- ❑ RoBERTa with a sentiment prompting: 0.63 (accuracy).

Stance Detection for Answers

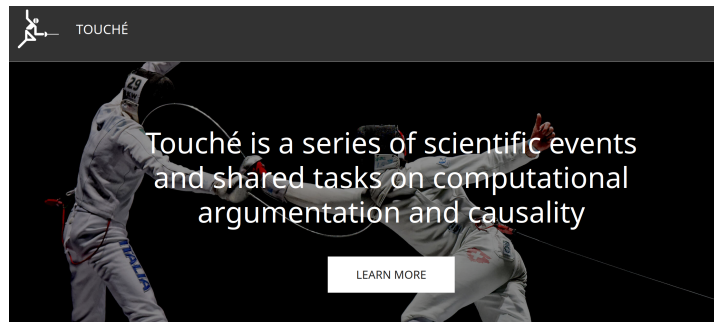
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 3. Input for RoBERTa: [OBJECT_1] is better [SEP] <answer>.
- ❑ RoBERTa with a sentiment prompting: 0.63 (accuracy).
- ❑ GPT-3 with a few-shot prompting: 0.65 (accuracy).

Retrieving Argumentative Answers

Retrieving Argumentative Answers

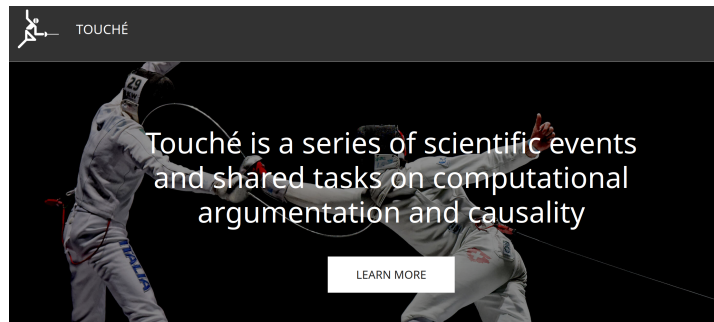
Touché: Argument Retrieval



- ❑ Platform for argument retrieval and argument analysis research.
- ❑ Argument relevance / quality / stance corpora and rankings.
- ❑ Organizing workshops at CLEF since 2020.

Retrieving Argumentative Answers

Touché: Argument Retrieval



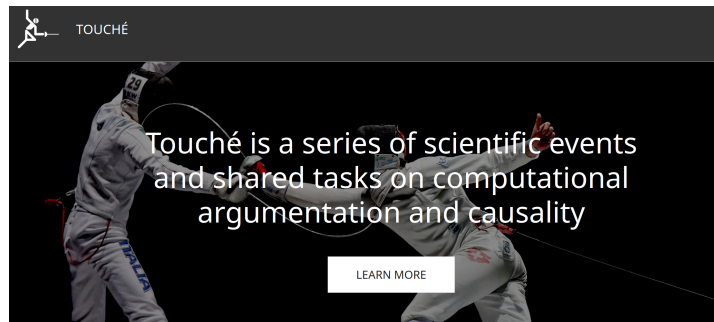
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Argument Retrieval for Comparative Questions:

- ❑ Task: Given a comparative question, retrieve and rank documents of high arg. quality, detect the stance.

Retrieving Argumentative Answers

Touché: Argument Retrieval



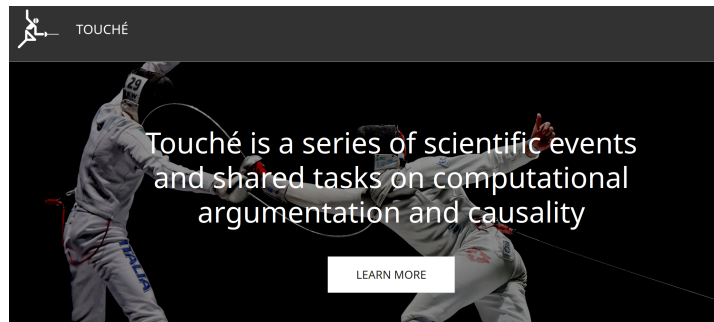
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Findings:

- ❑ From sparse to dense retrieval.
- ❑ Stance detection is hard.
- ❑ Best so far: retrieval pipelines that include argument mining and arg. quality estimation.

Contributions

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- ❑ High-precision classifiers for identifying comparative questions.
- ❑ A taxonomy of comparative information needs.
- ❑ Classifiers for detecting components in comparative questions.
- ❑ Stance detectors for potential answers.
- ❑ Shared tasks on argument retrieval and analysis.
- ❑ User study on clarifying comparative questions.

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thank you!