What do we use language for?
What do we use language for?

Communicating with other humans
  ▶ exchanging emails
  ▶ talking to friends
  ▶ writing
  ▶ giving lectures
  ▶ ...

Throw back Monday

Can you pass me the salt?
Pragmatics

The study of meaning as communicated by a speaker to a listener (Yule, 1996).
Pragmatics

The study of meaning as communicated by a speaker to a listener (Yule, 1996).

Or, contextual meaning
Pragmatics

The study of meaning as communicated by a speaker to a listener (Yule, 1996).

Or, contextual meaning

Pragmatics is important for building conversational agents, understanding human decision making, understanding language, etc.
Pragmatics vs. Syntax, Semantics (Yule, 1996)

- Syntax: the relationships between linguistic forms, how they are arranged in sequences, and which sequences are well-formed.
- Semantics: the relationships between linguistic forms and entities in the world.
- Pragmatics: the relationships between linguistic forms and the users of those forms.
Outline

Speech act theory

The effect of wording choices (big data pragmatics)

Modeling conversations: dialogue act categorization

Rational speech acts model
Outline

Speech act theory

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Rational speech acts model
Speech act theory

We do not simply produce utterances containing grammatical structures; we perform actions via those utterances.
We do not simply produce utterances containing grammatical structures; we perform actions via those utterances. Actions performed via utterances are generally called speech acts (Austin, 1975).
Speech act theory

- locutionary act (the actual utterance and its ostensible meaning)
- illocutionary act (its real, intended meaning)
- perlocutionary act (its actual effect, whether intended or not)
Outline

Speech act theory

The effect of wording choices (big data pragmatics)

Modeling conversations: dialogue act categorization

Rational speech acts model
Wording matters

Motivate voter turnout (Bryan et al., 2011)

“How important is it to you to be a voter in the upcoming election?”

“How important is it to you to vote in the upcoming election?”
Wording matters
Motivate voter turnout (Bryan et al., 2011)

“How important is it to you to be a voter in the upcoming election?”

“How important is it to you to vote in the upcoming election?”
Large-scale natural experiments
Large-scale natural experiments

A large number of social interactions in the format of texts

Potential opportunities for natural experiments
Large-scale natural experiments

The effect of wording on message propagation on Twitter (Tan et al., 2014)

Food trucks are the epitome of small independently owned LOCAL businesses! Help keep them going! Sign the petition bit.ly/P6GYCq

I know at some point you’ve have been saved from hunger by our rolling food trucks friends. Let’s help support them! bit.ly/P6GYCq
Large-scale natural experiments

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I know at some point you’ve have been saved from hunger by our rolling food trucks friends. Let’s help support them! bit.ly/P6GYCq
Large-scale natural experiments

- Millions of topic-author controlled pairs
- Ranking within a pair (classification)
  - Evaluation: the accuracy of predicting which one was retweeted more (random $\rightarrow$ 50%)
  - Classifier: logistic regression
Features

Pronouns

- first person singular (i)
- first person plural (we)
- second person (you)
- third person singular (she, he)
- third person plural (they)
Features

Pronouns

first person singular (i)  _____
first person plural (we)  _____
second person (you)  _____
third person singular (she, he)  ↑↑
third person plural (they)  ↑
Features

Pronouns

first person singular (i) ———
first person plural (we) ———
second person (you) ———
third person singular (she, he) ↑↑
third person plural (they) ↑

Referring to other people helps
Features

Generality

indefinite articles (a, an)
definite articles (the)
Generality

indefinite articles (a, an) ↑↑↑↑
definite articles (the) ————
Features

Generality

indefinite articles (a, an)  ↑↑↑↑
definite articles (the)  ———

Generality helps
Features

Language model scores

- similarity with overall Twitter users

  twitter unigram
  twitter bigram
Features

Language model scores

- similarity with overall Twitter users

  twitter unigram  ↑↑↑
  twitter bigram   ↑↑↑
Features

Language model scores

▶ similarity with overall Twitter users
  
  twitter unigram  ↑↑↑
  twitter bigram  ↑↑↑

▶ similarity with personal history
  
  personal unigram
  personal bigram
Features

Language model scores

▶ similarity with overall Twitter users
  twitter unigram ↑↑↑↑
  twitter bigram ↑↑↑

▶ similarity with personal history
  personal unigram ↑↑↑
  personal bigram ———

Be like the community & be true to yourself
Baseline without “natural experiments”

Supervised classification without control
- most-retweeted tweets vs. least-retweeted tweets
Prediction performance

- Controlling for context is important
- Big data can help understand pragmatics
Controlling for context is important
Big data can help understand pragmatics
https://chenhaot.com/retweetedmore
Beyond retweeting

- Persuasive arguments (Tan et al., 2016)
- Memorable (movie) quotes (Danescu-Niculescu-Mizil et al., 2012a)
- Power dynamics (Danescu-Niculescu-Mizil et al., 2012b; Prabhakaran et al., 2014)
- Newsworthiness of research articles and political speeches (Zhang et al., 2016)
Outline

Speech act theory

The effect of wording choices (big data pragmatics)

Modeling conversations: dialogue act categorization

Rational speech acts model
Dialogue act classification/tagging

Define categories and label corpora (Stolcke et al., 2000)

- statement
- question
- backchannel
- agreement
- apology
- ...


Dialogue act classification/tagging

Supervised classification
- SVM
- logistic classification

Structure prediction (sequence tagging)
- Hidden Markov model
- Conditional random field
Speech act theory

The effect of wording choices (big data pragmatics)

Modeling conversations: dialogue act categorization

Rational speech acts model
Cooperative Principle

Make your contribution as is required, when it is required, by the conversation in which you are engaged (Grice, 1975).
Conversational Implicatures

- Maxims of quality
  (Do not say what you believe to be false; do not say that for which you lack adequate evidence)
e.g., Noah is a nice person
Conversational Implicatures

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  e.g., Noah is a nice person ⇒ *I believe that* Noah is a nice person
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- Maxims of quantity
  Make your contribution as informative as is required (for the current purposes of the exchange); do not make your contribution more informative than is required
  - I have two hands
Conversational Implicatures

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  e.g., Noah is a nice person ⇒ *I believe that* Noah is a nice person

- Maxims of quantity
  Make your contribution as informative as is required (for the current purposes of the exchange); do not make your contribution more informative than is required
    - I have two hands ⇒ I have *no more than* two hands
Reference games (Wittgenstein, 1953; Frank and Goodman, 2012)

▶ Speaker. Imagine you are talking to someone and want to refer to the middle object. Would you say “blue” or “circle”?
Rational Speech Acts Model

Reference games (Wittgenstein, 1953; Frank and Goodman, 2012)

- Speaker. Imagine you are talking to someone and want to refer to the middle object. Would you say “blue” or “circle”?
- Listener. Someone uses the word “blue” to refer to one of these objects. Which object are they talking about?
Rational Speech Acts Model

Literal listener \((l_0)\)

\[ P_{l_0}(s \mid u) \propto P(s)[u](s) \]

- \(P(s)\): the prior over states
- \([u](s)\): a mapping from states of the world to truth values
Rational Speech Acts Model

Literal listener \((l_0)\)

\[
P_{l_0}(s \mid u) \propto P(s)[u](s)
\]

- \(P(s)\): the prior over states
- \([u](s)\): a mapping from states of the world to truth values

\[
\forall s, P(s) = 1/3
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Rational Speech Acts Model

Literal listener \((l_0)\)

\[ P_{l_0}(s | u) \propto P(s)[u](s) \]

Pragmatic speaker \((s_1)\)

\[ P_{s_1}(u | s, C) \propto U_{s_1}(u; s) \]

One way is to set the utility function to

More generally, we can incorporate message costs:

\[ P_{s_1}(u | s, C) \propto \exp(\alpha(\log P_{l_0}(s | u) - \text{cost}(u))) \]
Rational Speech Acts Model

Literal listener ($l_0$)

$$P_{l_0}(s \mid u) \propto P(s)[u](s)$$

Pragmatic speaker ($s_1$)

$$P_{s_1}(u \mid s, C) \propto U_{s_1}(u; s)$$

- One way is to set the utility function to $P_{l_0}(s \mid u)$:

$$P_{s_1}(u \mid s, C) \propto P_{l_0}(s \mid u) = \exp(\log P_{l_0}(s \mid u))$$
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- More generally, we can incorporate message costs:

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Pragmatic speaker \((s_1)\)

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P_{s_1}(u \mid s, C) \propto \exp(\alpha(\log P_{l_0}(s \mid u) - \text{cost}(u)))
\]

\[
\alpha = 1
\]

\[
\text{cost}(u) = \begin{cases} 
0, & u \in \{\text{blue, green, circle, square}\} \\
\infty, & \text{otherwise}
\end{cases}
\]

\[
\begin{array}{cccc}
\text{blue} & \text{green} & \text{square} & \text{circle} \\
0.5 & 0 & 0.5 & 0 \\
0.33 & 0 & 0 & 0.67 \\
0 & 0.67 & 0.33 & 0
\end{array}
\]
Rational Speech Acts Model

Literal listener ($l_0$)

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Pragmatic listener \( (l_1) \)

\[
P_{l_1}(s \mid u) \propto P(s)P_{s_1}(u \mid s)
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Rational Speech Acts Model

Literal listener \((l_0)\): utterance meaning \(\times\) state prior
Pragmatic speaker \((s_1)\): literal listener - utterance costs
Pragmatic listener \((l_1)\): pragmatic speaker \(\times\) state prior
Rational Speech Acts Model

Literal speaker ($s_0$): utterance meaning - utterance costs
Pragmatic listener ($l_1$): literal speaker $\times$ state prior
Pragmatic speaker ($s_1$): pragmatic listener - utterance costs
Experiments

Rational speech acts model is a powerful tool for understanding the pragmatic meaning of language.
Rational speech acts model is a powerful tool for understanding the pragmatic meaning of language.
Extensions and critiques

- Learning based approach by featurizing utterances and states (Monroe and Potts, 2015)
- Neural rational speech acts model (Monroe et al., 2017)
Extensions and critiques

- Learning based approach by featurizing utterances and states (Monroe and Potts, 2015)
- Neural rational speech acts model (Monroe et al., 2017)
- Exceptions: sarcasm, irony, hedging, etc
- Cultural differences
Summary

- Wording matters; we can learn useful insights from social interaction data available nowadays
- Modeling conversations by categorizing speech acts
- Rational speech acts model can achieve pragmatics understanding
Questions?
https://chenhaot.com
chenhao@chenhaot.com
References


