



Computational linguistics and human-agent interactions

Toward socially believable agents

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LTCl, Telecom-ParisTech

Introduction

Telecom-ParisTech, Social Computing Topic

Social Computing research topics

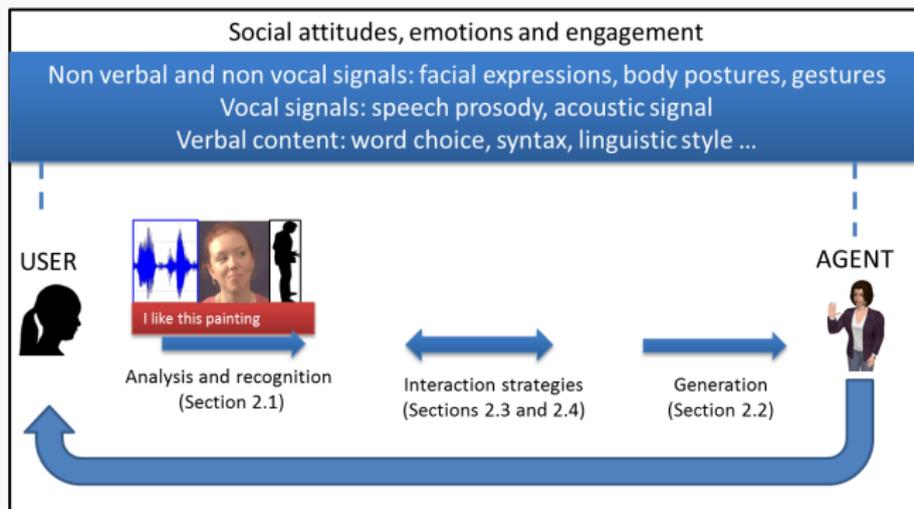
- Social web analysis
- Multimodal social signal processing
- Human-agent interaction

European and national projects of the team

- Chaire Machine Learning for Big Data
- Labex SMART
- National and European projects : H2020 Aria-Valuspa, ANR JCJC MAOI
- Research Training Network Animatas

Human-agent subtopic

in a close collaboration with ISIR : the greta team ¹



¹<http://www.tsi.telecom-paristech.fr/mm/en/themes-2/greta-team/>

Human-agent/robot interaction : applications

Personalized virtual assistant



Social Robotics



Outline of the talk

Computational linguistics for human-agent interactions

1. Introduction
2. Opinion analysis in H-A interactions
3. Verbal alignment in human-agent interactions
4. Conclusion

Opinion analysis in H-A interactions

Challenges



Clavel, C.; Callejas, Z., *Sentiment analysis: from opinion mining to human-agent interaction*, IEEE Transactions on Affective Computing,(2016)

Challenges



Features of human-agent interaction

- User's expression of opinion depends on agent's utterance
- the agent has its own social strategy
 - ↳ delimit relevant opinions according to agent's social goals

Related work

Related work

Non verbal cues analysis (facial expressions, prosody, ...) [Schuller et al., 2011]

First sentiment analysis modules integrated in human-agent interactions
[Smith et al., 2011, Pulman et al., 2010]

↪ use of an *off-the-shelf module* [Moilanen and Pulman, 2007] not designed for human-agent interaction

Clavel, C.; Callejas, Z., *Sentiment analysis: from opinion mining to human-agent interaction*, IEEE Transactions on Affective Computing, (2016)

Knowledge-based approach

[Langlet and Clavel, 2015] knowledge-based approach to model opinions

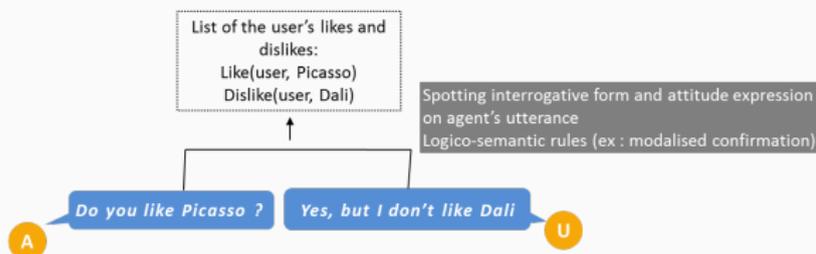
↪ opinions as defined by the appraisal theory [Martin and White, 2005] derived from functional systemic linguistics

C. Langlet and C. Clavel, *Improving social relationships in face-to-face human-agent interactions: when the agent wants to know users likes and dislikes* , in ACL 2015

Knowledge-based approach

Bottom-up approach based on three levels

- Patterns and rules to spot attitude expression in **the user's utterance**
- Patterns and rules to integrate **the adjacency pair** (agent utterance, user utterance)



C. Langlet and C. Clavel, *Improving social relationships in face-to-face human-agent interactions: when the agent wants to know users likes and dislikes*, in ACL 2015

Knowledge-based methods for opinion analysis in human-agent interactions

Bottom-up approach based on three levels

- Patterns and rules using **topic structure**
 - ↪ to help the modelling of the potential opinion target
 - ↪ to link the opinion target to the topic, ex: *I like it*

Caroline Langlet, Chloe Clavel, *Grounding the detection of the users likes and dislikes on the topic structure of human-agent interactions*, Knowledge-Based Systems (2016)

Machine learning/Deep learning vs. knowledge-based

ML advantage

- few linguistic expertise is required to build the model from the annotated data,

Machine learning/Deep learning vs. knowledge-based

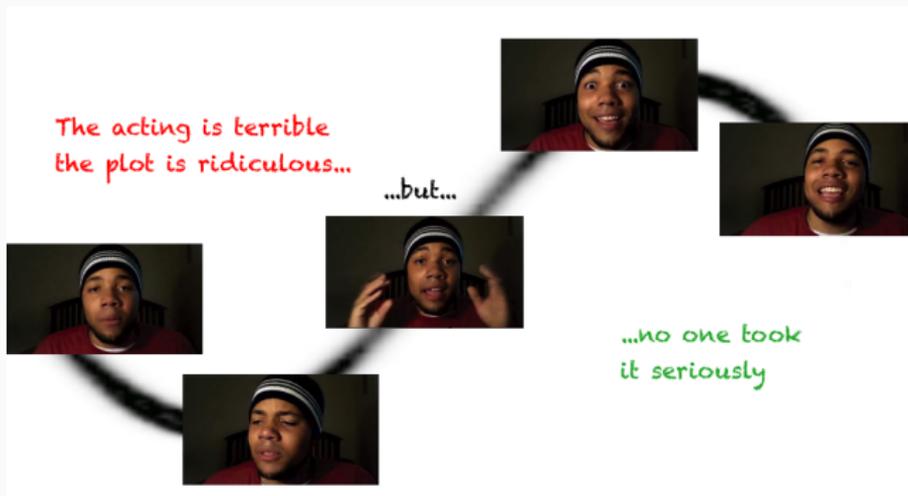
ML advantage

- few linguistic expertise is required to build the model from the annotated data,

ML drawback

- require a labelled dataset (big dataset for deep learning approaches) while annotating data in opinions is a difficult task

Machine learning for opinion dynamics modelling



Example of study

Model dynamics of movie review by using HCRF (Hidden Conditional Random Field) a latent state model interpretable and efficient with a small dataset

Barriere, V., Clavel, C., Essid, E., Opinion Dynamics Modeling for Movie Review Transcripts Classification with Hidden Conditional Random Fields, Interspeech 2017

Verbal alignment in human-agent interactions

Implementation of verbal alignment strategies in H-A

Challenge : foster user engagement (Poggi, 2007)

- Work on alignment phenomenon (Pickering and Garrod): the convergence of two participants;
- Work on verbal content and on other-repetitions [Svennevig, 2004]

37 - Obadiah: "Life is hard **sometimes**.

38 - User: "(Nods). **Life** can suck **sometimes**. I agree."

Clavel, C., Cafaro, A., Campano, S., & Pelachaud, C. (2016). Fostering user engagement in face-to-face human-agent interactions: a survey. In *Toward Robotic Socially Believable Behaving Systems*. Springer International Publishing.

Agent's verbal alignment on user appreciations relying on

- a module for the planification of appreciation task
- generation patterns of agent's verbal content

S. Campano, C. Clavel, C. Pelachaud, *I like this painting too : when an ECA shares appreciations to engage users*, in AAMAS 2015

Measures of verbal alignment in interactions

Motivations

- build a measure of the *social glue* during human-agent interaction ...
- ... as a parameter of socio-emotional interaction strategies

Dubuisson Duplessis, G.; Clavel, C.; Landragin, F., *Automatic Measures to Characterise Verbal Alignment in Human-Agent Interaction*, 18th Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL), 2017

Code available at <https://github.com/GuillaumeDD/dialign>

Measures of verbal alignment in interactions

Automatic building of the shared expression lexicon

Applying sequential pattern mining [Mooney and Roddick, 2013] on text pattern extraction (inspired from [Dubuisson Duplessis et al., 2017])

A ₁	well, that's an interesting idea. but no, <u>that's not gonna work for me.</u>
B ₂	what will <u>work for</u> you?
A ₃	what do <u>you</u> think about <u>me</u> getting two chairs and one plate and <u>you</u> getting one chair, one plate, and the clock?
B ₄	<u>that's not gonna work for me</u>



Shared Expr. Lexicon
<u>that's not gonna work for me</u>
<u>work for</u>
<u>me</u>
<u>what</u>
<u>you</u>

Dubuisson Duplessis, G.; Clavel, C.; Landragin, F., *Automatic Measures to Characterise Verbal Alignment in Human-Agent Interaction*, 18th Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL), 2017

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Measures of verbal alignment in interactions

Measures derived from the built shared Expression Lexicon

Example : the proportion of shared expressions initiated by locutor S

Dubuisson Duplessis, G.; Clavel, C.; Landragin, F., *Automatic Measures to Characterise Verbal Alignment in Human-Agent Interaction*, 18th Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL), 2017

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Conclusion

Computational linguistics and Social computing in human-agent interactions

What we've done...

- detecting user's likes and dislikes
- measuring and implementing verbal alignment

Lessons learnt

- pluridisciplinarity is crucial (psychology, functional linguistics, social science, machine learning, knowledge reasoning)
- knowledge-based methods are required to lay the foundations of new scientific issues of social computing
- machine learning/deep learning methods are great as soon as you get big reliable dataset labelled into socio-emotional phenomena (which is a big challenge !)

Other topics in the team

Human-robot interaction database for user engagement studies

Atef Ben Youssef, Miriam Bilac, Slim Essid, Chlo Clavel, Angelica Lim, Marine Chamoux, UE-HRI: A New Dataset for the Study of User Engagement in Spontaneous Human-Robot Interactions In Proceedings of ACM International Conference on Multimodal Interaction, Glasgow, Scotland, November 2017 (ICMI17)

Generation of socio-emotional behavior

Towards the Generation of Expressive Co-Speech Gestures - Brian Ravenet, Chlo Clavel and Catherine Pelachaud, VSI Workshop
Janssoone, T., Clavel, C., Bailly, K. and Richard, G. *Using temporal association rules for the synthesis of embodied conversational agents with a specific stance*. IVA 2016

Introduction

Opinion analysis in H-A interactions

Verbal alignment in human-agent interactions

Conclusion

Questions?



Clavel, C., Adda, G., Cailliau, F., Garnier-Rizet, M., Cavet, A., Chapuis, G., Courcinous, S., Danesi, C., Daquo, A.-L., Deldossi, M., Guillemin-Lanne, S., Seizou, M., and Suignard, P. (2013).

Spontaneous speech and opinion detection: mining call-centre transcripts.
Language Resources and Evaluation.



Dubuisson Duplessis, G., Charras, F., Letard, V., Ligozat, A.-L., and Rosset, S. (2017).

Utterance Retrieval based on Recurrent Surface Text Patterns.
In 39th European Conference on Information Retrieval (ECIR), pages 199–211, Aberdeen, United Kingdom.



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Speech Communication.



Smith, C., Crook, N., Dobnik, S., and Charlton, D. (2011).
Interaction strategies for an affective conversational agent.
In *Presence: Teleoperators and Virtual Environments*, volume 20, pages 395–411.
MIT Press.



Svennevig, J. (2004).

Other-repetition as display of hearing, understanding and emotional stance.

Discourse studies, 6(4):489–516.