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ABSTRACT

Over the last decade, the study of group behavior for multimodal interaction technologies has increased. However, we believe that despite its potential benefits on society, there could be more activity in this area. The aim of this workshop is create a forum for more interdisciplinary dialogue on this topic to enable the acceleration of growth. The workshop has been very successful in attracting submissions addressing important facets in the context of technologies for analyzing and aiding groups. This paper provides a summary of the activities of the workshop and the accepted papers.

KEYWORDS

group interaction, natural language processing, computational social science, social signal processing, conversation analysis, meeting science, social network analysis

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1 WORKSHOP GOALS

Analysis of group interaction and team dynamics is an important topic in a wide variety of fields, owing to the amount of time that individuals typically spend in small groups for both professional and personal purposes, and given how crucial group cohesion and productivity are to the success of businesses and other organizations. This fact is attested by the rapid growth of fields such as People Analytics and Human Resource Analytics, which in turn have grown out of many decades of research in social psychology, organizational behaviour, computing, and network science, amongst other fields.

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While there are many people working on small group interaction and team dynamics in numerous different disciplines, it is still easy to miss highly relevant work taking place in a researcher's own field. One of the key challenges the research community currently faces is how to bridge the gap between work that focuses on behavioral studies and work that performs large scale corpus analyses. Although there has been a push towards using larger data sets, the way to move from smaller scale behavioral experiments is not obvious, especially when dealing with data collected 'in the wild'. Similarly, we would like to explore ways in which labeled data collected by the group research community could be used to develop more robust multi-modal technologies. Thus, one important goal for this workshop was to increase inter-disciplinary networking and collaboration. In particular, we aimed to identify important tasks and useful resources to help develop common purposes and cohesion in the wider research community.

GIFT 2018 brings together researchers from diverse fields related to group interaction, team dynamics, people analytics, multi-modal speech and language processing, social psychology, and organizational behaviour. This workshop builds on the Workshop on Interdisciplinary Insights into Group and Team Dynamics held at the Lorentz Centre in the Netherlands in 2016, and the resulting 2017 special issue on the topic in *Small Group Research* [9].

2 WORKSHOP CONTENT

2.1 Summary of the Accepted Papers

Ten papers were accepted for presentation at the workshop. These cover a broad range of topics related to group interaction including (i) the analysis of nonverbal behavior in groups, (ii) methods addressing how to combine verbal and nonverbal behavior analysis, and (iii) analyzing and influencing group dynamics.

Analyzing Nonverbal Behavior:

Tan et al. [14] describe a novel approach for improving upon head and body pose estimates in crowded mingle scenarios using matrix completion. In crowded social events such as mingling scenarios, conversational groups form, split, and merge at will so estimating head and body pose is a crucial first step for small group conversation analysis. The initial idea of using matrix completion to jointly estimate both head and body pose from video was presented by Alameda-Pineda et al. [1]. Tan et al. improve upon this model by modifying the linear assumption of a temporal consistency constraint using Gaussian Process Regression. Their approach shows

considerable improvement in performance. Their results suggest that this extension to the matrix completion solution of Alameda-Pineda's work also relaxes the constraint for the head and body orientation to be the same, which provides a more realistic representation of head and body behavior in group conversations.

During group interactions, the pace of the conversation can vary greatly. The initial idea of the "hot spot" in meetings was investigated with the ICSI meeting recorder corpus by Wrede and Shriberg [15]. In this workshop, Miller [10] proposes a method to automatically find parallel episodes of speech in a similar spirit. The idea of parallel episodes came from Patnaik et al. [13] who applied the idea of frequent episode discovery to mine neural network activity from spike data. Miller defines parallel episodes in meeting interactions to be any moment when speaking turns of multiple participants partially overlap. The author applies this representation to reference annotations of speaking status from meetings in the AMI corpus [5]. From this method, when, who, and the duration of the parallel episodes can be identified for further scrutiny of the structure of the meeting data.

Celepkolu and Boyer [6] analyze the relationship between task roles in pair programming exercises using eye-tracking. They find that participants in different roles varied in how much they looked at locations that were not associated with the task. They also find that participants in the driver role obtained better post-test scores when they spent more time looking at exercise instructions and notes, while the effect of looking at the programming screen was negative. This indicates that gaze can be used to understand how participants use resources differently in group interaction, and how this relates to task success.

Combining Verbal and Nonverbal Behavior:

Non-verbal aspects of communication are clearly an important aspect of group interaction. However, a number of studies in this workshop highlight the usefulness of including the verbal (i.e. linguistic or lexical) features in multi-modal approaches analyzing of group discussions. Murray and Lai [11] use machine learning methods to understand how group attitudes are reflected by different aspects of spoken content. Their experiments on the AMI corpus [5] meetings show that including verbal linguistic features can improve predictions of group satisfaction with meeting direction in conjunction with other acoustic feature, even though linguistic features yield poor performance by themselves.

The work in Huang et al. [8] also highlights the potential of incorporating linguistic features into automatic group analysis. This work analyzes the relationship between functional roles and and communication skills in an annotated corpus of Japanese group discussion. Results of experiments in automatic classification of roles found linguistic features to be most predictive, although again including prosodic, turn timing, and face direction features provided the best results overall.

Nihei et al. [12] use verbal and non-verbal features to perform extractive summarization of group discussion in the MATRICS corpus. This work employs Convolutional Neural Networks to identify important points in the discussion using low-level features including head motion and pose, speech spectrogram and intensity, head pose, and word embeddings. Once again, they find that the model that integrates both verbal and non-verbal features performed the best, and that verbal and non-verbal models are somewhat complementary.

Analyzing or Influencing Group Dynamics:

Hoey et al. [7] describe a theoretically informed way of using computational simulation for analyzing large amounts of social media data. Using the *BayesAct* model of task-oriented group interaction, which generalizes the affective control theory model, they present affect control theory-based simulations exhibiting different power dynamics in groups. The intention is to compare simulated dynamics to observed group dynamics on the collaborative online software development platform GitHub. The authors illustrate how to use psychologically grounded agent-based modeling to explain dynamical patterns of behaviour observed in such groups. Their demonstration and results will help scholars study and understand how social forces shape group outputs, including implicit biases and group members relations, and how these outputs then translate into products that affect the wider social structure.

Andrei and Murray [3] show how formal methods can be used to explore temporal aspects of social interactions, which are modeled in terms of Markov processes. In this work, states are induced from manual annotations of the AMI meeting corpus [5]: utterances are associated with states capturing participant role, dialogue act, sentiment, presence of a decision or action item. The authors use probabilistic computation tree logic to derive the probability of an event occurring given discrete-time Markov model. This is used to quantify, for example, the expected time until a decision is made, given specific role and sentiment observations.

Anderson et al. [2] present Kid Space, a perspective for conceptualizing new smart spaces for children, and a prototype under development. This prototype is enabled by an innovative, centralized projection device that senses multimodal interactivity and intelligently projects augmented reality (AR) content across surfaces. Kid Space uses a visible agent to guide learning through play. Two preliminary studies evaluated Kid Space with a group of children 5 to 8 years old. Study 1 showed that children engaged enthusiastically with the projected character during a math exercise and during physically active games (e.g., engaged in conversations and responded to the character's suggestions). Questionnaire data demonstrates that parents valued Kid Space for learning and physical activity. Study 2 found that children engaged with a projected agent at a closer distance than with a television. Parents showed a preference for a projected AR agent over an agent on a television or a standard projection, whereas children preferred the agent on television. Parents also showed a preference for an agent that demonstrated awareness of children's physicality in the space, whereas children had no preference. Overall, parents expressed a clear presence for the AR condition.

Finally, Braley and Murray [4] describe a group interaction corpus that has been collected and is being made publicly available. It is based on a winter survival scenario, with item ranking tasks that are performed at both the individual and group levels. The corpus has been collected with a particular focus on decision-making processes, and contains annotations for decision proposals, agreement, disagreement, and confirmation. It is also annotated for positive and negative sentiment. This Group Affect and Performance (GAP) Corpus will include manual transcripts and audio recordings.

2.2 Keynote Speakers

In addition to the submitted papers, we also invited three keynote speakers:

- Sidney D'Mello (University of Colorado, Boulder)
- Steve Kozlowski (Pennsylvania State University)
- Mary J. Waller (Texas Christian University)

These researchers were selected to bring perspectives from both fields within the ICMI commmunity (Sidney D'Mello) as well as from the group research community (Mary J. Waller and Stephen Kozlowski).

3 WORKSHOP ORGANISATION

3.1 Review Process

Invited program committee members represented a broad spectrum of expertise. They were invited to bid on papers from which a random assignment was made. Each paper received at least 2 reviews. Selection of accepted paperswas based on whether there was sufficient merit of the work judged by at least one of the reviewers. The accepted papers were then subdivided for oral or poster presentation based on relevance to the workshop topic and reviewer ratings.

3.2 Organising Committee

- Gabriel Murray, University of the Fraser Valley (Chair)
- Hayley Hung, Delft University of Technology
- Joann Keyton, North Carolina State University
- Catherine Lai, University of Edinburgh
- Nale Lehmann-Willenbrock, University of Hamburg
- Catharine Oertel, École Polytechnique Fédérale de Lausanne

3.3 Program Committee

- Oya Aran
- Mckenzie Braley
- Laura Cabrera-Quirós
- Giuseppe Carenini
- Daniel Gatica-Perez
- Dinesh Babu Jayagopi
- Lesley Jessiman
- David Johnson
- Shafiq Joty
- Thomas Kleinbauer
- Dimosthenis Kontogiorgos
- José David Lopes
- Yoichi Matsuyama
- Chreston Miller
- Skanda Muralidhar
- Jennifer Olsen
- Chirag Raman
- Steve Renals
- Dairazalia Sanchez Cortes
- Tanmay Sinha
- Gualtiero Volpe

4 CONCLUSIONS

Overall, we are pleased with the diversity of work presented at this workshop. The majority of the works presented are very much aligned with the goals of the workshop. This provides plenty of scope to discuss interdisciplinary perspectives on the work and collaborate further. We strongly believe that a more interdisciplinary perspective will be extremely benefitial in increasing the impact of research on technologies for the understanding and influence of group behavior.

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