Supporting the Development of Team-Climate-Aware Collaborative Web Applications

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Abstract. Collaborative web applications are widely used in enterprises to support work in virtual teams. Here, monitoring mood is essential for team managers to intervene and restore optimal working conditions to ensure work success. To retrieve mood information from natural language communication, sentiment analysis techniques are necessary. This, however, requires expertise and is time-consuming if done individually for each web application. In this paper, we present TCAS which supports developers of collaborative web applications to leverage sentiment analysis for team climate assessment.

Keywords: Team climate assessment · Sentiment analysis · Collaboration

1 Introduction

Collaborative web applications for project, case or content management and enterprise social networks like Jive, Yammer and Salesforce Chatter are used in enterprises to support work in virtual teams. These teams are locally and temporally decoupled and formed to accomplish a common objective. Employees can work on a multiplicity of work items in different virtual teams. This leads to team managers having to oversee many different teams with distributed members.

Here, monitoring team climate is an important challenge as team climate, individual mood and job satisfaction are associated with each other. In this context, team climate is a combination of a team's level of activity and its sentiment state.

Team sentiment – the mood of the whole team, as expressed and perceived between team members – and the mood of the individual member are interlinked. [4] An employee's mood is an indicator of job satisfaction. [3] The team climate is an important factor for companies' productivity [4] and reputation and influences staff fluctuation. [8] In agile teams, happiness at work is even stated as essential for an organization's success and fostering creativity [7]. Monitoring team climate is therefore essential for team managers to intervene to avoid crises, restore optimal working conditions and ensure work success.

Manual observation of team climate is hardly feasible due to high team count, distributed members and high amount of text-based communication. To automatically retrieve mood information from natural language communication,

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sentiment analysis techniques are necessary. Their application requires expertise applying suitable algorithms, determining parameters, combining results etc. Developing this functionality individually for each web application is time-consuming. Therefore, we propose a framework which supports developers of collaborative web applications to leverage sentiment analysis for team climate assessment. Section 2 introduces the Team Climate Assessment Service (TCAS), Section 3 discusses related work and Section 4 concludes the paper.

2 TCAS: Team Climate Assessment Service

Virtual teams are organized in different ways, e.g. in projects, cases, streams. They provide different types of information for team climate assessment, in particular communication and events. Communication is represented by messages between team members. Events, e.g. completion of a work task, occur at a certain point in time. Messages can be considered a specific event. We use JSON Activity Streams[1] as common format. Existing communication and events data can easily be mapped to this web standard format or is already available as activity streams.

For this demonstration, we describe TCAS applied to the project management domain as shown in Figure 1. 1) The project management system represents its projects as Activity Streams and invokes the TCAS. 2) Two components process the input: The activity analyzer utilizes event timestamps to determine the level of activity in the project. The mood analyzer applies sentiment analysis techniques to retrieve mood information from messages. 3) Results are mapped to the state model. It has two dimensions: activity (inactive, low, high) and mood (negative, neutral, positive). 4) A filtered list of relevant projects is returned to the project management system. By default, all states with negative mood indication or inactive activity are considered relevant. Figure 2 shows highlighting of theses critical instances in the VSRCM[2] case management system.

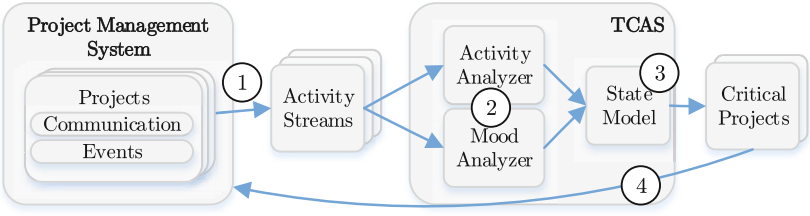

Fig. 1. Project Management Example of using TCAS

This allows team managers to intervene where either mood is poor or possible stagnation occurs. TCAS is customizable by developers. They can define

[1] http://tools.ietf.org/html/draft-snell-activitystreams
[2] https://vsr.informatik.tu-chemnitz.de/demos/vsrcm

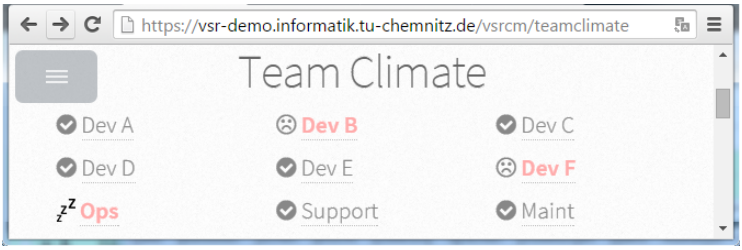

Fig. 2. Critical cases highlighting using TCAS in VSRCM

thresholds for the state model dimensions and states considered relevant for filtering. The state model allows for easy extension: additional (e.g. domain-specific) analyzers can be added and incorporated as dimensions.

TCAS is implemented in C# as web service with REST API. Analyzers are run in parallel. The default mood analyzer filters activity streams for communication items using verbs post or create with object types note or message. The object's content value is the message text. Activity Streams allow arbitrary encoding of messages. Hence the filter is configurable, defaults as described above.

The analysis step is implemented as MapReduce algorithm. The map function applies sentiment analysis to each activity, the reduce function combines results taking into account the message age. More recent messages have a greater impact. To conduct sentiment analysis, different algorithms can be used as plugins. As a default, the Free Natural Language Processing Service[3] is used.

With TCAS focusing on reuse, developers of various types of collaborative web applications can leverage team climate assessment in their domain. Integration is addressed by employing JSON Activity Streams as common input format. For extensibility, parallel filters and the state model abstraction is provided.

Demonstration: For a screencast and further information, please visit https://vsr.informatik.tu-chemnitz.de/demos/vsrcm.

3 Related Work

Different services are available to extract sentiment information from natural language data like AlchemyAPI[4]. These services support development of sentiment-aware applications. In contrast, our approach allows to incorporate additional factors like team activity in order to evaluate the state of a virtual team: its team climate.

Sentiment analysis is also present in end user development. DashMash is a Web platform allowing end users to compose their analyses. [1] Our approach intends to support developers of arbitrary collaborative web applications.

Approaches like [6] use sentiment analysis to target market research by identifying the mood about products and brands expressed in the web. Others, like [5],

[3] http://www.mashape.com/loudelement/free-natural-language-processing-service
[4] http://www.alchemyapi.com/

enhance web search through sentiment information in order to improve users' access to the web. These approaches extract a crowd's sentiment about a given entity, while we evaluate general sentiment, i.e. mood, and level of activity of a given group.

Other approaches target communities or nations as a whole: [2] analyses tweets to obtain happiness values of the Twitter community. It constitutes the basis of a web service that correlates Twitter happiness with events.

Self-tracking systems provide measurement of team level happiness. They require employees to assess their happiness themselves. [7] So far an automated approach on team level is lacking, especially for team climate assessment.

4 Conclusion

In this paper we motivated team climate assessment for collaborative web applications. While specific applications of sentiment analysis exist in related work, we propose a development framework implemented as web service. To support developers, activity streams are used as common input format, a configurable set of analyzers is applied and the result is mapped into an extensible state model. We demonstrated the application of TCAS in a project management system.

In future work, feedback mechanisms need to be investigated. This way, the team climate assessment can be improved by learning and adaption to specific environments. In addition to activity levels, we plan to incorporate the dynamics of activity (e.g. increasing, decreasing, constant) in the state model. While this demonstration features a batch-processing model, continuous stream processing for reactive team climate detection requires further investigation.

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