Facial Emotion Analysis in Down's syndrome children in classroom

Pablo Torres-Carrión
Universidad Técnica Particular de Loja
Ecuador
pvtorres@utpl.edu.ec

Carina González-González
Universidad de La Laguna
Spain
cjgonza@ull.edu.es

Alberto Mora Carreño
Universitat Operta de Catalunya
Spain
amoraca@uoc.edu

ABSTRACT
Sentiment analysis has allowed a degree of machines "intelligent" interaction, although its development is still at an early stage. This document presents the progress of the research project in this line, with a particular focus on children with Down Syndrome (DS). Their singularities are considered through personalized learning resources, and interaction with Kinect HCI, and the Tango:H platform. In this first moment we made an initial interaction, resulting in video images of the interaction, and a subjective assessment of emotions through one extension of EMODIANA. The next step will be the comparison of the patterns of facial recognition applied in people without SD, to identify whether there are significant differences.

Categories and Subject Descriptors
K.4.2. [**Computers and Society**]: Computing Milieux – Social Issues: *Assistive technologies for persons with disabilities.*

General Terms
Human Factors, Theory.

Keywords
Down Syndrome, Emotion, Affective Computing, AI, Digital Learning.

1. INTRODUCTION
http://dx.doi.org/10.1145/2829875.2829882The human person as a social entity, learn from inside the environment that develops and lives; it is necessary therefore to develop the skill of reading behaviors and emotions to infer the possible intentions [15]. In this context, the emotional intelligence as part of the multiple intelligences of Gardner [6], joins two types of intelligences: intrapersonal and interpersonal; that refer to how we know ourselves, the way in which we managed to control and regulate our feelings; the ability to understand others, what you feel and the skills to relate to others[7], respectively.

With the development of these intelligences, teachers and psychologists *comprehenden* (understand from inside) to each other and their environment (social field). Explicitly in the learning process, the student and teacher through educational activities can know, appreciate and share, generating one *compre-h-ensión integral* (comprehensive understanding), which is reflected in a significant learning [15].

Interacción '15, September 07-09, 2015, Vilanova i la Geltrú, Spain
ACM 978-1-4503-3463-1/15/09.
DOI: http://dx.doi.org/10.1145/2829875.2829882

The above applies to the entire student population, from initial training to top, without making a cognitive or mental age discrimination. Against this background, in this paper we focus on the people with DS, that within the population with Special Educational Needs (SEN), represent one of the largest and most vulnerable around the world [10]. The process of educational and social adaptation of this population requires an individual treatment, due to psychological, cognitive and kinesthetic abilities [1]. Scientific research about their characteristics and possibilities of performance in different areas of life: social, work and school, have expanded considerably in the last three decades [14] improving your quality of life standards.

People with DS usually have well-developed emotional intelligence, maintain good social interaction skills. They are communicative and respond well to the demands of the environment [2]. The emotions of the people seldom are expressed in words, so it is necessary to interpret them from non-verbal channels such as: the gestures, tone of voice and facial expression [7]. People with SD shows emotional sensitivity that allows them to capture emotions that others go unnoticed [2].

Each person's emotional state can be expressed in different ways; the facial expression is one of the most common ways to show others our feeling with respect to any act or thing [4]. In the case of persons with SD, we have to consider that certain facial characteristics distinguish them from the rest of population [3,9], therefore, studies and identification of emotions patterns based on face, may not extend and apply to this population in general.

2. ADVANCE RESEARCH
Research in the field of the SEN, and specifically in people with DS have increased over the last three decades [14]. However they have not been significant in the area of human-computer interaction (HCI) with affective computing (AC), and the consideration of emotions during interaction.

2.1 Metodology
The methodology that guides this research, is a continuous work qualitatively and quantitatively (see Table1). In the first time we plan doing the emotional assessment in environments of interaction in the classroom. This work was done with a sample of six children (3 male and 3 female) of the Down Tenerife Association, located in the autonomous community of Canary, Spain.

The pre-test phase included meetings with teachers to identify the population, for the experimental group and the control sample, keeping the equity in terms of motor and cognitive profiles. We organized an initial intervention, composed of three working sessions. The experimental group used the platform Tango:H and MS Kinect; the control group used conventional resources.

The first data were obtained from a subjective assessment by teachers, about the emotions displayed by the children during the

interaction; it was carried out according to the methodology of the EMODIANA [8] and their assessment scales. This instrument was adapted in a proprietary format, which allowed to measure continuously the 10 basic emotions, and their possible causes: subject, activity and external.

Fase	Tool	Actors
Pre-test	- Competency Test	- Testers - DS's people
Test	- EMODIANA - Rehabilitation platform (cognitive and physical) TANGO:H. - Record of videos	- Testers - Teachers - Physiotherapist - DS's children
Post-test	- Competency Test - EMODIANA - Observation Method (videos) - HER Tool (videos)	- Testers - DS's people

Table1. Methodology for the emotional assessment[13]

For a further analysis all sessions were recorded on video. These videos will undergo evaluation patterns, to contrast with results obtained by these tools in environments of interaction with non-SD. This contrast, in addition to the subjective assessment performed with the EMODIANA, will allow establish scientific findings about the possible differences between people with and without SD, in terms of patterns and AI algorithms on recognition of emotions previously validated.

The objective pursued is to customize in real time, both teaching resources such as teaching strategies, based on the cognitive, motor and emotional profile of the student with SD. We believe that learning will be more significant.

3. BRIEF REVIEW OF LITERATURE

3.1 HCI and *Affective Computing*

Every human relationship contains many and varied doses of affection, knowledge and interaction [15]. The literature about "affective" includes research and study areas, where relates: psychology, science of consciousness, neuroscience, engineering, computer science, sociology, philosophy, and medicine; from this epistemological context seeks to understand the feelings, such as: emotion, motivation, attention, memory, among others [11].

3.2 Emotions through the face and gestures

Research about emotion recognition are held mainly in facial expressions, intonation of voice and gestural traits [11]. In the corresponding face, muscle movements associated with sentimental or emotional situation have been related to patterns that relate basic emotions like raised them by Ekman: joy, surprise, disgust, anger, sadness and fear, along with a Neutral option [4]. These emotions can be extended up to levels of valuation of complex emotions, product of its combination and semantic reading of the sequence in which certain gestures are shown [12].

The recognition of *genuine* emotions [5] against those that occur in environments where the user poses specifically for an evaluation of the emotion, varies significantly. Therefore, it is necessary that these studies are carried out in the natural environment of interaction, avoiding as far as possible the variation of expressions by external agents [11].

In the TED-Woman 2015 event, the PhD. Rana el Kaliouby of the Affectiva company, presented the *Affdex SDK*, that allows the recognition of emotions in real time, supported in a study of approximately two million videos, coming from more than 75 countries. This is one of the reference works in the area. Additionally, there is the need to relate these algorithms in classrooms and in our case with children with SD.

4. REFERENCES

1. Amadó, A., Benejam, B., Mezuca, J., Serrat, E., and Vallès-Majoral, E.Socio-cognitive abilities in children with Down's syndrome: results of a preliminary study. *International Medical Review on Down Syndrome 16*, 3 (2012), 34–39.

2. Angulo A. Luna, M., M.G. and Prieto, I.*Manual de Atención al Alumnado con Necesidades Específicas de Apoyo Educativo Derivadas de Sindrome Down.* Junta de Andalucía, Sevilla, 2010.

3. Carvajal, F., Fernández-Alcaraz, C., Rueda, M., and Sarrión, L.Processing of facial expressions of emotions by adults with Down syndrome and moderate intellectual disability. *Research in developmental disabilities 33*, 3 (2012), 783–790.

4. Cerezo, E. and Hupont, I.Emotional Facial Expression Classification for Multimodal User Interfaces. In *Articulated Motion and Deformable Objects*. Springer Berlin Heidelberg, Berlin, Heidelberg, 2006, 405–413.

5. Dibeklioğlu, H., Salah, A.A., and Gevers, T.Recognition of Genuine Smiles. *IEEE Transactions on Multimedia 17*, 3 (2015), 279–294.

6. Gardner, H.*Estructuras de la mente: La teoría de las inteligencias múltiples.* Fondo de Cultura Económica, México, 2001.

7. Goleman, D.*Inteligencia emocional.* Kairo´s, Barcelona, 2011.

8. González-González, C.S., Cairós-González, M., and Navarro-Adelantado, V.EMODIANA: Un instrumento para la evaluación subjetiva de emociones en niños y niñas. *Actas del XIV Congreso Internacional de Interacción PersonaOrdenador*, (2013).

9. Hippolyte, L., Barisnikov, K., Van der Linden, M., and Detraux, J.-J.From facial emotional recognition abilities to emotional attribution: A study in Down syndrome. *Research in developmental disabilities 30*, 5 (2009), 1007–1022.

10. Hodapp, R.M. and Freeman, S.F.N.Advances in educational strategies for children with Down syndrome. *CURRENT OPINION IN PSYCHIATRY 16*, 5 (2003), 511–516.

11. Picard, R.W., Papert, S., Bender, W., et al.Affective learning - a manifesto. *BT Technology Journal 22*, 4 (2004), 253–268.

12. Tapia, S.A.A., Gomez, A.H.F., Corbacho, J.B., et al.A contribution to the method of automatic identification of human emotions by using semantic structures. *2014 International Conference on Interactive Collaborative Learning (ICL)*, IEEE (2014), 60–70.

13. Torres-Carrion, P., González-González, C.S., and Mora Carreño, A.Methodology of emotional evaluation in education and rehabilitation activities for people with Down syndrome. *XV International Conference on Human Computer Interaction*, (2014), 12–15.

14. Troncoso, M.V. and Flórez, J.Comprensión en la lectura de las personas con síndrome de Down. *Revista Síndrome de Down: Revista española de investigación e información sobre el Síndrome de Down*, 2011, 50–59.

15. De Zubiría, M.*Inteligencia Emocional.* Fundación Alberto Meraní para el Desarrollo de la Inteligencia, Bogotá, 1999.