Automated Assessment of Pain

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ABSTRACT

Pain communication varies, with some patients being highly expressive regarding their pain and others exhibiting stoic forbearance and minimal verbal account of discomfort. Considerable progress has been made in defining behavioral indices of pain [1-3]. An abundant literature shows that a limited subset of facial movements, in several non-human species, encode pain intensity across the lifespan [2]. To advance reliable pain monitoring, automated assessment of pain is emerging as a powerful mean to realize that goal. Though progress has been made, this field remains in its infancy. The workshop aims to promote current research and support growth of interdisciplinary collaborations to advance this groundbreaking research.

CCS CONCEPTS

• **Applied computing**; • **Life and medical sciences; Health informatics**;; • **Human-centered computing**; • **User interface design; User models**;

KEYWORDS

Pain, Health Informatics, Human Centered Computing, Clinical Datasets, Automated Assessment

1 INTRODUCTION

Pain evaluation and management are complicated even in the most favorable circumstances [1-3]. The complication is amplified in situations in which the principal criterion on which inferences about it are made are unreliable or absent [1-3]. Growing interest in evaluating pain by assessment of non-verbal behavior has been driven by clinical concerns; in particular, the fact that large cohorts of people cannot report on their pain because of verbal communication deficits [1-3]. For instance, among neonates, young children, or patients with cognitive impairments. Consequently, there has been a similar interest within a variety of scientific communities (e.g., machine learning, computer vision, wearable and physiological sensing technology) for the development of automated measures of pain [1-6]. Commercial tools for pain assessment informed by the existing literature on automated assessment have also been developed and marketed [2, 9]. Though progress has been made, this field remains in its infancy. Effective advancement in automated assessment of pain needs repeated iterations between technical and clinical experts from the early stages of conceptualization of the technology until it's possible delivery to the clinical practice.

The workshop aims to bring together interdisciplinary researchers working in field of automated assessment of pain. A key focus of the workshop is the translation of laboratory work into clinical practice.

2 WORKSHOP CONTENT

After a double blind per review process, the third edition of the International Workshop on Automated Assessment of Pain (AAP) includes six presentations covering a range of topics in AAP. These include two per reviewed and accepted papers and four keynote presentations:

- *"Towards Automated Pain Assessment using Embodied Conversational Agents"* by Ricken et al. [7], presents a study that investigates the value of an embodied conversation agent for automated pain assessment. A Wizard of Oz system is used with 9 participants, and compared with a protocol where the system displays the reported pain intensity to the user at the end of the assessment interaction. Preliminary findings indicate that individuals are comfortable reporting their pain experiences to the agent, and are largely satisfied with this assessment methodology. They also find evidence that individuals prefer the conversational empathic summary to the standard self-report measures. The paper further presents an analysis of gestures used by users in narrating their pain experience, highlighting the richness of the information encapsulated in these gestures. These preliminary findings could inform the design of embodied conversational agents for enhanced patient experience during automated assessment of patients' outcomes in home settings.
- *"Pain Recognition Differences between Female and Male Subjects: An Analysis based on the Physiological Signals of the X-ITE Pain Database"* by Tobias et al. [8], investigates the differences in automatic pain detection performance between male and female participants as well as between second-level and minute-level pain stimuli. The work is based on a dataset captured from healthy people during experimentally-induced thermal and electric pain experiences and uses different modalities (unimodal and multimodal). Their findings suggest that accuracy for female pain threshold and tolerance levels were generally higher with the shorter-term thermal stimuli than the accuracy for male suggesting value in accounting for gender in the automated measurement of pain intensity.

In addition to the per reviewed and accepted papers described above, the workshop also invited four keynote speakers:

- Benedikt Schick - Clinic of Anesthesiology and Intensive Care Medicine, University Hospital Ulm, Germany.
- Claus Deissler, - KPUNKT Technologie Marketing GmbH, Stuttgart, Germany.
- Albert Ali Salah - Department of Information and Computing Science, Utrecht, Netherlands.
- Lola Cañamero - Paris-Seine INEX Chair Neuroscience and Robotics, France.

The speakers bring a unique and complementary perspective of future directions for research into automated assessment of pain that would address the conceptual and practical reasons for interest in automated assessment of pain.

ACKNOWLEDGMENTS

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