Understanding and Detecting Supporting Arguments of Diverse Types

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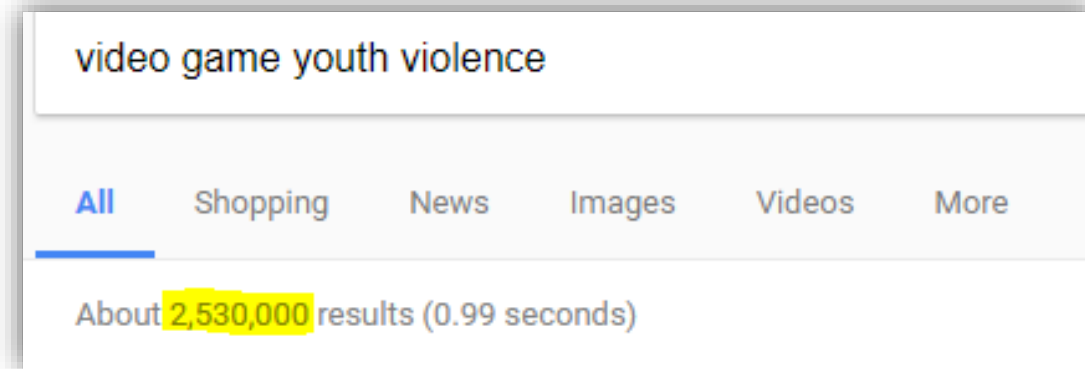Project page: http://xinyuhua.github.io/Resources/

Problem

- Alice wants to write an essay

- Topic: Video game and youth violence

- Thesis: Video game contributes to youth violence

Problem

- Alice uses Google to find some related documents.

- But, wait…

Problem

Do Violent Video Games Contribute to Youth Violence? - Violent ...
videogames.procon.org/view.answers.php?questionID=001608 ▾
"An overlooked but highly potent factor in **youth violence** and gun violence is the influence of first-person shooter **video games**. Neuroscientific research during ...

Violent video games and young people - Harvard Health
www.health.harvard.edu/newsletter_article/violent-video-games-and-young-people ▾
Oct 1, 2010 - They argue that most youths are not affected by violent **video games**. ... General on the topic of **youth violence** made a similar judgment. Some ...

Video Games and Youth Violence: A Prospective Analysis in ...
https://link.springer.com/article/10.1007/s10964-010-9610-x
by CJ Ferguson - 2011 - Cited by 167 - Related articles
The potential influence of violent **video games** on **youth violence** remains an issue of concern for psychologists, policymakers and the general public. Although ...

Do video games lead to violence? - CNN.com
www.cnn.com/2016/07/25/health/video-games-and-violence/index.html ▾
Jul 26, 2016 - The Munich rampage led many parents to worry that **violent video games** may be negatively affecting their own teens, but recent studies ...

Do Video Games Influence Violent Behavior? - Michigan Youth ...
yvpc.sph.umich.edu/video-games-influence-violent-behavior/ ▾
Aug 24, 2011 - A more critical analysis of the link between **video game** playing and **violence** is necessary for fully understanding a complex problem like **youth** ...

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Problem

- How to efficiently select relevant arguments?

- Can we ensure the arguments cover different aspects and are non-redundant?

Diverse Types of Arguments

1. The 18-year old gunman who killed 9 people in Munich, Germany, on Friday was a fan of first-person shooter video games.   Event

2. A 2015 peer-reviewed study found "compelling evidence that the use of realistic controllers can have a significant effect on the level of cognitive aggression."   Study

3. Violent video games require active participation and identification with violent characters, which reinforces violent behavior.   Reasoning

Our Goal

- Characterize different types of arguments

- Detect supporting arguments by leveraging type information

Related Work

- Argumentation mining
  - Argument component extraction (Moens et al 2007; Palau and Moens, 2009; Mochales and Moens, 2011; Park and Cardie, 2014)
  - Argument scheme classification (Biran and Rambow, 2011; Al Khatib et al, 2006; Feng and Hirst 2011; Stab and Gurevych 2014)

- Evidence detection
  - Evidence retrieval, on identifying whole documents (Cartright et al., 2011; Bellot et al., 2013)
  - Detection of sentence-level factual evidence from Wikipedia articles (Aharoni et al., 2014; Rinott et al, 2015)

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Data

- Data source: `Idebate.org`
  - A Wikipedia style online debate forum
  - Around 1,000 debate motions

topic

claim

arguments

citations

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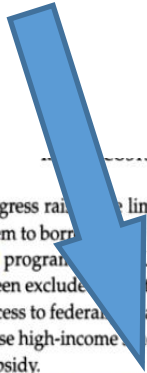Xinyu Hua and Lu Wang

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Our Goal

- Characterize different types of arguments

- Detect supporting arguments by leveraging type information

Sample Annotation

annotation

Individuals have a right to the experience of higher education

POINT

University offers personal, intellectual, and often spiritual, exploration. In secondary school and in professional life, no such opportunities exist as they are about instruction and following orders, not about questioning norms and conventions in the same way university so often is.[1] A life without the critical thinking skills provided by university will be less useful to society, as citizens will be unable to engage with political debate effectively – citizens need to be critical of what politicians tell them. The state has a responsibility to provide citizens with the skillset to take partake in the democratic process. [2] Free universities benefit both the citizen, as an exploration for his/her own development, and to society, for an educated and active populace.

[1] Key Degree. 2010. "How to Reap the Benefits of College". Keydegree.com.
Available: http://www.keydegree.com/articles/benefitsofcollege.html

[2] Swift, Adam. 2001. Political Philosophy: A Beginner's Guide for Students and Politicians. Cambridge: Polity.

own. In 1992 Congress rai... limits on parental borrowing, essentially allowing them to borr... the full cost of attendance through the parental loan progra... US program). Higher-income students, who had been exclude... the student loan programs in 1981, were provided access to federa... aranteed loans, known as unsubsidized loans because high-income ... dents would not qualify for the in-school interest subsidy.

Federal college loan volume has risen dramatically since 1992. But most of this increase has been due to expansion of the volume of unsubsidized student and parental loans (figure 3-3).[14] Loan volume under the programs that qualify for the in-school interest subsidy rose from $15.0 billion to $17.9 billion between 1991–92 and 1996–97.[15] However, borrowing under the unsubsidized loan programs increased from $1.4 billion in 1991–92 to $13.2 billion in 1996–97. Therefore, more than three-fourths of the increase was in the unsubsidized programs.

This large increase in borrowing is somewhat puzzling, given that the PLUS loans and unsubsidized Stafford Loans are often more expensive for families than other sources of financing. The average home mortgage rate in 1995 was 7.9 percent. Because mortgage interest can be deducted

cited documents

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Annotation

- 200 debate motions are randomly chosen for annotation.
    - 462 claims with 640 citation documents
    - Annotation includes *supporting arguments* and their *types.*

- Inter-annotator agreement (Cohen's κ): 0.80 overall

Annotation – Four types of arguments

- STUDY
  - Only 11.7% of bird-owning households currently seek veterinary advice for their birds.

- FACTUAL
  - Ongoing circulation of H5N1 and H7N9 continue to pose threats to public heath.

- OPINION
  - Birds could spread diseases.

- REASONING
  - Birds are routinely denied two of their fundamental natural behaviors – flying and socialization, which can cause physical and behavioral abnormalities.

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Argument Type Prediction

- A log-linear model with one-vs-rest setup

- Dataset: Arguments annotated with types, divided as training, development, and test sets

- Features:
  - BASIC FEATURES: part-of-speech tags, named entities
  - DISCOURSE FEATURES: discourse connections from the Penn Discourse Treebank (Prasad et al, 2007)
  - SENTIMENT FEATURES: negative and positive words (Wilson et al, 2005; Stone et al, 1966)
  - STYLE FEATURES: concreteness (Brysbaert et al, 2014) , dominance, arousal, and valence (Warriner et al, 2013)

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Sample Features

- Concreteness
    - STUDY, FACTUAL -> more concrete words
    - *luckiness, happiness* vs. *ginger, bicycle*

- Named Entities
    - REASONING -> less NEs

- Sentiment
    - FACTUAL -> less sentiment words
    - *admirable, bright* vs. *movie, sound*

Type Prediction - Results

- Baselines: majority class, log-linear model with only unigram and bigram features

	Accuracy	F1
majority class	0.520	0.171
log-linear (unigram, bigram features only)	0.535	0.277
log-linear (all features)	0.622	0.436

Used in our argument detection model

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Supporting Argument Detection

- A state-of-the-art ranking model: LambdaMART (Burges, 2010)

- Dataset: Annotated relevant arguments, split as training, development, and test sets

- Features:
    - SENTENCE FEATURES: unigram, bigram, part-of-speech, named entities, sentiment features, style features
    - SIMILARITY FEATURES: word2vec and TF-IDF similarity between claim and candidates; ROUGE (Lin, 2004) and BLEU (Papineni et al., 2002)
    - COMPOSITE FEATURES: linguistic features combined with argument type

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Composite Features

- Goal: explicitly modeling the interplay of type and linguistic features

- Consider a candidate sentence s for a given claim c

- Composite feature function: $\phi_{(\text{TYPE}, feature)}(s, c)$

  - Assume sentence type REASONING, and feature $ROUGE_L$

$\implies$ $\phi_{(\text{REASONING}, ROUGE_L)}(s, c) = ROUGE_L(s, c)$

Supporting Argument Detection - Metrics

- Evaluate using ranking metrics
  - Mean Reciprocal Ranking (MRR)
  - Normalized Discounted Cumulative Gain (NDCG)

  (higher score -> correct sentence is ranked higher)

Supporting Argument Detection - Results

MRR (x100) for models trained with different features

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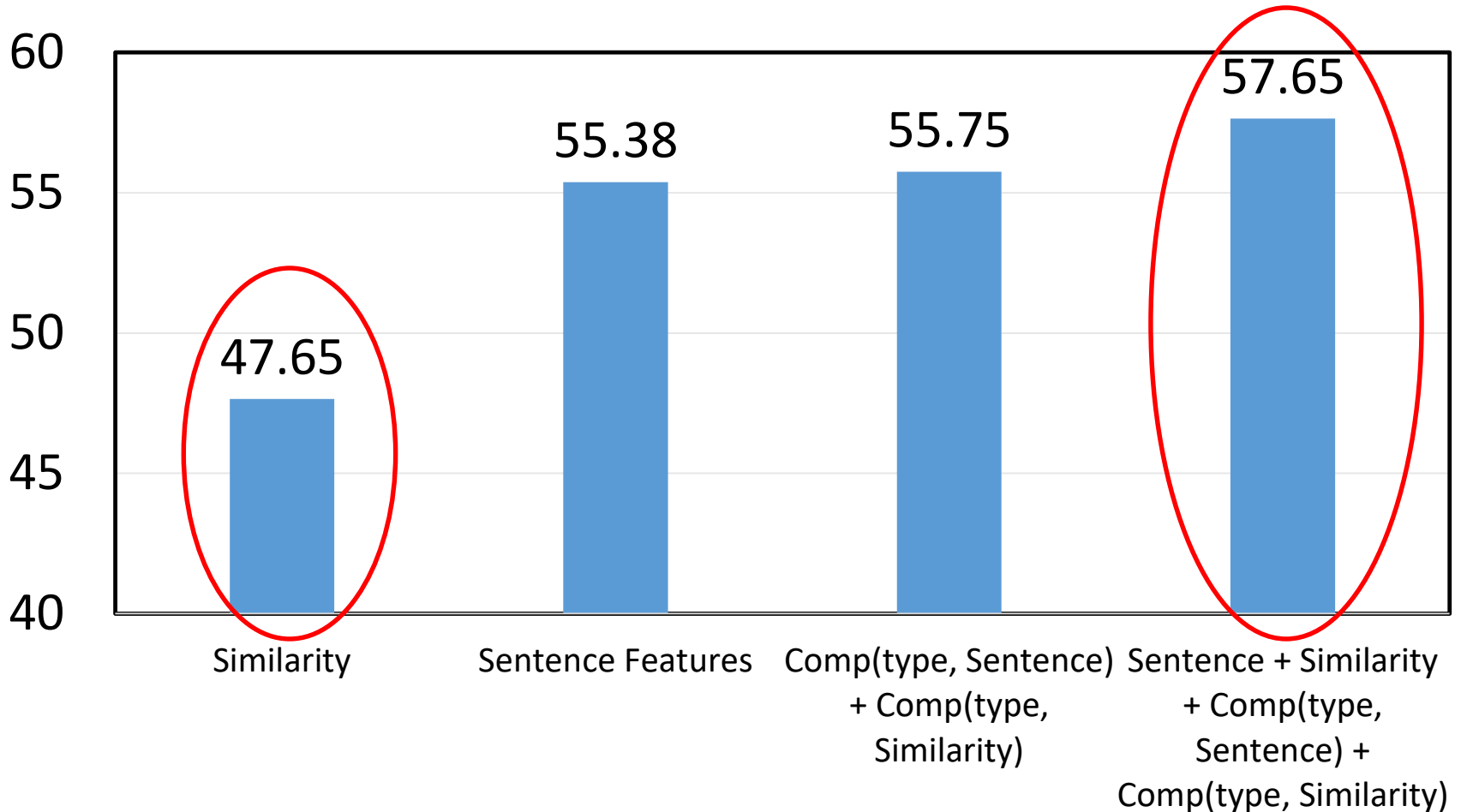
Feature Analysis

- Understand the interplay between argument type and linguistic features

- Composite features: compare relevant arguments to irrelevant ones

Feature Analysis – Sentence Features

Feature	STUDY	FACTUAL	OPINION	REASONING
Position of sentence	⬇	⬇		⬇
Concreteness of sentence	⬆		⬆	⬇
Arousal of sentence	⬆		⬆	⬇
Number of hedging word	⬆			

⬆ : Significantly higher in this category

⬇ : Significantly lower in this category

Feature Analysis – Named Entities

Feature	STUDY	FACTUAL	OPINION	REASONING
Number of PERCENTAGE	⬆			
Number of LOCATION			⬆	⬆

⬆ : Significantly higher in this category

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Feature Analysis – Claim Features

Feature	STUDY	FACTUAL	OPINION	REASONING
ROUGE	⬆	⬆	⬆	
Concreteness of claim	⬆		⬆	⬇
Arousal of claim	⬆		⬆	⬇

⬆ : Significantly higher in this category
⬇ : Significantly lower in this category

Conclusion

- We study sentence-level relevance estimation for supporting arguments construction.

- We characterize relevant arguments by four types and annotate accordingly on a newly collected dataset of 200 debate motions.

- We find that
  - human writers seek for different types of supporting arguments;
  - relevant arguments of different types are indicated by different linguistic features.

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Future Work – Towards Automatic Argument Generation

Operation	Sentence in cited article	Sentence reused by human
Paraphrase	The global counterfeit drug trade, a billion-dollar industry, is thriving in Africa.	This is exploited by the billion dollar global counterfeit drug trade.
Summarize	" I think it sets up a cycle of resistance to school because they don't have access to the cultural and emotional and learning support which middle-class children can get . "	Teachers in Britain fear that poor children, because they lack the support to do their homework, will be turned off school.
Generalize	Hidjaba is struggling to take care of her family - like nearly 200,000 other Malians who have fled the north of their country to escape the fighting …	Much of the population of the North had already fled to the south.

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Thank you!

- Check out our released dataset at:
  http://xinyuhua.github.io/Resources/

- Contact: hua.x@husky.neu.edu

- Find us at: https://nlp.ccis.northeastern.edu

- Any question?

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