

## Chapter 65

# A Linguistic Approach to Identify the Affective Dimension Expressed in Textual Messages

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### ABSTRACT

*The digital mediation resources used in Distance Education can hinder the teacher's perception about the student's state of mind. However, the textual expression in natural language is widely encouraged in most Distance Education courses, through the use of Virtual Learning Environments and other digital tools. This fact has motivated research efforts in order to identify feelings expressed by students in textual messages. A significant part of the known approaches in this area apply textual analysis without a deep linguistic representation, which can lead to some weakness in the results obtained. This paper reports an approach using theories of Computational Lexical Semantics for the representation of the lexicon of emotion. The methodology was developed through studies regarding corpus analysis, lexical unit description, and the implementation of a computational system to identify the feelings expressed in the textual messages in natural language, using the lexicon of emotion. This system was used in evaluation experiments that indicate improvements when comparing the adopted approach with other similar approaches.*

### INTRODUCTION

The dynamics of digital mediation used in Distance Education (DE) generates contexts that can drive to student isolation or little integration with colleagues. However, the use of subsidies gener-

ated in this digital mediation interaction process in Virtual Learning Environments (VLE) allows the creation of resources that can promote closer student-teacher relations. Some examples of these situations are the use of the students' textual production and their interaction data in order to

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generate profiles of these students that can help in the diagnosis of their difficulties and in the identification of subjectivity elements.

The aim of this paper is to describe and evaluate mechanisms to improve the identification of the students' emotional state, by identifying feelings and emotions expressed in textual messages by the students in the different tools available in a VLE. This is an objective described in some works as a possible way to foster the effectiveness and the quality of the interactions between teachers and students in DE (Bercht, 2001; Jaques & Vicari, 2005; Desmarais & Baker, 2012). Some studies on the relationship between emotion and memory indicate a positive relationship between the students' state of mind and cognitive activities like memorization and learning (Le Doux, 2001; Pergher et al., 2006).

Given the large and recent development and expansion of Distance Education, the analysis of students generated textual messages and the processing of the interaction data can contribute significantly to identify evidences about feelings or to report significant facts about the students learning process.

The automatic analysis of students' feelings based on their textual messages is the objective of several works. The methodologies and techniques adopted to reach this objective are very diverse. In some cases these works describe initiatives to identify pupils' emotional states based on the occurrence of specific textual terms in the students' natural language messages (Longhi, 2009; Azevedo, 2011; Edécio, 2011). In other cases, statistical tools or machine learning resources are applied to identify important textual elements and generate evidences and confirmation using the textual production (Macedo, 2009; Klemman, 2009; Oliveira et al., 2011). These initiatives demonstrated that the adopted approaches effectively promote the generation of resources to support some activities regarding the teacher's analysis of the state of mind of students. Nevertheless, the great diversity of writing styles observed in natu-

ral language messages present some challenges not yet fully met by these approaches, fostering therefore new research efforts.

In the present paper we describe the methodological choices and the results obtained from a linguistic representation approach dedicated to the analysis of emotions expressed in the textual messages in VLEs. This work is motivated by the possible improvements in the textual treatment of these messages considering linguistic elements. The textual treatment approaches without the support of linguistic elements present some errors in the identification of situations involving figures of speech, synonyms and different writing styles. One of the improvements obtained in the use of linguistic elements is related to the more precise identification of textual sentences in natural language.

The approach described in this paper is the result of an interdisciplinary research effort involving the integrated use of Computational Lexical Semantics and Natural Language Processing (NLP) resources. With respect to language analysis oriented tasks, we adopted the principles of Cognitive Linguistics as a theoretical basis for the description of the text corpus. Thereby, this corpus description is done with information such as lexical-conceptual relations and semantic frames. This organization of the lexicon integrates description of meaningful relations and frames, therefore making the representation capable to support the proposals of the WORDNET (Miller, 1995; Fellbaum, 1998) and FRAMENET (Fillmore, 2003), facilitating future studies regarding multi-domain and multi-language requisites. From the computational point of view, the main challenges were the design and validation of a software tool to support the identification and classification of subjective textual statements made by students in the VLEs.

The adopted methodology is based on linguistic knowledge, focusing in the analysis of the studied corpus, which consists of textual messages collected in disciplines in Distance Education.

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