The Role of Polarity in Inferring Acceptance and Rejection in Dialogue

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Introduction

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- To maintain coherence over the course of a dialogue, interlocutors must track which information they jointly take for granted.
- To this end, they must determine which positions have been accepted and which have been rejected.
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- But frequently, this is non-trivial.

(1) A: I never did care for him, in the James Bond movies.
B: I was never into those movies, either.

(2) A: This is a very interesting design.
B: It's just the same as normal.

Examples from the AMI Meeting Corpus and the Switchboard corpus.

Polarity Particles

Even when the responding utterance seems trivial, determining its dialogue function is not.

(3) A: But it's uh yeah it's uh original idea.
B: Yes it is. $\rightsquigarrow$ acceptance.

(4) A: a banana is not it's not really handy .
B: Yes it is. $\rightsquigarrow$ rejection.

(5) A: It's not very well advertised.
B: No, it's not. $\rightsquigarrow$ acceptance.

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We focus on the apparent ambiguity of these responses and arrive at a wider theory on logical polarity

We need to look at proposal and response, determine their polarity and specify how these polarities interact.

Talk Outline

- Some observations on properties of acceptance and rejection.
- A formal model to account for polarity effects.
- Heuristics to operationalize the model.
- Experimental results in a machine learning experiment.

Observations

Rejections

There is a body of work on computational disagreement detection, drawing on observations from, *i.a.*, conversation analysis.

Rejections are dispreferred moves, as such they tend to:

- Be longer.
- Start with hedges.
  - *well, actually, I mean, perhaps...*
- Contain more disfluencies
  - repetitions, hesitations, filled and unfilled pauses...

P. Brown & S. Levinson. *Politeness: Some universals in language usage. Cambridge University Press*, 1987.

M. Galley, K. McKeown, J. Hirschberg, E. Shriberg. Identifying agreement and disagreement in conversational speech: Use of bayesian networks to model pragmatic dependencies. *ACL 2004*.

S. Germesin & T. Wilson. Agreement detection in multiparty conversation. *Proceedings of the 2009 international conference on multimodal interfaces*.

A. Misra & M. Walker. Topic independent identification of agreement and disagreement in social media dialogue. *SIGDIAL 2013*.

Logical Polarity

Logical polarity has not been explored in computational approaches.

Formal semantics has seen renewed interest in polarity particles and negation.

(6) Sue failed the exam.
Yes she did. / No she didn't.

(7) Sue did not pass the exam.
No she didn't. / Yes she did.

Farkas, Roelofsen. 2013. *Polar initiatives and polar particle responses in an inquisitive discourse model*.

Parallelism

The relative nature of acceptance and rejection is also reflected in sentential parallelisms.

(8) A: <u>It's</u> still working.
B: <u>It is</u>.

(9) A: <u>It's</u> a fat cat.
B: <u>It is not</u> a fat cat.

→ The key observation: When the polarities of proposal and response align, it is an agreement move, if they differ, disagreement.

Formal Model

Relative Polarity

We consider pairs of a proposal P and its response R.

We assign a polarity, either positive or negative, to both proposal and response.

- aligned polarities $\rightsquigarrow$ accepting force.
  - Polarity signature of P–R: positive-positive or negative-negative.
- misaligned polarities $\rightsquigarrow$ rejecting force.
  - Polarity signature of P–R: positive-negative or negative-positive.

Absolute Polarity

Disregarding proposal polarity, there are absolute acceptance / rejection moves.

(10) A: Ah, that's not the ecological part, yeah.
B: That's true. $\rightsquigarrow$ absolute positive

(11) A: We can't make a docking station anyway.
B: That's not true. $\rightsquigarrow$ absolute negative

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- Agreement Acts signal agreement.
  - *I hereby agree.*
- Rejection Acts signal disagreement.
  - *I hereby disagree.*

Formal Model

Assume a proposal P is on the table.

The next move R accepts P iff $P \wedge R$ is consistent.

- $R \equiv \top$: absolute agreement.
- $R \equiv \bot$: absolute rejection.
- $R \equiv P$: relative agreement.
  - P positive $\rightsquigarrow$ default case; signature positive-positive.
  - P negative $\rightsquigarrow$ reverse case; signature negative-negative.
- $R \equiv \neg P$: relative rejection.
  - P positive $\rightsquigarrow$ default case; signature positive-negative.
  - P negative $\rightsquigarrow$ reverse case; signature negative-positive.

$\equiv$ is truth-conditional equivalence.

Heuristics

Heuristics

- Local indicators for acceptance and rejection, inspired by previous work.
  - Utterance length.
  - *absolutely, okay, agree, true,...*
  - *but, well, actually, umm...*
  - *'Yeah, but'*

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- Indicators to determine proposal polarity and response polarity.
  - Indicators are polarity particles and negation indicators
  - *not, never, nobody...*
  - Tag questions need special treatment.
  - The contrast particle *but* cancels polarity particles.
  - By default, an utterance has positive polarity.
  - Syntactic parallelisms.

Experiment

Setup

We extract datasets from the AMI and SWB corpora:

- The AMI is annotated with adjacency pairs which are marked as POS or NEG; we take all these where the first-part is marked as a proposal.
- The SWB is annotated with acceptance and rejection acts; we assign each of these the preceeding utterance of the other speaker, if marked as a proposal.
- We filter out responses that are *'Yeah.'*, in both copora these are 100% acceptances.

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	acceptances	**rejections**	**total** P-R
SWB	4534 (97%)	145 (3%)	4679
AMI	7405 (91%)	697 (9%)	8102

Featuresets

Based on our heuristics we have the featuresets:

- LOCAL FEATURES: Cuewords, length of the response
- LOCAL POLARITY: Polarity of the response,
  - positive or negative.
- RELATIVE POLARITY: Polarity signature of the pair.
  - positive–positive
  - negative–negative
  - positive–negative
  - negative–positive
- SENTENTIAL PARALLELISM: Repetition of a negated syntactic pattern.

Results

- Task: Retrieval of rejections.
- Classifier: Bernoulli-distributed Naive Bayesian classifier from scikit-learn.
- The classifier was developed on the AMI dataset.
- Method: Cross-validiation, 10x AMI, 5x SWB.
- Unigram baseline: all words that appear 5 times or more.

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	AMI			SWB		
Feature sets	Precision	Recall	F1	Precision	Recall	F1
Unigrams	35.61%	28.97%	31.66	24.20%	12.93%	16.63
Local + Local Polarity	**44.13%**	64.12%	52.24	**20.80%**	82.46%	33.00
Local + Relative Polarity	**58.08%**	61.63%	59.75	**49.12%**	72.93%	58.49
Loc. + Rel. + Parallel.	58.23%	64.04%	60.96	n/a	n/a	n/a

→ Logical polarity helps significantly.

→ Relative polarity widespread in actual dialogue.

Summary

- Discerning agreement from disagreement requires making inferences—we have studied how logical polarity helps this process.
- Inspired by recent formal work we have developed a framework that can be operationalized.
- Both absolute and relative polarities occur in actual spoken language.
- We have confirmed that the proposal–response polarity signature is important for disagreement retrieval.

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Thank you!