# **Stress Analytics in Education**

Rafal Kocielnik, Mykola Pechenizkiy, Natalia Sidorova Department of Computer Science Eindhoven University of Technology P.O. Box 513, 5600 MB Eindhoven the Netherlands

{r.d.kocielnik, m.pechenizkiy, n.sidorova}@tue.nl

## ABSTRACT

During the years of college and university education students are exposed to different kinds of stress, especially during the difficult studying periods like final exams weeks or project deadlines. Stress on a long run is dangerous and can contribute to illness through its physiological effects or maladaptive health behaviors. Many students admit, or are self-aware, that they become stressed under different circumstances and have some clues about their potential stressor. Still, even for such students, the monitoring and awareness of stress are not systematic and based on subjective data, i.e. someone's feelings. In our work we aim at providing means to students to become aware of the past, current and expected (objectively measured) stress and its correlation with their performance, to understand their stressors, to cope with and prevent stress - thus, to live healthier and happier lives and better organize their studies.

#### 1. INTRODUCTION

Stress has become a serious problem affecting many people of different professions, life situations, and age groups. The workplace has changed dramatically due to globalization of the economy, use of new information and communications technologies, growing diversity in the workplace, and increased mental workload. In the 2000 European Working Conditions Survey (EWCS)<sup>1</sup>, work-related stress was found to be the second most common work-related health problem across the EU. Similar emphasize can be observed from the surveys in US. Although not studied thoroughly (yet), similar threats has been observed in education. According to a survey by fifteen university and college newspapers in the Netherlands<sup>2</sup> many students themselves confirm that they encounter serious stress in related to their studies. E.g. in Delft University of Technology, more than 450 students filled out the questionnaire and 52.9% of them said 'yes' to the question: "Have you ever experienced huge stress on your studies?". Moreover, stress might not even be observed as problematic by the persons themselves; high levels of stress are often perceived by people as a norm, a signal that they do their best to achieve their goals.

Stress can contribute to illness directly, through its physiological effects, or indirectly, through maladaptive health behaviors (smoking, poor eating habits, lack of sleep, etc.) [4]. It is important to motivate people to adjust their life style or start using appropriate stress coping strategies.

Being enrolled in a study program at a college or university students may encounter a number of challenges<sup>3</sup>. There is a continuous pressure (whether coming from parents, increasing competition on a job market, society in general, or other students) to perform well. Students regularly encounter difficult studying periods like final exams weeks or (group) project deadlines. Many students may experience financial insecurity, problems with communicating to other students, loneliness. Becoming independent, many students develop bad habits like smoking, drinking, taking drugs, Internet addiction, and gambling.

In general, there are a number of factors that are likely to cause stress for students including but not limited to long study hours, work overload, time pressure, difficult, demanding or complex tasks, high responsibility, lack of breaks, conflicts, lack of training, income insecurity, poor physical work conditions (limited space, inconvenient temperature, limited or inappropriate lighting conditions) as many of such factors have been found to be important in the analysis of stress at work [5].

The complete avoidance of stress in education is impossible. Still, if people are *informed of their stress levels*, they become empowered for taking some preemptive actions in order to alleviate stress.When educational organizations become aware of stress-related problems they figure out different ways to help students. It is becoming a more popular practice to promote healthier lifestyle to students, give advices regarding safety and security, eating well, anger management, dealing with emotional abuse or a culture shock, overcoming loneliness, and alike. However, still not that much is done to systematically monitor the levels of stress that students experience. In the current practice students often get help only when the problem becomes severe and may require psychological or medical help.

Appearance of modern sensor technologies does allow measure stress level based on objective physiological signals in non-lab settings, i.e. in a daily life. Our goal is to provide a *stress analytics* solution that would help students to monitor, understand and manage their stress thus preventing severe stress-related problems.

<sup>&</sup>lt;sup>1</sup>http://www.eurofound.europa.eu/pubdocs/2001/21/ en/1/ef0121en.pdf

<sup>&</sup>lt;sup>2</sup>http://web.tue.nl/cursor/internet/jaargang54/ cursor12/nieuws/index.php?page=x37

<sup>&</sup>lt;sup>3</sup>http://www.onlineeducation.net/resources/ stress-facing-students

## 2. APPROACH – STRESS ANALYTICS

In [1] we proposed the conceptual framework for managing stress at work. One very important step in the process of stress management is making the person aware of the past, current and expected stress. We automate the identification of the stress from sensor data and the common stressors from the other data sources and meta-data that a student is willing to provide to the system, including e.g. the schedule, calendar events and daily routing of the student, and personal correspondence in e-mail and social media.

Figure 1 illustrates the main objective of the stress analytics - to provide an overview of the stressors, allow to explore them interactively with OLAP style operations on the data cube and to enable access to the evidence, i.e. (annotated) physiological signals (Figure 2, top).



Figure 1: Interactive overview of stressors

To achieve this we measure stress-related physiological signs from the sensor data. Galvanic skin response (GSR) reflecting sweating is known to be highly correlated with the level of stress a person experiences [3]. In [2] we proposed an automated approach for the acute stress detection from GSR signal. We make stress and stressors visible by keeping track of the calendar events and daily routine of the worker (Figure 2, bottom), and relating these events with detected stress from the sensor data. We also enable automated analysis of additional information sources, such as sentiment classification of the incoming and outgoing e-mails or social media messages<sup>4</sup> and explicit user feedback. Besides being an awareness tool, stress analytics supports data mining on the already aligned data. By discovering relationships between event data and stress occurrences we can further help a student to focus on the most important patterns observed in the past and cast predictions regarding the foreseeing stressful events in her agenda.



Figure 2: Stress levels: Monday (top) and the week (bottom)

# 3. ONGOING WORK

Our current efforts are focused on two kinds of tasks. From the technology perspective we develop the infrastructure for stress-related data management and processing. This include raw and preprocessed multi-modal data storage and indexing, data schema for efficient data cube operations, data mining techniques supporting feature extraction, stress detection, pattern mining, classification and prediction, and visual interactive data exploration. From the domain perspective we perform different case studies, collecting subjective and measuring objective stress before, during and after the group project presentations, partial exams as online multiple choice tests and regular written and oral examinations.

#### 4. REFERENCES

- J. Bakker, L. Holenderski, R. Kocielnik, M. Pechenizkiy, and N. Sidorova. Stress@work: From measuring stress to its understanding, prediction and handling with personalized coaching. In 2nd ACM IHI 2012, pages 673–678.
- [2] J. Bakker, M. Pechenizkiy, and N. Sidorova. What's your current stress level? Detection of stress patterns from GSR sensor data. In *IEEE ICDM 2011 Workshops*, pages 1247–1250.
- [3] W. Boucsein. *Electrodermal activity*. New York and London: Plenum Press, 1992.
- [4] K. Glanz and M. Schwartz. Stress, coping, and health behavior. *Health behavior and health education: Theory,* research, and practice, pages 211–236, 2008.
- [5] S. Michie. Causes and management of stress at work. Occupational and Environmental Medicine, 59(1):67, 2002.

<sup>&</sup>lt;sup>4</sup>www.win.tue.nl/~mpechen/projects/senticorr/