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Facultad de Ingeniería
Escuela Profesional de Ingeniería en Informática y Sistemas

Proyecto Concytec Banco Mundial

CONGRESO INTERNACIONAL EN INFORMÁTICA Y SISTEMAS

KUSISQA: Ayudando a Regular Nuestras Emociones en los Procesos de Enseñanza y Aprendizaje

Dr (c). Wilber Ramos Lovón
Coordinador Técnico del proyecto

CIIS XXIII

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XXIII Congreso Internacional de Informática y Sistemas
Del 07 al 11 de noviembre de 2022
Tacna - Perú

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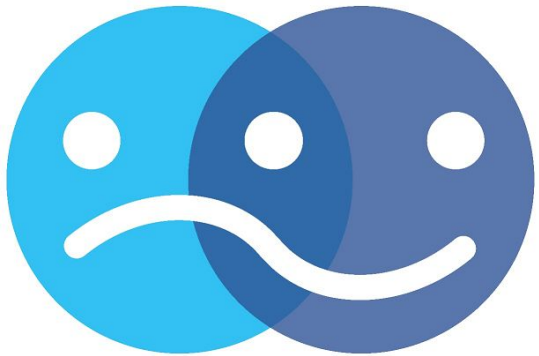

KUSISQA: Ayudando a Regular Nuestras Emociones en los Procesos de Enseñanza y Aprendizaje

Contrato N° 014-2019-FONDECYT-BM-INC.INV

Dr (c). Wilber Ramos Lovón
Coordinador Técnico del proyecto
Universidad Nacional de San Agustín de Arequipa
Escuela Profesional de Ciencia de la Computación

Noviembre de 2022

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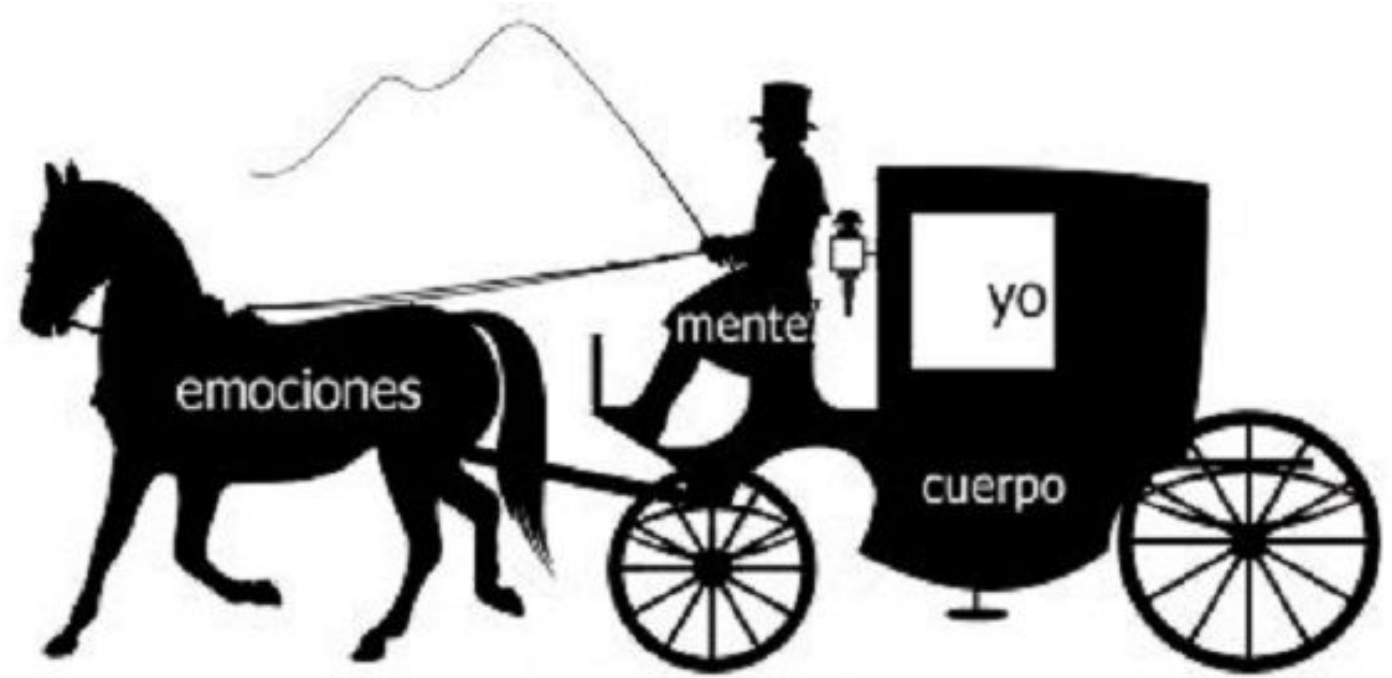
Las emociones humanas

Fuente: Gearstd/Shutterstock

La metáfora del carruaje



Fuente: Haiki

El **cuerpo** humano es el **carruaje**; el **yo**, el hombre que lo **conduce**; el **pensamiento** son las **riendas**, y los **sentimientos/emociones**, los **caballos**. *Platón*

Las emociones humanas en la toma de decisiones

Decisiones de índole personal

Decisiones de índole organizacional/corporativo

Medición de las emociones humanas

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Autoinforme

Cuestionario

Entrevista

Técnicas tradicionales

Medición de las emociones humanas

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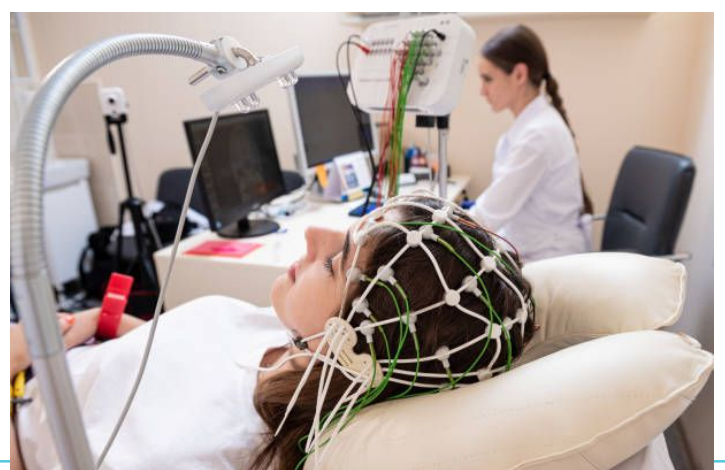
Técnicas tradicionales

Autoinforme

Cuestionario

Entrevista

Neuroimagen



Electroencefalograma

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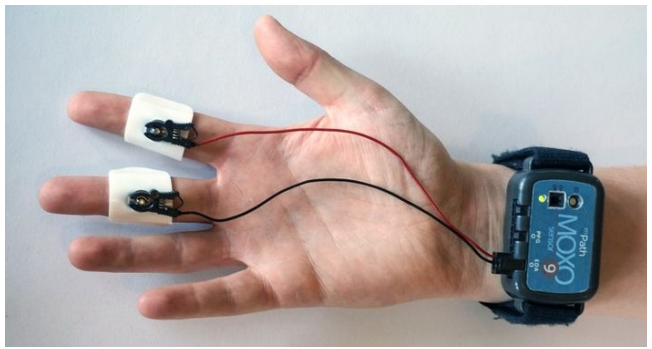
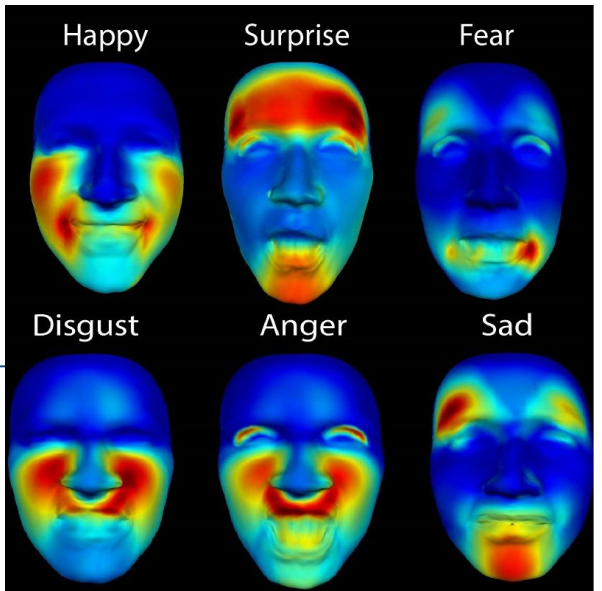
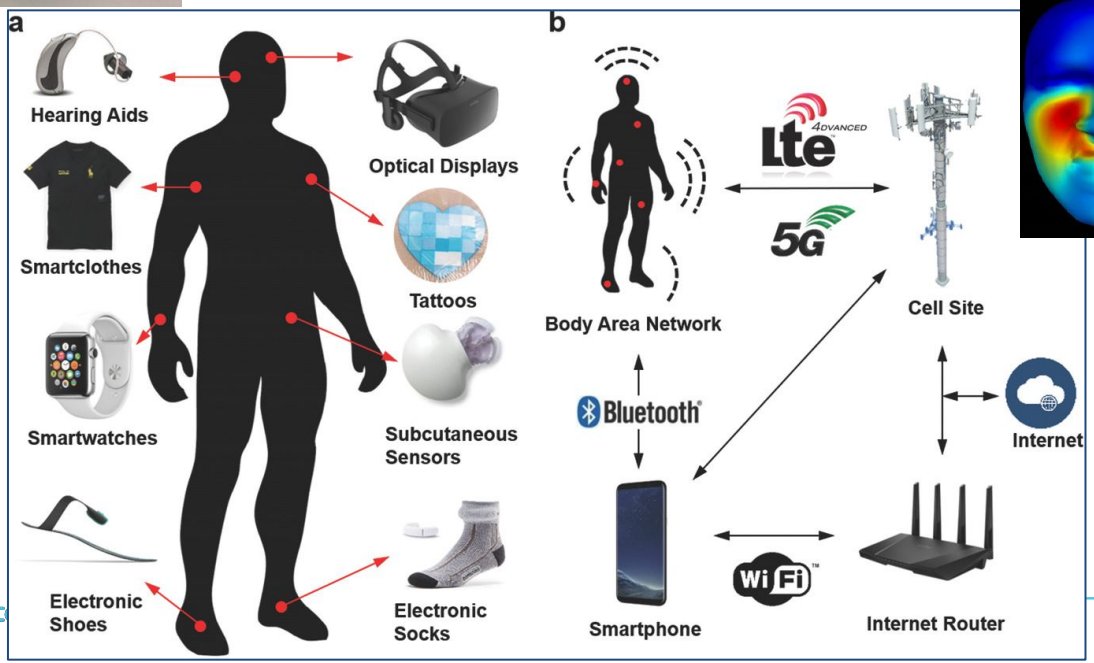
Medición de las emociones humanas

Proyecto Concytec Banco Mundial



Técnicas modernas





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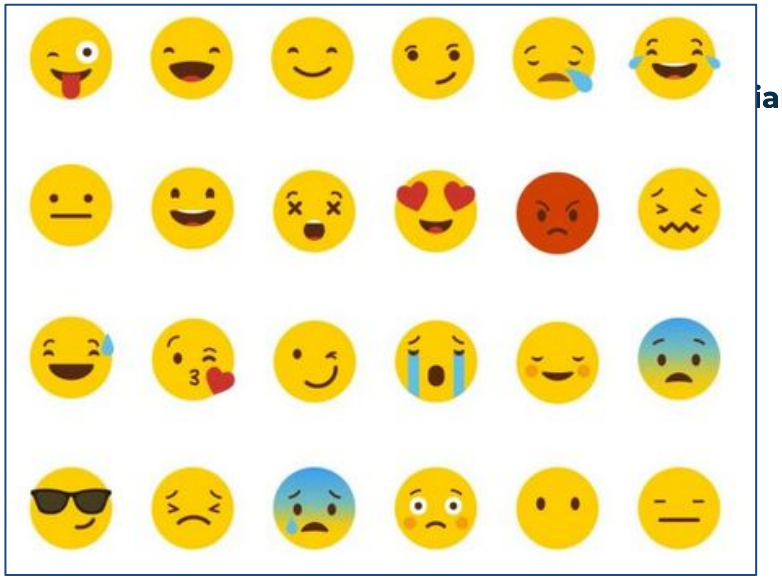
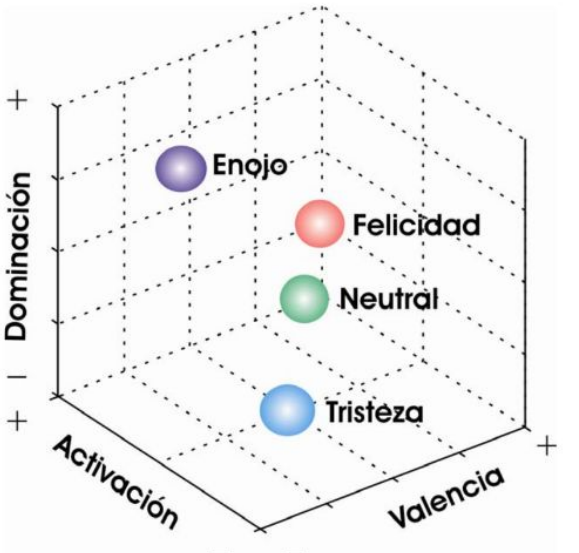
El proyecto KUSISQA

Señales fisiológicas (EDA)

Señales de voz





El proyecto KUSISQA: equipo técnico

Proyecto Concytec Banco Mundial















KUSISQA: resultados

Proyecto Concytec Banco Mundial

Indicador	Comprometido	Alcanzado
Al menos dos (02) proyectos adicionales presentados para algún financiamiento que contribuya con la continuidad de la línea de investigación	3	3
Al menos un (01) prototipo a nivel de laboratorio	3	3
Al menos un (01) artículo científico, por investigador incorporado, presentado o aceptado para publicación en revistas indizadas en Q1 o Q2, preferentemente	5	5
Al menos dos (02) tesis de pregrado o posgrado presentados ante el jurado de tesis que conlleven a la obtención de títulos o grados académicos en universidades peruanas	4	4
Al menos dos (02) ponencias de alcance internacional	7	11
Al menos un (01) contrato de trabajo o prestación de servicios con un investigador incorporado con una vigencia mínima de tres (03) años, una vez culminado el proyecto	1	2
(Opcional) Para la línea de investigación a crear, fortalecer o consolidar: Al menos un (01) artículo científico, presentado o aceptado para publicación en revistas indizadas, de proyectos que tengan en curso o culminados	2	3

KUSISQA: resultados

Proyecto Concytec Banco Mundial

Al menos dos (02) proyectos adicionales presentados para algún financiamiento que contribuya con la continuidad de la línea de investigación

Proyecto 1

EUROPEAN COMMISSION

Education, Audiovisual and Culture Executive Agency

Department A: Erasmus+, EU Solidarity Corps

Erasmus+ A3: Erasmus Mundus, Sport

Brussels,
EACEA.A.3/LDF

Tanja Grönlund
LAPPEENRANNAN-LAHDEN TEKNILLINEN YLIOPISTO LUT
YLIOPISTONKATU 34
LAPPEENRANTA
FI - 53850

Programme	EPPKA1 - KA1 - Key Action 1
Action	JMD-MOB - Joint Master Degrees
Proposal	Call for proposals : EAC/A02/2019 JMD-MOB
Application No	619839-EPP-1-2020-1-FI-EPPKA1-JMD-MOB
Title	Educating software engineers with a sustainability mindset to improve the well-being of people through software solutions
Decision	ACCEPTED

Dear Applicant,

You have submitted an application to the Erasmus+ programme, 2020 call for proposals for the action specified above. The call for proposals closed on 13/02/2020 - 17:00 (CET/CEST, Brussels time). The Education, Audiovisual and Culture Executive Agency (EACEA) received 97 eligible applications for this call.

I am writing to inform you about the selection decision taken by the Head of Department of the Agency, acting in her capacity as authorising officer, based on the recommendations of an Evaluation Committee assisted by external experts.

I am pleased to inform you that your application has been selected for EU co-funding.

It received 86/100 points, which is on or above the minimum threshold for funding of 81/100 points given the available budget.

The maximum amount of funding to be awarded to your project is 4,460,000.00 Euro.

For your information, out of the 100 applications submitted, 40 have been selected for funding.

The list of all selected projects will be published on the website of the Executive Agency when all applicants have been notified about the selection results:

http://eacea.ec.europa.eu/erasmus-plus/selection-results_en

Attached to this letter (Annex 1), you will find an evaluation report drawn up by the Evaluation Committee.

On behalf of the EACEA, the Research Executive Agency Validation Services (REA Validation Services) may contact you via the messaging system embedded in the Participant Register, requesting you to submit certain documentation within a specified deadline.

- This is in order to prove – in the event that your PIC number (Participant Identification Code) has not yet been validated – the legal existence and status of your organisation. In case of a multi-applicant proposal, each applicant will be contacted individually.
- The REA Validation Services may also contact your organisation requesting documentation to assess the financial capacity of your organisation.

Commission européenne/Europese Commissie,
Avenue du Bourget 1- 1049 Bruxelles - Belgium - Tel. +32 22991111
Office: J-59 01/033 - Tel. direct line +32 229-67108

http://eacea.ec.europa.eu
Luciano.DI-FONZO@ec.europa.eu

619839-EPP-1-2020-1-FI-EPPKA1-JMD-MOB

Page 1/3

Proyecto 2

8/26/2021 Detección automatizada del estado emocional de los adultos mayores en procedimientos de atención sanitaria pos...

IDB Inter-American Development Bank

View Edit

APPLY
MY PROPOSALS
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Detección automatizada del estado emocional de los adultos mayores en procedimientos de atención sanitaria post-pandemia COVID-19

Language
English

Institution name
Universidad Nacional de San Agustín de Arequipa

Director
Wilber Roberto Ramos Lovón

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Web address
https://fips.unsa.edu.pe/cienciadelacomputacion/

Country
Peru

Proposal file
FORMULARIO GDLAB Esp_1.pdf

https://research-proposals.iadb.org/node/2481 1/2

Proyecto 3

UNSA

UNSA Investiga
VICERRECTORADO DE INVESTIGACIÓN

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SE FINANCIA HASTA 280 000 NUEVOS SOLES

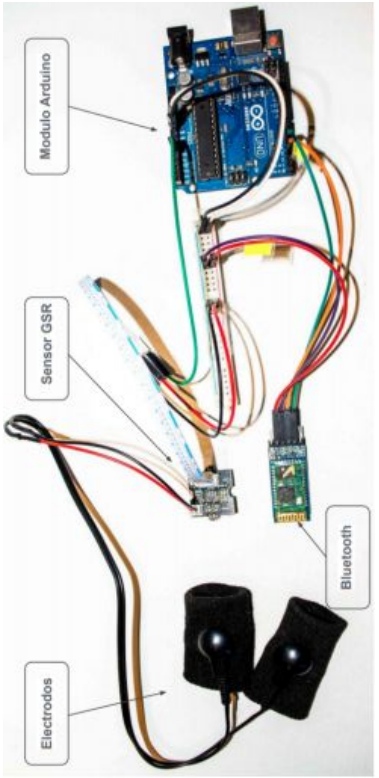
Vicerrectorado de Investigación de la Universidad - UNSA
http://vri.unsa.edu.pe

KUSISQA: resultados

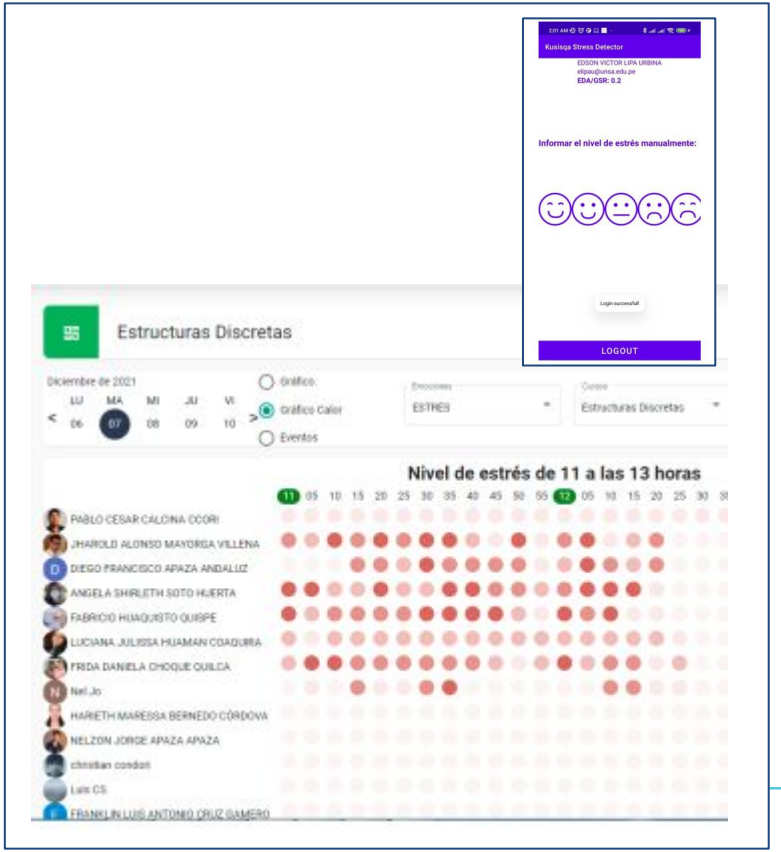
Proyecto Concytec Banco Mundial

Al menos un (01) prototipo a nivel de laboratorio

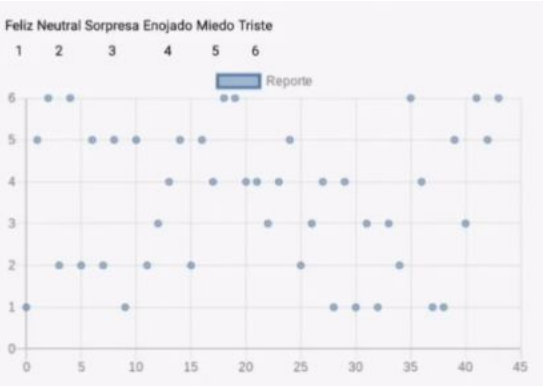
Prototipo 1



Prototipo 2



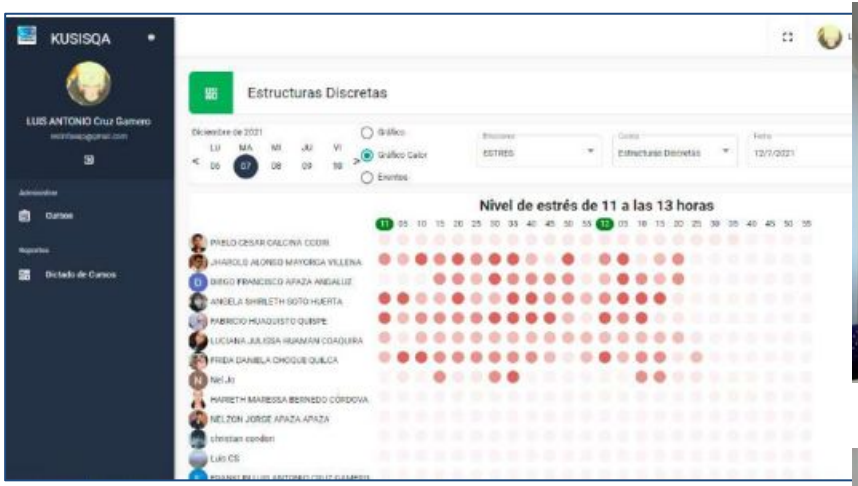
Prototipo 3

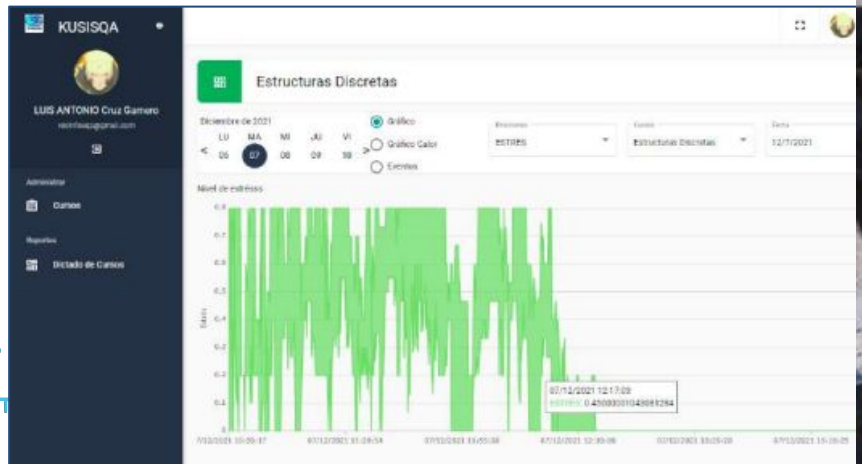


El prototipo de software

(detección de emociones a partir de señales fisiológicas - EDA)

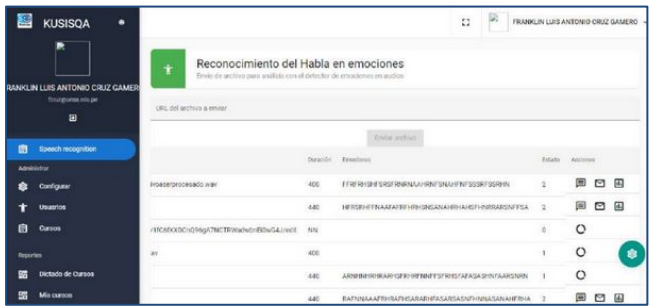
Proyecto Concytec Banco Mundial

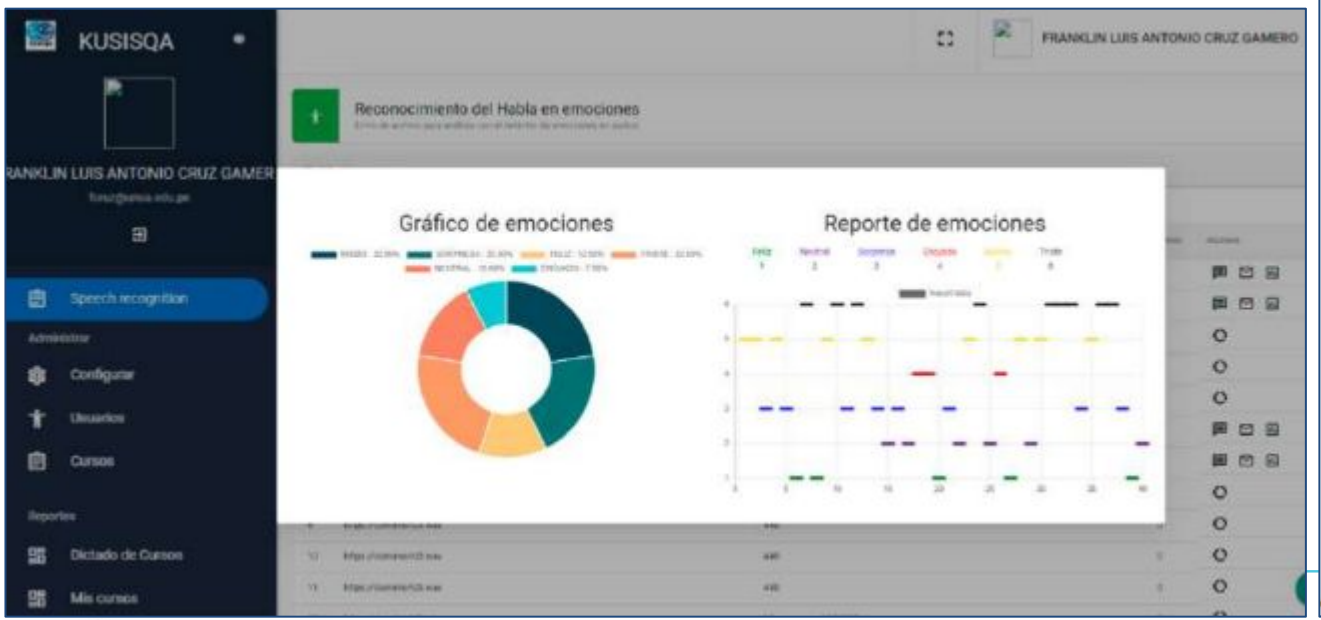




El prototipo de software

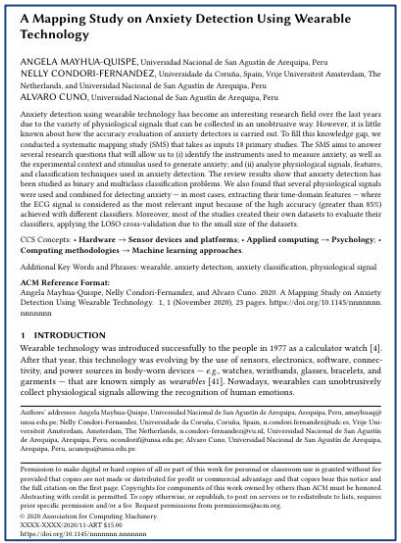
(detección de emociones a partir del habla)





KUSISQA: resultados

Al menos un (01) artículo científico, por investigador incorporado, presentado o aceptado para publicación en revistas indizadas en Q1 o Q2, preferentemente



A Mapping Study on Anxiety Detection Using Wearable Technology

ANGELA MAYHUA-QUISPE, Universidad Nacional de San Agustin de Arequipa, Peru
NELLY CONDORI-FERNANDEZ, Universidade da Coruña, Spain, Vrije Universiteit Amsterdam, The Netherlands, and Universidad Nacional de San Agustin de Arequipa, Peru
ALVARO CUNO, Universidad Nacional de San Agustin de Arequipa, Peru

Anxiety detection using wearable technology has become an interesting research field over the last years due to the variety of physiological signals that can be collected in an unobtrusive way. However, it is little known about how the accuracy evaluation of anxiety detectors is carried out. To fill this knowledge gap, we conducted a systematic mapping study (SMS) that takes as inputs 18 primary studies. The SMS aims to answer several research questions that will allow us to (i) identify the instruments used to measure anxiety, as well as the experimental context and stimulus used to generate anxiety, and (ii) analyze physiological signals, features, and classification techniques used in anxiety detection. The review results show that anxiety detection has been studied as binary and multiclass classification problems. We also found that several physiological signals were used and combined for detecting anxiety – in most cases, extracting their time-domain features – where the ECG signal is considered as the most relevant input because of the high accuracy (greater than 85%) achieved with different classifiers. Moreover, most of the studies created their own datasets to evaluate their classifiers, applying the LOSO cross-validation due to the small size of the datasets.

CCS Concepts: • **Hardware** → **Sensor devices and platforms**; • **Applied computing** → **Psychology**; • **Computing methodologies** → **Machine learning approaches**.

Additional Key Words and Phrases: wearable, anxiety detection, anxiety classification, physiological signal

ACM Reference Format:
Angela Mayhua-Quispe, Nelly Condori-Fernandez, and Alvaro Cuno. 2020. A Mapping Study on Anxiety Detection Using Wearable Technology. 1, 1 (November 2020), 25 pages. https://doi.org/10.1145/nnnnnnn.nnnnnnn

1 INTRODUCTION

Wearable technology was introduced successfully to the people in 1977 as a calculator watch [4]. After that year, this technology was evolving by the use of sensors, electronics, software, connectivity, and power sources in body-worn devices – *e.g.*, watches, wristbands, glasses, bracelets, and garments – that are known simply as *wearables* [41]. Nowadays, wearables can unobtrusively collect physiological signals allowing the recognition of human emotions.

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XXXX-XXXX/2020/11-ART $15.00
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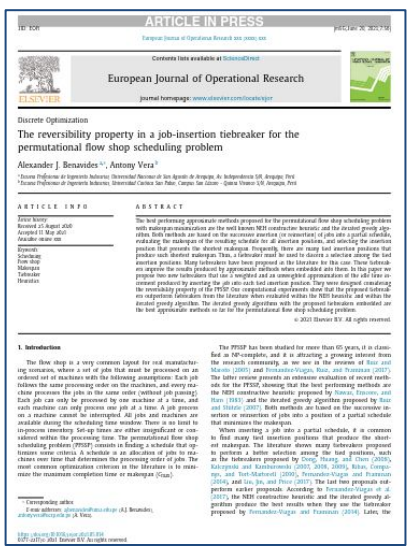

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European Journal of Operational Research xxx (xxxx) xxx

Contents lists available at ScienceDirect

European Journal of Operational Research

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Discrete Optimization

The reversibility property in a job-insertion tiebreaker for the permutational flow shop scheduling problem

Alexander J. Benavides[a,*], Antony Vera[b]

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ARTICLE INFO

Article history:
Received 31 August 2020
Accepted 31 May 2021
Available online xxx

Keywords:
Scheduling
Flow shop
Makespan
Tiebreaker
Heuristics

ABSTRACT

The best performing approximate methods proposed for the permutational flow shop scheduling problem with makespan minimization are the well known NEH constructive heuristic and the iterated greedy algorithm. Both methods are based on the successive insertion (or reinsertion) of jobs into a partial schedule, evaluating the makespan of the resulting schedule for all insertion positions, and selecting the insertion position that generates the shortest makespan. Frequently, there are many tied insertion positions that produce such shortest makespan. Thus, a tiebreaker must be used to discern a selection among the tied insertion positions. Many tiebreakers have been proposed in the literature for this case. These tiebreakers improve the results produced by approximate methods when embedded into them. In this paper we propose two new tiebreakers that use a weighted and an unweighted approximations of the idle time increment produced by inserting the job into each tied insertion position. They were designed considering the reversibility property of the PFSP. Our computational experiments show that the proposed tiebreakers outperform tiebreakers from the literature when evaluated within the NEH heuristic and within the iterated greedy algorithm. The iterated greedy algorithms with the proposed tiebreakers embedded are the best approximate methods so far for the permutational flow shop scheduling problem.

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1. Introduction

The flow shop is a very common layout for real manufacturing scenarios, where a set of jobs that must be processed on an ordered set of machines with the following assumptions: Each job follows the same processing order on the machines, and every machine processes the jobs in the same order (without job passing); Each job can only be processed by one machine at a time, and each machine can only process one job at a time. A job process on a machine cannot be interrupted. All jobs and machines are available during the scheduling time window. There is no limit to in-process inventory. Set-up times are either insignificant or considered within the processing time. The permutational flow shop scheduling problem (PFSP) consists in finding a schedule that optimizes some criteria. A schedule is an allocation of jobs to machines over time that determines the processing order of jobs. The most common optimization criterion in the literature is to minimize the maximum completion time or makespan (C_{max}).

The PFSP has been studied for more than 65 years, it is classified as NP-complete, and it is attracting a growing interest from the research community, as we see in the reviews of Ruiz and Maroto (2005) and Fernandez-Viagas, Ruiz, and Framinan (2017). The latter review presents an extensive evaluation of recent methods for the PFSP, showing that the best performing methods are the NEH constructive heuristic proposed by Nawaz, Enscore, and Ham (1983), and the iterated greedy algorithm proposed by Ruiz and Stützle (2007). Both methods are based on the successive insertion or reinsertion of jobs into a position of a partial schedule that maximizes the makespan.

When inserting a job into a partial schedule, it is common to find many tied insertion positions that produce the shortest makespan. The literature shows many tiebreakers proposed to perform a better selection among the tied positions, such as the tiebreakers proposed by Dong, Huang, and Chen (2008), Kalczynski and Kamburowski (2005, 2008, 2009), Ribas, Companys, and Tort-Martorell (2009), Fernandez-Viagas and Framinan (2014), and Liu, Jin, and Price (2017). The last two proposals outperform earlier proposals. According to Fernandez-Viagas et al. (2017), the NEH constructive heuristic and the iterated greedy algorithm produce the best results when they use the tiebreaker proposed by Fernandez-Viagas and Framinan (2014). Later, the

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https://doi.org/10.1016/j.ejor.2021.05.034
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ESCorpus-PE: A speech emotional database in Spanish with Peruvian accent

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[*] corresponding author: Alvaro Cuno (acunopa@unsa.edu.pe)

ABSTRACT

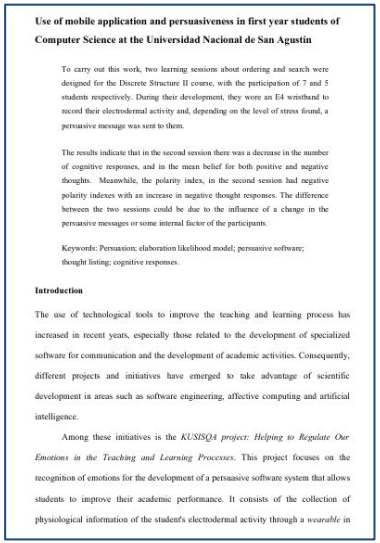
Lately, there has been considerable progress in speech emotion recognition systems based on deep learning. However, many of them are not generalizable to languages for which they were not trained. One of the reasons for this limitation is the absence of corpora in all existing human languages, dialects, and accents. This paper contributes to filling this gap, presenting ESCorpus-PE, which contains three hours, five minutes, and six seconds of speech of adult speakers in Spanish with a Peruvian accent annotated with three emotional attributes: valence, arousal, and dominance. Speech data originates from YouTube videos with interactions in their natural form. Our database can be a valuable resource for researchers studying emotion recognition in multilingual settings.

Background & Summary

Emotions are an essential component in communication between human beings, although they are also essential in communication between humans and machines[1,2]. For this reason, in many areas of the scientific community, automatic emotion recognition systems are a latent research topic nowadays[3–6]. One of the schemes that have received the most attention from researchers due to their availability is those based on recognizing emotions from speech using techniques based on supervised deep learning. However, it is known that these techniques strongly depend on the existence of data for training, validation, and testing and that the use of large-scale, diverse, and high-quality data results in superior quality ones[3].

Currently, there are several challenges related to the availability of speech datasets (also known as corpus) usable in intelligent systems, particularly those to be used to recognize emotions. For example, recognize the emotions of speakers of different ages[4] or recognize the voice of speakers in different languages[5]. Concerning the language problem, it is observed that corpora can be grouped into two main groups: a majority group where several corpora of the same language can be found (English or German)[3] and a minority group made up of corpus in languages such as Spanish,[7] Hebrew, Russian, Korean, Japanese, Shindi[10] and Urdu[11]. One aspect that increases the complexity of the language challenge is the variety of dialects that exist in the same[12], and the differences in accents of the speakers[13]. Since, for example, it is not the same to compare a Spanish-language speaker from Spain with a Spanish-language speaker from Peru. Studies by Hansen J.[12], and Yang X. et al.[13] have shown that variation in speech due to dialect is a factor that significantly affects the speech system as each dialect is differentiated by acoustic features such as vowel and consonant phonetics, rhythm and prosodic characteristics as well as grammar and vocabulary. These characteristics are the ones that usually generate a mismatch in the performance of machine learning systems.

For the reasons above, an oral corpus in Spanish but with a Peruvian accent is justified. Different machine learning systems from different manufacturers could use this corpus to obtain greater precision when recognizing the emotions of Peruvian speakers. Likewise, it could also be used in cross-lingual research speech emotion recognition[14,15]. It is essential to point out that, traditionally, the construction of a specialized corpus for the detection of emotions is a complex task[6] as it requires an effort of expert and previously trained teams of actors, transcriptionists, annotators, and evaluators, which leads to a cost, not only economic but also very high in time. Although this modality generates overemphasized expressions that differ subtly from behaviors observed during interactions in daily life[16]. Against this, an alternative is to create a naturalistic corpus with balanced emotional content. This paper presents ESCorpus-PE, a free access database obtained from realistic interaction scenarios between Spanish speakers with a Peruvian accent. It contains audio segments labeled with three emotional attributes: valence (negative to positive), arousal (calm to active), and dominance (dominated to dominating). This corpus contributes to the current state of the art of automatic recognition of emotions, which according to our knowledge, is the first of its kind.



Use of mobile application and persuasiveness in first year students of Computer Science at the Universidad Nacional de San Agustín

To carry out this work, two learning sessions about ordering and search were designed for the Discrete Structure II course, with the participation of 7 and 5 students respectively. During their development, they wore an E4 wristband to record their electrodermal activity and, depending on the level of stress found, a persuasive message was sent to them.

The results indicate that in the second session there was a decrease in the number of cognitive responses, and in the mean belief for both positive and negative thoughts. Meanwhile, the polarity index, in the second session had negative polarity indexes with an increase in negative thought responses. The difference between the two sessions could be due to the influence of a change in the persuasive messages or some internal factor of the participants.

Keywords: Persuasion; elaboration likelihood model; persuasive software; thought listing; cognitive responses.

Introduction

The use of technological tools to improve the teaching and learning process has increased in recent years, especially those related to the development of specialized software for communication and the development of academic activities. Consequently, different projects and initiatives have emerged to take advantage of scientific development in areas such as software engineering, affective computing and artificial intelligence.

Among these initiatives is the *KUSISQA project: Helping to Regulate Our Emotions in the Teaching and Learning Processes*. This project focuses on the recognition of emotions for the development of a persuasive software system that allows students to improve their academic performance. It consists of the collection of physiological information of the student's electrodermal activity through a *wearable* in

Pattern Recognition Letters
journal homepage: www.elsevier.com

A prototype for emotion detection in classroom based on speech analysis

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Article history:

Speech analysis, machine learning, emotions, software architecture.

ABSTRACT

During a class session there are many situations that generate different emotions in the participants. There are many works devoted to the analysis of the emotions in students, but few of them try to analyze the emotions of the teachers. In this article we aim to develop a prototype that extracts audio from video recordings of classes. From the extracted audio we use a classifier to identify the emotion contained in each video and generate a report that helps the teacher to improve the lectures. We compared the results of the implemented algorithm with a manual annotated dataset.

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1. Introduction

In the COVID-19 pandemic scenario, remote education has played a transcendental role in maintaining the educational structure with schools closed or with limited capacity [1]. In this context, remote education has faced new challenges related to the increase of stressful situations and other negative emotions in students and teachers due to confinement [2].

In this sense, it is necessary to be able to know the emotions of students and teachers in remote educational environments. Recently, there has been a surge of interest in human emotion recognition in a wide range of situations, with several fields of computing, such as pattern recognition, artificial intelligence, and affective computing, addressing this problem [3, 4].

Many previous efforts were devoted to the development of emotion recognition systems, for instance, in [5] the multimodal emotion recognition in response to videos is addressed using electroencephalogram (EEG), pupillary response and gaze distance. A reinforcement online learning (ROL) method for real-time emotion state prediction is proposed in [6] from detected user's EEG signals. [7] deals with the facial emotion recognition based on single Deep Convolutional Neural Networks (DNNs), which contain convolution layers and deep residual blocks. [8] presents a multimodal emotion recognition system, a convolutional neural network is applied to detect emotions from audio-video archives. Dynamical Graph Convolutional Neural Networks are applied in [9] to detect emotions through the intrinsic relationship between different EEG channels. In [10], the authors deal with the detection of multimodal unbalanced emotions by using a fitness function in genetic programming. [11] addresses the emotion recognition designing a Graph Convolutional Broad Network for exploring the deeper-level information of graph-structured emotional data. The online product sentiment analysis using random evolutionary whale optimization algorithm and deep belief network is studied in [12].

Particularly, the speech emotion recognition (SER) is a study field of growing interest among the scientific community due to its applications in real-life scenarios. In [13] the facial and speech recognition emotion in distance education system is addressed using statistical algorithms for extraction and classification. In [14], the authors develop an affective Speech-to-speech translation system with a particular focus on speakers' emotional states. The emotion detection in speech using deep networks is investigated in [15] based on an hybrid model consisting of a generative and discriminative model. In [16], algorithm based on Hidden Markov Model tool kit for speech, speaker and emotion recognition using emotional database in Berlin language is proposed. The Fourier parameter model for speaker-independent speech emotion recognition using the perceptual content of voice quality and the first- and second-order differences is addressed in [17]. [18] presents a probabilistic echo-state network for density estimation over variable-length sequences of random vectors introducing a constrained maxi-

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Tesis sustentada 1

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DE TÍTULO PROFESIONAL DE CIENCIA DE LA COMPUTACIÓN

Br: LUIS ANTONIO BERNAL CHAHUAYO

En Arequipa, siendo las 09:00. hrs. del día .24. de Diciembre. de 2021 en la plataforma virtual del DUTIC por Google Meet, enlazándose mediante los correos electrónicos institucional DE LA UNIVERSIDAD NACIONAL DE SAN AGUSTÍN DE AREQUIPA, en cumplimiento al Decreto Nro. **535-2021-FIPS** se reunió el Jurado presidido por el **Dr. EDWARD HINOJOSA CARDENAS**

Integrado por los Profesores: **Dr. YUBER ELMER VELAZCO PAREDES**
Dr. ALVARO ERNESTO CUNO PARARI

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Expuso la Tesis Titulada: **FRAMEWORK PARA LA EVALUACIÓN COMPARATIVA DE MODELOS DE DEEP LEARNING PARA EL RECONOCIMIENTO DE EMOCIONES A PARTIR DEL HABLA**

Rendida la sustentación, absueltas las observaciones y preguntas formuladas por cada uno de los miembros integrantes del Jurado y efectuada la Evaluación correspondiente, el resultado fue:

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Br: ... ALEXIS ALDO MENDOZA VILLARROEL.....

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..... **ALEXIS ALDO MENDOZA VILLARROEL** .....

Expuso la Tesis Titulada: **HERRAMIENTA PARA LA VISUALIZACIÓN DE SERIES TEMPORALES DE EMOCIONES DERIVADAS DE DATA FISIOLÓGICA.**

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Aprobado por Unanimidad con felicitación pública

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Tesis sustentada 3

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Br: EDSON VICTOR LIPA URBINA

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Br: ... YONEL YVAN MAMANI MAMANI.....

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Integrado por los Profesores: **Dra. OLINDA NELLY CONDORI FERNANDEZ**
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..... **YONEL YVAN MAMANI MAMANI** .....

Expuso la Tesis Titulada: **DETECCIÓN DE ESTRÉS EN TIEMPO REAL A PARTIR DE SEÑALES DE VOZ Y DATOS FISIOLÓGICOS.**

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REFSQ 2020 Doctoral Symposium

Anxiety as Implicit User Feedback in Serious Games

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Abstract. The application of serious games in different areas (*e.g.*, as education, training, health care) has been growing rapidly because of their main purpose of teaching or improving skills in end-users. A well-designed game maintains the players into their flow zones, avoiding negative emotions (*e.g.*, anxiety) to achieve the didactical and pedagogical goals. For that reason, good user experience is fundamental to engage the player with the game and support his learning process. In this context, this paper presents a general approach to use the player's anxiety levels as implicit feedback for validating UX requirements and improve the serious game.

Keywords: Anxiety detection · Implicit user feedback · Serious games.

1 Introduction

The emerging area of serious games has been growing during the last ten years in the research and the industry fields [10]. It is estimated that this market reaches $9,167 million by 2023 due to serious games are being used in different contexts (*e.g.*, healthcare, education, government) with the main function to train, inform, or teach end-users [14]. Similar to other games, the entertainment is a component of serious games [10] and has an important role to maintain the user engagement in the training or learning process.

A well-designed game maintains the player into his flow zone, evoking positive emotions and feelings. According to Chen [3], the flow experience means what a user experiences playing a game so that it depends on maintaining a balance between the players' ability and the inherent challenge of the game. Fig. 1a displays the location of Flow Zone compared to anxiety and boredom. For example, if the challenge is higher than ability, the activity generates anxiety and the player could leave the game. On the other hand, Fig. 1b shows the different flow zones according to the different players (*e.g.*, hardcore, novice). This means that the flow experience for each user depends on his/her abilities.

The flow experience is related to user experience (UX) playing the game. Moreover, according to Condori-Fernandez *et al.* [4], the negative emotions perceived by end-users are useful information for discovering unsatisfied non-functional requirements (NFR), and improving the UX. In serious games, as negative emotions (*e.g.*, anxiety, stress) can also affect the processing of the learning content

Live study track at REFSQ 2020

Exploring the influence of the emotional state on the efficiency for correcting defects in conceptual models: a live study

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Abstract

The purpose of this live study is to investigate the impact of emotional states on the efficiency of correcting defects within a Conceptual Model verification context. We plan to use the CoSTest tool for verifying defects and measure the experimented emotions during the testing tasks through I-PANAS-SF and SUDS instruments. Furthermore, the design, overview and potential threats of this experiment are presented.

1 Introduction

1.1 Research problem

Emotions have an important role in our life and their influence on our work is not an exception. According to Weiss and Cropanzano [WC96], emotions and moods have effects on work performance, affecting the duration of activities and the perceived experience. This situation is not only present in industrial activities; some researchers have been analyzing the influence and importance of emotions in software engineering [Wro13, CSdlB+14, MF15, RFB+19], being the software development process one of the principal centers of interest.

Wrobel [Wro13] analyzed the influence of the emotional state on the performance of programming tasks collecting data through a questionnaire and an interview for each participant, the Job Emotions Scale (JES) was applied to measure human emotions. Romano *et al.* [RFB+19] also investigated in this area, analyzing emotions when novice developers apply the TDD (Test-Driven Development) approach on change tasks; in a similar way, they collected data through self-reported emotions by the participants. In the same way, we propose to analyze the influence of the emotional state on the work productivity based on correcting defects in conceptual models.

In line with this notion, according to Granda *et al.* [GCVP15], defects (*e.g.*, missing, wrong and unnecessary elements) in conceptual models (*e.g.*, UML class diagram) can be located in several ways through Validation & Verification techniques, which use a detection mechanism (based on rules, metrics, and modelling conventions)

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In: M. Sabetzadeh, A. Vogelsang, S. Abualhaija, M. Borg, F. Dalpiaz, M. Daneva, N. Condori-Fernández, X. Franch, D. Fucci, V. Gervasi, E. Groen, R. Guizzardi, A. Herrmann, J. Horkoff, L. Mich, A. Perini, A. Susi (eds.): Joint Proceedings of REFSQ-2020 Workshops, Doctoral Symposium, Live Studies Track, and Poster Track. Pisa, Italy, 24-03-2020, published at http://ceur-ws.org

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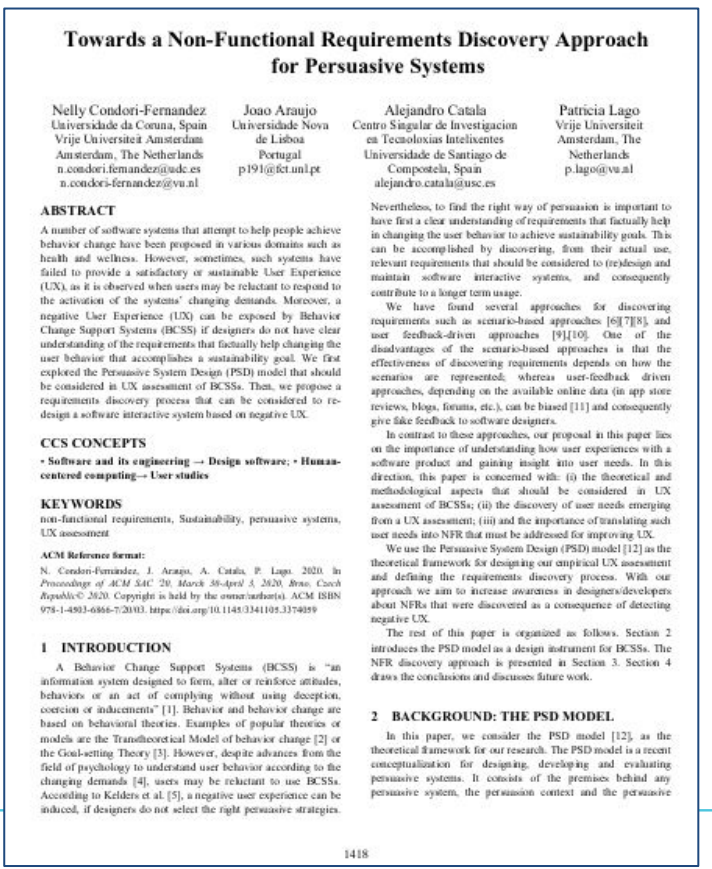

Towards a Non-Functional Requirements Discovery Approach for Persuasive Systems

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ABSTRACT

A number of software systems that attempt to help people achieve behavior change have been proposed in various domains such as health and wellness. However, sometimes, such systems have failed to provide a satisfactory or sustainable User Experience (UX), as it is observed when users may be reluctant to respond to the activation of the systems' changing demands. Moreover, a negative User Experience (UX) can be exposed by Behavior Change Support Systems (BCSS) if designers do not have clear understanding of the requirements that factually help changing the user behavior that accomplishes a sustainability goal. We first explored the Persuasive System Design (PSD) model that should be considered in UX assessment of BCSSs. Then, we propose a requirements discovery process that can be considered to re-design a software interactive system based on negative UX.

CCS CONCEPTS

• **Software and its engineering → Design software;** • **Human-centered computing→ User studies**

KEYWORDS

non-functional requirements, Sustainability, persuasive systems, UX assessment

ACM Reference format:

N. Condori-Fernández, J. Araujo, A. Catala, P. Lago. 2020. In *Proceedings of ACM SAC '20, March 30-April 3, 2020, Brno, Czech Republic.*© 2020. Copyright is held by the owner/author(s).ACM ISBN 978-1-4503-6866-7/20/03. https://doi.org/10.1145/3341105.3374059

1 INTRODUCTION

A Behavior Change Support Systems (BCSS) is "an information system designed to form, alter or reinforce attitudes, behaviors or an act of complying without using deception, coercion or inducements" [1]. Behavior and behavior change are based on behavioral theories. Examples of popular theories or models are the Transtheoretical Model of behavior change [2] or the Goal-setting Theory [3]. However, despite advances from the field of psychology to understand user behavior according to the changing demands [4], users may be reluctant to use BCSSs. According to Kelders et al. [5], a negative user experience can be induced, if designers do not select the right persuasive strategies.

Nevertheless, to find the right way of persuasion is important to have first a clear understanding of requirements that factually help in changing the user behavior to achieve sustainability goals. This can be accomplished by discovering, from their actual use, relevant requirements that should be considered to (re)design and maintain software interactive systems, and consequently contribute to a longer term usage.

We have found several approaches for discovering requirements such as scenario-based approaches [6][7][8], and user feedback-driven approaches [9],[10]. One of the disadvantages of the scenario-based approaches is that the effectiveness of discovering requirements depends on how the scenarios are represented; whereas user-feedback driven approaches, depending on the available online data (in app store reviews, blogs, forums, etc.), can be biased [11] and consequently give fake feedback to software designers.

In contrast to these approaches, our proposal in this paper lies on the importance of understanding how user experiences with a software product and gaining insight into user needs. In this direction, this paper is concerned with: (i) the theoretical and methodological aspects that should be considered in UX assessment of BCSSs; (ii) the discovery of user needs emerging from a UX assessment; (iii) and the importance of translating such user needs into NFR that must be addressed for improving UX.

We use the Persuasive System Design (PSD) model [12] as the theoretical framework for designing our empirical UX assessment and defining the requirements discovery process. With our approach we aim to increase awareness in designers/developers about NFRs that were discovered as a consequence of detecting negative UX.

The rest of this paper is organized as follows. Section 2 introduces the PSD model as a design instrument for BCSSs. The NFR discovery approach is presented in Section 3. Section 4 draws the conclusions and discusses future work.

2 BACKGROUND: THE PSD MODEL

In this paper, we consider the PSD model [12], as the theoretical framework for our research. The PSD model is a recent conceptualization for designing, developing and evaluating persuasive systems. It consists of the premises behind any persuasive system, the persuasion context and the persuasive

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An evaluation of physiological public datasets for emotion recognition systems

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Abstract. [Background] The performance of emotion recognition systems depends heavily on datasets used in their training, validation, or testing stages. [Aims] This research aims to evaluate the extent to which public available physiological datasets created for emotion recognition systems meet a set of reference requirements. [Method] Firstly, we analyze the applicability of some reference requirements proposed for stress datasets and adjust the corresponding evaluation criteria. Secondly, nine public physiological datasets were identified from a previous survey. [Results] None of the evaluated datasets satisfy all the reference requirements in order to be considered as a reference dataset for being used in the construction of reliable emotion recognition systems. [Conclusion] Although the evaluated datasets do not support the whole reference requirements, they provide a baseline for further development. Also, a greater effort is needed to establish specific reference requirements that can appropriately guide the creation of physiological datasets for emotion recognition systems.

Keywords: Physiological datasets · Reference requirements · Assessment.

1 Introduction

In recent years, automatic emotion recognition systems have been undergoing considerable popularity growth because it can be applied in many critical areas such as safe driving [32], health care [19, 29] citizen security [21], and so on [25, 1, 17, 33]. In particular, those attracting the most attention are the systems based on physiological signals because of their involuntary nature and the difficulty involved in controlling them. According to Shu et al. [25], in emotion recognition systems, physiological signals (i.e., electroencephalogram, temperature, electrocardiogram, electromyogram, galvanic skin response, respiration, etc.) are having

SCCC 2020

A FAIR evaluation of public datasets for stress detection systems

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***Abstract*—Nowadays, datasets are an essential asset used to train, validate, and test stress detection systems based on machine learning. In this paper, we used two sets of FAIR metrics for evaluating five public datasets for stress detection. Results indicate that all these datasets comply to some extent with the (F)indable, (A)ccessible, and (R)eusable principles, but none with the (I)nteroperable principle. These findings contribute to raising awareness on (i) the need for the FAIRness development and improvement of stress datasets, and (ii) the importance of promoting open science in the affective computing community.**

***Index Terms*—FAIR principles, Stress detection, Datasets.**

I. Introduction

Open Science [1] is the international movement to make any research artifact (i.e., software source code, datasets, algorithms, analysis scripts, manuscripts, tools, and so on) available and accessible to society. One of the common justifications for open science is the growing concern that researchers have expressed about a "reproducibility crisis" in some scientific fields [2], [3], including artificial intelligence [4] and computer science [5]. Open Science seeks to increase the transparency and, thus, **repeatability** (i.e., same team, same experimental setup), **reproducibility** (i.e., different team, same experimental setup) and **replicability** (i.e., different team, different experimental setup) of the scientific process and their results [6].

Several countries have taken the initiative to follow the Open Science movement. For instance, in 2018, the European Commission launched the European Open Science Cloud (EOSC) as a process of making research data in Europe accessible to all researchers under the same terms of use and distribution [7]. This initiative aims to push Europe towards a culture of open research artifacts that are **F**indable, **A**ccessible, **I**nteroperable, and **R**eusable. In other words, it aims to satisfy the FAIR principles [8]. In a broader global context, there are similar initiatives such as the USA NIH Data Commons, the Australian Research Data Commons, and the proposed African Open Science Platform [9]. In the South American region, we must highlight the GO FAIR Office's implementation in Brazil [10].

The FAIR principles have been broadly accepted in some scientific communities, such as in bio and natural sciences [11]. However, there is still insufficient implementation in the development of advanced information systems like emotion-aware systems[1]. As this kind of system has received much attention in recent years (e.g., [12], [13], [14]), it is important to determine the degree of FAIRness of datasets used for emotion recognition or detection. Usually, datasets are used to train, validate, and test supervised learning systems [15]; however, very little has been done to explore its findability, accessibility, interoperability, and reusability properties. Therefore, we aim to investigate the following research question: *How FAIR are the public datasets used in human stress detection systems?* To answer this question, five datasets were selected and evaluated employing two sets of FAIR metrics. Our work contributes to the maturity of open science in the affective computing community.

The paper is organized as follows: Section II introduces the FAIR principles, implementations, evaluation tools, and related work. In section III, we present the materials and the method used in this study. Section IV reports the results as well as the threats to the validity of our study. Finally, in Section V, the conclusion and some ideas for future work are presented.

II. Background

A. The FAIR principles

The FAIR foundational principles introduced by Wilkinson et al. [8] provide guidelines to enable digital resources, such as datasets, source code, tools, workflows, and other scientific research artifacts, to become more **F**indable, **A**ccessible, **I**nteroperable, and **R**eusable for humans and computers. Jacobsen et al. [16] describe the core objective of these principles as following:

[1]A type of software-intensive system that is aware of the user's emotions like stress, anger, disgust, fear, happiness, among others.

978-1-7281-8328-2/20/$31.00 ©2020 IEEE

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https://doi.org/10.1145/3387940.3391466

Understanding Implicit User Feedback from Multisensorial and Physiological Data: A case study

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ABSTRACT

Ensuring the quality of user experience is very important for increasing the acceptance likelihood of software applications, which can be affected by several contextual factors that continuously change over time (e.g., emotional state of end-users). Due to these changes in the context, software continually needs to adapt for delivering software services that can satisfy user needs. However, to achieve this adaptation, it is important to gather and understand the user feedback. In this paper, we mainly investigate whether physiological data can be considered and used as a form of implicit user feedback. To this end, we conducted a case study involving a tourist traveling abroad, who used a wearable device for monitoring his physiological data, and a smartphone with a mobile app for reminding him to take his medication on time during four days. Through the case study, we were able to identify some factors and activities as emotional triggers, which were used for understanding the user context. Our results highlight the importance of having a context analyzer, which can help the system to determine whether the detected stress could be considered as actionable and consequently as implicit user feedback.

KEYWORDS

Actionable emotion, Implicit user feedback, Physiological data, Context information, Case study

1 INTRODUCTION

Nowadays, software systems have become more complex but at the same time adaptable due to the continuous evolution of information technologies such as wearable sensors. However, to achieve the (self-) adaptation of a system, it is required to obtain information about any response of the interaction between the system and the user (i.e., user feedback) [48]. According to Maalej and Vandenkendelr, the usefulness of this information depends on its consistency, credibility, and accuracy [34]. Given user feedback has become a resource of valuable information for software developers, companies or users that are looking for an opinion of the quality of a service or product (e.g., [32]), it has been largely investigated by different computer science fields, especially in Human-Computer Interaction [22, 28, 34, 39, 51] and Software Engineering [16, 35, 45].

Hence, one of the main issues is how to collect useful user feedback which is both accurate and credible [34]. In this direction, different approaches have been investigated (e.g., [13, 18, 26, 36]). For example, some works argue that implicit user feedback —an indirect or inferred reaction of the user upon his experience using a software service (e.g., elapsed time, emotions, mouse movement, mouse clicks and scrolling) [39]—can be used as a suitable source in many cases without distracting users from their primary tasks. Besides, the work in [11] introduced the idea of measuring physiological emotions as an alternative source to empower the adaptability of software services at run-time. As a result of that preliminary research, authors argued that negative emotions (i.e., stress) could also be considered as implicit user feedback for enhancing adaptability and user experience in service-based mobile applications [9].

We developed a real-time stress detector that was initially evaluated within an experimental setting in [31]. Nevertheless emotions are subjective and highly context-dependent [3, 25]. Thus, conducting empirical studies in real-life environments is much more challenging, especially since users are exposed to diverse stimuli under uncontrolled conditions or settings.

In this paper, we present a case study with the aim of investigating whether negative emotions (i.e., stress) can be used as implicit user feedback. Our case focuses on a tourist visiting a city abroad, who interacted with a persuasive mobile app and was exposed to different situations during four days, while context and physiological data were gathered using wearable sensors in combination with other smartphone sensors.

The paper is organized as follows. Section 2 discusses related work on user feedback. The description of the case study is presented in Section 3. The results and design of the context analyzer are discussed in Section 4. Section 5 provides the threats to validity. Finally, conclusions and future works are presented in Section 6.

2 RELATED WORK ON USER FEEDBACK

The assessment of user feedback is important for self-adaptation and software evolution, which is concerned about involving old designs to generate new ones [36]. In this context, the user feedback is interpreted as relevant information from any response about the interaction between the software system and the user [33]. During many years, user feedback has been mainly used by recommendation systems [35], depending largely on explicit feedback (e.g., filling questionnaires, sending a report about an error, suggestion of new functionalities, or ratings) that users can provide. Nonetheless, users are not interested to give feedback, or they could even give false feedback; for that reason, explicit feedback is sometimes difficult to obtain [38].

KUSISQA: resultados

Proyecto Concytec Banco Mundial

Al menos dos (02) ponencias de alcance internacional

SEmotion 2020

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How Do Negative Emotions Influence on the Conceptual Models Verification? A live study proposal

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ABSTRACT

The present live study is proposed with the objective of investigating the influence of negative emotions (i.e., stress) in the efficiency for verifying conceptual models. To conduct this study, we use a Model-driven Testing tool, named CoSTest, and our own version of stress detector within a competition setting. The experiment design, overview of the empirical procedure, instrumentation and potential threats are presented in the proposal.

1 INTRODUCTION

1.1 Research problem

Emotions and moods are inherent to all human experiences and consequently have effects on our work performance [15]. For example, emotions might affect the correctness and duration of activities, or the perceived experience. In the last years, some researchers have been focused on analyzing what emotions are present and their influence in the software engineering field (e.g., [2, 4, 11, 13, 18]), being the software development process one of the main topics of interest.

The influence of the emotional state on the performance of programming tasks was analyzed by Wrobel [18], who applied a questionnaire and an interview for each participant to collect data. In this study, the Job Emotions Scale (JES) was applied to measure human emotions. Romano et al. [13] analyzed emotions when novice developers apply the TDD (Test-Driven Development) approach on change tasks; similarly, they collected data through self-reported emotions by the participants.

On the other hand, researchers have not focused only on analyzing self-reported emotional states, we have also found some attempts in using physiological data to determine automatically some emotions in a specific context. For instance, Müller and Fritz [11] collected bio-metric measures (e.g., electro-dermal activity, electroencephalography, skin temperature, heart rate) using different devices (Empatica E3-wristband, Neurosky MindBand and Eye Tribe) to distinguish positive and negative emotions using machine learning techniques in the context of software change tasks; also, participants assessed their emotions answering periodically a short questionnaire. Girardi et al. [4] replicated the work of Müller and Fritz in the same context, using similar devices (Empatica E4-wristband, Emotiv Insight and Tobii 4C), including more subjects in their experiment. Other work was proposed by Suni Lopez et al. [10], they were focused on detecting physiological stress in real-time in a quiet office workplace environment, using some well-known emotional triggers from the Psychology community. Authors used the E4-wristband for gathering the electrodermal activity (EDA) and applying an arousal-based statistical approach for the stress detection.

Although the amount of research for understanding the influence of emotions in software development process is rising, the impact of emotions in model-driven development (MDD) has not been yet well investigated. We selected the MDD context, because its adoption in the industry is growing quite rapidly [12]. Additionally, we have access to CoSTest, a model-driven testing tool. A conceptual model (CM) is a key asset in MDD because represents abstract concepts of the relationships between objects in a specific problem. If a CM has defects, these are passed on to the following stages (e.g., coding) and could be more expensive the correction. According to Granda et al. [5], defects in conceptual models (e.g., missing, wrong and unnecessary elements) can be located in several ways through Validation & Verification techniques, which can be statically or dynamically supported by a tool and can have different scope and limitation depending on its purpose (*i.e.*, detect, prevent and resolve).

For these reasons, we propose to analyze the influence of negative emotions (focusing mainly on detect stress from physiological data) on the conceptual models verification process. This verification process includes the correction of defects found in the conceptual model.

1.2 Motivation to conduct the study

In this live study proposal, we start from the hypothesis that negative emotions of workers influences on their productivity when they develop model-driven tasks. As the emotional state could be influenced by the user profile (*e.g.*, background, personality, experience in the task) or the way how the emotions are experiment for each one, we focus on investigating the emotions that could be generated along the tasks of defect detection in CMs, which are supported by a testing tool [8].

PERSUASIVE 2021

Towards an Automatic Generation of Persuasive Messages

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Abstract. In the last decades, the *Natural Language Generation*(NLG) methods have been improved to generate text automatically. However, based on the literature review, there are not works on generating text for persuading people. In this paper, we propose to use the SentiGAN framework to generate messages that are classified into levels of persuasiveness. And, we run an experiment using the Microtext dataset for the training phase. Our preliminary results show 0.78 of novelty on average, and 0.57 of diversity in the generated messages.

Keywords: Text generation · SentiGAN · Persuasive Message

1 Introduction

The messages used to persuade a target audience in certain domains (e.g., marketing) have demonstrated to be very effective. However, the production of persuasive message requires a profound knowledge of receptor's characteristics as well as the involvement of a variety of stakeholders. For companies and organizations, this translates into time and money.

Automatic text comprehension and generation are very important in the areas of Natural Language Processing (NLP) and Natural Language Generation (NLG) respectively. In the literature, exist different methods for automatically generating text, which means that its operation does not require human intervention. Despite this growing interest in proposing techniques and models for the automatic text generation (e.g., [11], [14], [8]), there is not yet evidence on automatic message generation that can be used to persuade people. Currently there are some works that address the design of persuasive message for behavior change (e.g., [3]), and others focused on detection of persuasion in texts or conversations [6]. In this paper, we focus on the automatic generation of persuasive messages, through the application of SentiGAN[11], a short text generation framework based on Generative Adversarial Network(GAN). We consider that our work might contribute not only to reduce time, but also to enhance the novelty and diversity of the generated persuasive messages in certain domains. To do this, we exploit the Microtext corpus [13] as a training dataset, which

ICCE 2022

An Emotion-Aware Persuasive Architecture to Support Challenging Classroom Situations

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***Abstract*—Nowadays, students face stressful situations that affect their mental health and negatively impact their academic performance. This situation has been exacerbated due to the COVID-19 pandemics. Teaching and learning process stakeholders face two main problems: the lack of awareness of the situations arising from students and the little available information that support the teaching activities. Here, we propose an emotion-aware architecture for persuasive systems in education, identifying challenging classroom situations and promoting mental health through multi-modal persuasive notifications. An important module is emotion inference, which reads real-time physiological data from students through the Empatica E4 wristband. Based on this architecture, we developed the Kusisqa persuasive system, to support students in regulating their negative emotions (They can all lead to stress) during challenging classroom situations. Preliminary results provide insights that teachers achieved an increased awareness of the situations of students and perceived the prototype tool as useful.**

***Index Terms*—Context-Aware Systems, emotion-aware, Persuasive systems, internet of things, software architecture**

I. Introduction

Dropout and low performance are two major issues faced by educational systems of all levels. The pandemic has deeply exacerbated existing education issues, including stress, sleep difficulty, and anxiety [1]. This emotional disturbance poses mental health challenges that negatively impact students' academic performance.

Though many efforts were devoted to monitoring and evaluating the learning process [2], the interventions occur after measuring learning outcomes and it is hard for teachers to be aware of the situations arising from students and to provide the right information, at the right time, in the right place, in the right way, and to the right person.

In this paper, we propose an emotion-aware architecture for persuasive systems in education using a powerful emotion detection module. An Empatica E4 wristband[6] device is used to capture physiological signals of a student. These signals are used as the input to the emotion detection module. An algorithm based on statistical learning is used to identify negative emotions and determine the level of stress. If the student is stressed, student and teacher receive persuasive notifications on time and in the right way. This architecture considers three sources of context: the student, the teacher, and the environment, to generate a multi-modal (text, audio, video or comic) persuasive message accordingly.

An emotion-aware persuasive system (E-APS) must be aware of the situations (e.g. student is feeling a negative emotion at any moment during the lecture) arising from the actors' context and provide relevant persuasive notifications to change actors' attitudes or behaviors, so that, they can use (read, hear or watch - media type) in a specific context (possible activity). Therefore, an E-APS is a context-aware [3] [4] and persuasive system [5].

To validate the architecture, we developed the Kusisqa persuasive system, a prototype tool to support students in regulating their negative emotions (stress responses often include negative emotions) in challenging classroom situations.

Preliminary results of evaluation provide evidence that teachers and educational supervisors achieved an increased awareness of the situations of students and perceived the prototype system as an adequate tool to support their coordination while attending to a challenging situation.

Fig. 1. Overview of an E-APS for supporting education

II. Emotion-Aware Persuasive Architecture

An E-APS in education domain must consider contextual information about two actors: i) the student with negative emotions, as the person to be persuaded (receive notification) and about whom the event (acquired context) is generated; and (ii) the teacher and his/her environment, as the person who

This research was funded by Concytec - World Bank "Improvement and extension of services of the National System of Science, Technology and Innovation" 8682-PE through its executive unit ProCiencia. Contract N° 014-2019-FONDECYT-BM-INC.INV

[6] https://www.empatica.com/research/e4/

KUSISQA: resultados

Proyecto Concytec Banco Mundial

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COMIA 2022

Una Evaluación Comparativa de Modelos de *Deep Learning* para el Reconocimiento de Emociones a partir del Habla

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Resumen Diversos modelos de reconocimiento de emociones a partir del habla vienen siendo propuestos en los últimos años. Sin embargo, las evaluaciones de desempeño de algunas propuestas podrían no ser lo suficientemente confiables. Este trabajo tiene como finalidad contribuir con abordar esta problemática, presentando una manera práctica de implementar evaluaciones comparativas cuyos resultados disten de ser atribuidos a la casualidad. La propuesta utiliza las pruebas de significancia estadística no paramétricas en base al test de Wilcoxon para la comparación del desempeño de modelos de *Deep Learning*. Se demostró la utilidad de la propuesta, realizando las comparación del desempeño de cinco modelos convolucionales, dos entrenados con la base de datos RAVDESS y tres entrenados con la base de datos IEMOCAP.

Keywords: Emociones, Evaluación.

1. Introducción

El interés en lograr reconocer las emociones humanas de manera automatizada ha sido motivado por diversas áreas de aplicación. Por ejemplo, para diseñar robots inteligentes que puedan interactuar de manera empática con las personas, para crear anuncios personalizados que tengan en cuenta el estado emocional de potenciales clientes, para mejorar los procesos de enseñanza/aprendizaje, para mostrar contenido más adecuado a una audiencia objetivo, entre otras aplicaciones [4].

Existen varios métodos para medir las emociones humanas, cada una con sus ventajas y desventajas. Para el caso de los sistemas automatizados, podemos clasificarlos en invasivos y no invasivos. Entre los invasivos, tenemos aquellos que utilizan dispositivos pegados al cuerpo para medir alguna señal fisiológica como electrocardiogramas, electroencefalogramas, respuestas galvánicas de la piel, temperatura, respiración, entre otros. Entre los no invasivos podemos encontrar a los que utilizan como señal de entrada expresiones faciales, gestos, posturas, voz, entre otras.

GIoTS 2022

A Persuasive system for Stress Detection and Management in an Educational Environment *

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Abstract. This paper addresses the development of a persuasive IoT system for stress detection and management in students during classroom situations. An emotion-aware persuasive architecture is developed with four modules: Context Acquisition, Context Manager, Persuasion Manager and Context-Aware Applications. By using the galvanic skin response biomarker, the real-time stress level is measured by the wearable wristband Empatica E4. The data, processed and classified on discrete stress levels from 0 to 5, is sent to the context module that identifies situations of interest where the students need positive reinforcement from the persuasive system. Based on the situation of interest and the user's profile, the persuasive module composes personalized persuasive messages displayed in a mobile application. The persuasive system was evaluated through an exploratory study during a class session, with encouraging results in detecting stress levels and the positive effect of persuasive messages on students.

Keywords: Persuasive system · Internet of Things · wearable electronics · student's stress management · emotion-awareness · affective computing

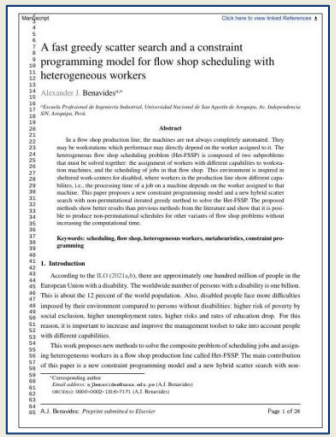
1 Introduction

Students are exposed to various stressful situations, from homework to their relationships [11]. Continuous stressful situations can cause psychological and physiological problems in students, leading to reduced academic performance and even school dropout. In the pandemics scenario, conditions causing stress have been accentuated, while others have appeared, such as confinement and remote education [18, 3].

* This research was founded by Concytec - World Bank "Improvement and extension of services of the National System of Science, Technology and Innovation" 8682-PE, through its executive unit ProCiencia. Contract Nro: 014-2019-FONDECYT-BM-INC.INV.

KUSISQA: resultados adicionales

Proyecto Concytec Banco Mundial



A fast greedy scatter search and a constraint programming model for flow shop scheduling with heterogeneous workers

Alexander J. Benavides

Fast pyramidal heuristics for minimising the makespan in ordered flow shops

Alexander J. Benavides

6 planes de tesis de pregrado aprobados

RESOLUCIÓN DECANAL NRO. 211-2022-FIPS-UNAS

Arequipa, 13 de mayo de 2022

Vista.
La solicitud del (los) Bachiller(es):

PILCO PANCCA LUZ MARINA

Quienes solicitan la aprobación del Plan de Tesis para la obtención del TITULO PROFESIONAL de CIENCIA DE LA COMPUTACIÓN

CONSIDERANDO:
Que el director de la Unidad de Investigación designo el jurado para la evaluación del Proyecto de Plan de Tesis titulado: MEDICIÓN DE LA SEGURIDAD DIGITAL DE LOS PORTALES INSTITUCIONALES DE LAS UNIVERSIDADES PÚBLICAS DEL ESTADO PERUANO
Integrado por los docentes:

1. Presidente: Dr. ROXANA FLORES QUISPE
2. Integrante: Mg. LUCY ANGELA DELGADO BARRA
3. Secretario: Ing. PEDRO ALEX RODRIGUEZ GONZALEZ

Que mediante ACTA DE CONFORMIDAD DEL PROYECTO DE PLAN DE TESIS el jurado evaluador acordó APROBAR y continuar con el trámite correspondiente.
Que la Unidad de Investigación de la Facultad de Ingeniería de Producción y Servicios es la encargada de registrar, revisar y aprobar los Proyectos de Planes de Tesis, de conformidad con lo dispuesto en el Estatuto y el Reglamento de Grados y Títulos (RCU 255-2021-UNSA) vigente, en uso de las atribuciones conferidas a esta Decanato y conforme a la designación efectuada.

SE RESUELVE:
1. Aprobar el Proyecto de Plan de Tesis titulada:

MEDICIÓN DE LA SEGURIDAD DIGITAL DE LOS PORTALES INSTITUCIONALES DE LAS UNIVERSIDADES PÚBLICAS DEL ESTADO PERUANO

RESOLUCIÓN DECANAL NRO. 247-2022-FIPS-UNAS

Arequipa, 31 de mayo de 2022

Vista.
La solicitud del (los) Bachiller(es):

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Quienes solicitan la aprobación del Proyecto de Plan de Tesis para la obtención del TITULO PROFESIONAL de CIENCIA DE LA COMPUTACIÓN

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Que el director de la Unidad de Investigación designo el jurado para la evaluación del Proyecto de Plan de Tesis titulado: UNA SISTEMATIZACIÓN DE LOS CORPUS DE HABLA INFANTIL PARA EL RECONOCIMIENTO AUTOMÁTICO DE EMOCIONES
Integrado por los docentes:

1. Presidente: Mg. WILBER ROBERTO RAMOS LOVON
2. Integrante: Mg. YUBER ELMER VELAZCO PAREDES
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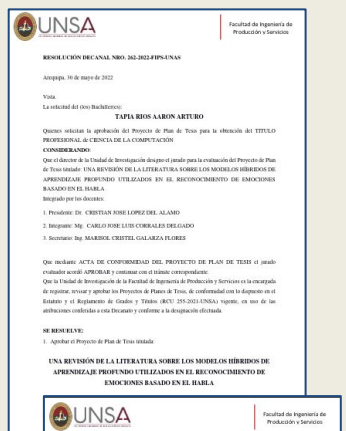
SE RESUELVE:
1. Aprobar el Proyecto de Plan de Tesis titulada:

UNA SISTEMATIZACIÓN DE LOS CORPUS DE HABLA INFANTIL PARA EL RECONOCIMIENTO AUTOMÁTICO DE EMOCIONES



RESOLUCIÓN DECANAL NRO. 262-2022-FIPS-UNAS

Arequipa, 30 de mayo de 2022

Vista.
La solicitud del (los) Bachiller(es):

TAPIA RIOS AARON ARTURO

Quienes solicitan la aprobación del Proyecto de Plan de Tesis para la obtención del TITULO PROFESIONAL de CIENCIA DE LA COMPUTACIÓN

CONSIDERANDO
Que el director de la Unidad de Investigación designo el jurado para la evaluación del Proyecto de Plan de Tesis titulado: UNA REVISIÓN DE LA LITERATURA SOBRE LOS MODELOS HÍBRIDOS DE APRENDIZAJE PROFUNDO UTILIZADOS EN EL RECONOCIMIENTO DE EMOCIONES BASADO EN EL HABLA
Integrado por los docentes:

1. Presidente: Dr. CRISTIAN JOSE LOPEZ DEL ALAMO
2. Integrante: Mg. CARLO JOSE LUIS CORRALES DELGADO
3. Secretario: Ing. MARESOL CRISTEL GALARZA FLORES

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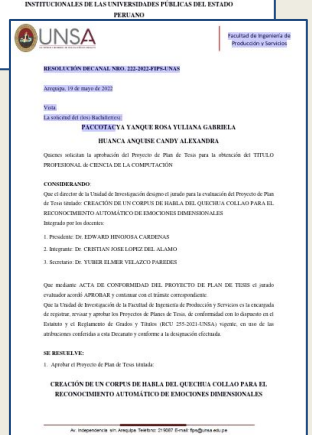
SE RESUELVE:
1. Aprobar el Proyecto de Plan de Tesis titulada:

UNA REVISIÓN DE LA LITERATURA SOBRE LOS MODELOS HÍBRIDOS DE APRENDIZAJE PROFUNDO UTILIZADOS EN EL RECONOCIMIENTO DE EMOCIONES BASADO EN EL HABLA



RESOLUCIÓN DECANAL NRO. 222-2022-FIPS-UNAS

Arequipa, 19 de mayo de 2022

Vista.
La solicitud del (los) Bachiller(es):

PACCOTACYA YANQUE ROSA YULIANA GABRIELA
HUANCA ANQUISE CANDY ALEXANDRA

Quienes solicitan la aprobación del Proyecto de Plan de Tesis para la obtención del TITULO PROFESIONAL de CIENCIA DE LA COMPUTACIÓN

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Que el director de la Unidad de Investigación designo el jurado para la evaluación del Proyecto de Plan de Tesis titulado: CREACIÓN DE UN CORPUS DE HABLA DEL QUECHUA COLLAO PARA EL RECONOCIMIENTO AUTOMÁTICO DE EMOCIONES DIMENSIONALES
Integrado por los docentes:

1. Presidente: Dr. EDWARD HINOJOSA CARDENAS
2. Integrante: Dr. CRISTIAN JOSE LOPEZ DEL ALAMO
3. Secretario: Dr. YUBER ELMER VELAZCO PAREDES

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SE RESUELVE:
1. Aprobar el Proyecto de Plan de Tesis titulada:

CREACIÓN DE UN CORPUS DE HABLA DEL QUECHUA COLLAO PARA EL RECONOCIMIENTO AUTOMÁTICO DE EMOCIONES DIMENSIONALES

RESOLUCIÓN DECANAL NRO. 279-2022-FIPS-UNAS

Arequipa, 07 de junio de 2022

Vista.
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CRUZ VALDIVIA KATERINE MELIDA

Quienes solicitan la aprobación del Proyecto de Plan de Tesis para la obtención del TITULO PROFESIONAL de CIENCIA DE LA COMPUTACIÓN

CONSIDERANDO
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Integrado por los docentes:

1. Presidente: Mg. RICARDO FABRIZIO CALIENES RODRIGUEZ
2. Integrante: Mg. CARLO JOSE LUIS CORRALES DELGADO
3. Secretario: Ing. ELIANA MARIA ADRIAZOLA HERRERA

Que mediante ACTA DE CONFORMIDAD DEL PROYECTO DE PLAN DE TESIS el jurado evaluador acordó APROBAR y continuar con el trámite correspondiente.
Que la Unidad de Investigación de la Facultad de Ingeniería de Producción y Servicios es la encargada de registrar, revisar y aprobar los Proyectos de Planes de Tesis, de conformidad con lo dispuesto en el Estatuto y el Reglamento de Grados y Títulos (RCU 255-2021-UNSA) vigente, en uso de las atribuciones conferidas a esta Decanato y conforme a la designación efectuada.

SE RESUELVE:
1. Aprobar el Proyecto de Plan de Tesis titulada:

UN CATÁLOGO DE MENSAJES PERSUASIVOS PARA MEJORAR EL RENDIMIENTO ACADÉMICO EN LOS ESTUDIANTES UNIVERSITARIOS A TRAVÉS DE LA REGULACIÓN DEL ESTRÉS

RESOLUCIÓN DECANAL NRO. 260-2022-FIPS-UNAS

Arequipa, 31 de mayo de 2022

Vista.
La solicitud del (los) Bachiller(es):

HUMPIRE CUTIPA HAYDE LUZMILA

Quienes solicitan la aprobación del Proyecto de Plan de Tesis para la obtención del TITULO PROFESIONAL de CIENCIA DE LA COMPUTACIÓN

CONSIDERANDO
Que el director de la Unidad de Investigación designo el jurado para la evaluación del Proyecto de Plan de Tesis titulado: EVALUACIÓN DE DESEMPEÑO DE LAS REDES NEURONALES RECURRENTES (LSTM) EN ESCENARIOS ATÍPICOS DE RECONOCIMIENTOS DE EMOCIONES DIMENSIONALES
Integrado por los docentes:

1. Presidente: Mg. JUAN CARLOS GUTIERREZ CACERES
2. Integrante: Mg. WILBER ROBERTO RAMOS LOVON
3. Secretario: Dr. EDWARD HINOJOSA CARDENAS

Que mediante ACTA DE CONFORMIDAD DEL PROYECTO DE PLAN DE TESIS el jurado evaluador acordó APROBAR y continuar con el trámite correspondiente.
Que la Unidad de Investigación de la Facultad de Ingeniería de Producción y Servicios es la encargada de registrar, revisar y aprobar los Proyectos de Planes de Tesis, de conformidad con lo dispuesto en el Estatuto y el Reglamento de Grados y Títulos (RCU 255-2021-UNSA) vigente, en uso de las atribuciones conferidas a esta Decanato y conforme a la designación efectuada.

SE RESUELVE:
1. Aprobar el Proyecto de Plan de Tesis titulada:

EVALUACIÓN DE DESEMPEÑO DE LAS REDES NEURONALES RECURRENTES (LSTM) EN ESCENARIOS ATÍPICOS DE RECONOCIMIENTOS DE EMOCIONES DIMENSIONALES

Tesis de posgrado

DECRETO DIRECTORAL Nº 0020-2021-EPG/UNSA

Arequipa, 24 de noviembre del 2021

Visto la solicitud de Doña ALESSANDRA DANIELA DELGADO MATTOS, quien solicita nombramiento de jurado para sustentar su Tesis de MAESTRIA EN CIENCIAS: INFORMÁTICA, CON MENCIÓN EN TECNOLOGÍAS DE LA INFORMACIÓN Y COMUNICACIÓN EN GESTIÓN Y EDUCACIÓN.

CONSIDERANDO:
Que, los Estudios de Posgrado conducen optar los Grados Académicos de Maestro(a) y Doctor(a) de conformidad con lo dispuesto en el Estatuto de la UNSA, el Reglamento vigente de la Escuela de Posgrado y en uso de las atribuciones conferidas a esta Escuela.
Habiéndose realizado en la Escuela de Posgrado el sorteo de jurado de tesis el día: 24 de noviembre del 2021.

SE DECRETA:
1. Nombrar al Jurado integrado por los Señores Docentes:
- Mag. Ana María Cuadros Valdivia
- Mag. Vicente Enrique Machaca Arceda
- Dr. Alvaro Ernesto Cuno Parari (Asesor)

Presidido por el primero de los nombrados.

ACTA DE EVALUACIÓN DE RENDIMIENTO PRUEBA DE CUALIFICACIÓN PARA DOCTORANDOS EN CIENCIAS DE LA COMPUTACION

Dando cumplimiento a la Evaluación del Doctorado en Ciencias de la Computación, se realizó al examen de cualificación rendida por el (la):

Maguier:

ANGELA GABRIELA MAYHUA QUISPE

Cuyo Título de Tesis es:

MODELO BASADO EN MACHINE LEARNING PARA LA DISTINCIÓN ENTRE ANSIEDAD Y DEPRESION A PARTIR DE SENALES FISIOLÓGICAS

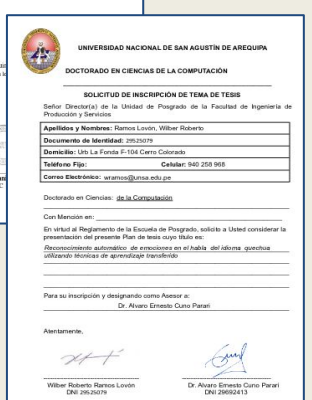
Al final, y luego de la calificación respectiva.

La nota obtenida fue:

Nota: 15
En números

Arequipa, 30 de Diciembre 2021

Dr. Alvaro Henry Mamani
Coordinador DCC



UNIVERSIDAD NACIONAL DE SAN AGUSTÍN DE AREQUIPA

DOCTORADO EN CIENCIAS DE LA COMPUTACIÓN

SOLICITUD DE INSCRIPCIÓN DE TEMA DE TESIS

Señor Director(a) de la Unidad de Posgrado de la Facultad de Ingeniería de Producción y Servicios

Apellidos y Nombres:	Ramos Lovón, Wilber Roberto
Documento de Identidad:	29525079
Domicilio:	Urb La Fonda F-104 Cerro Colorado
Teléfono Fijo:	Celular: 940 258 968
Correo Electrónico:	wramos@unsa.edu.pe

Doctorado en Ciencias: de la Computación

Con Mención en:

En virtud al Reglamento de la Escuela de Posgrado, solicito a Usted considerar la presentación del presente Plan de tesis cuyo título es:

Reconocimiento automático de emociones en el habla del idioma quechua utilizando técnicas de aprendizaje transferido

Para su inscripción y designando como Asesor a:
Dr. Alvaro Ernesto Cuno Parari

Atentamente,

Wilber Roberto Ramos Lovón
DNI 29525079

Dr. Alvaro Ernesto Cuno Parari
DNI 29692413

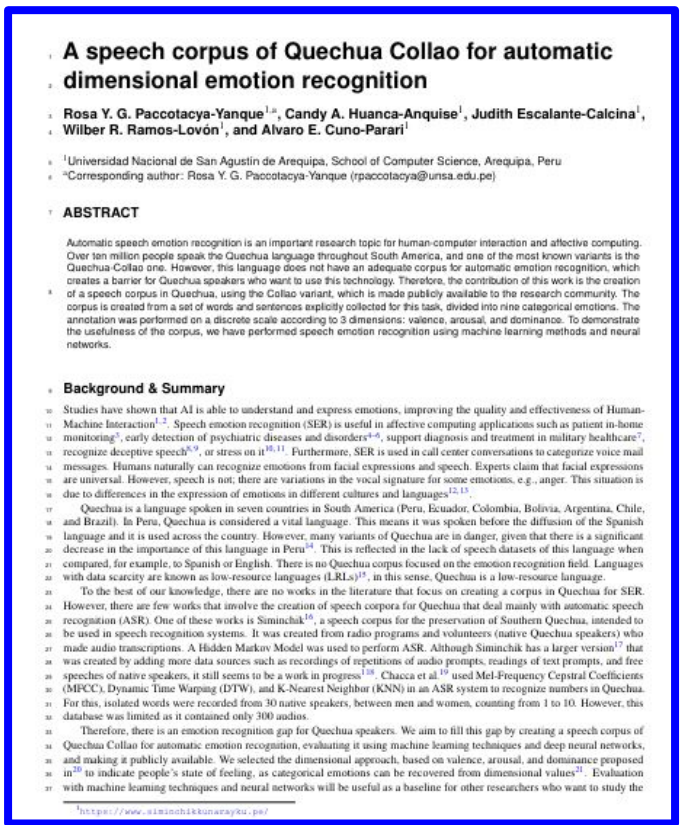
1 tesis de maestría sustentada

2 planes de tesis de doctorado aprobados

KUSISQA: resultados

Proyecto Concytec Banco Mundial

(Opcional) Para la línea de investigación a crear, fortalecer o consolidar: Al menos un (01) artículo científico, presentado o aceptado para publicación en revistas indizadas, de proyectos que tengan en curso o culminados



A speech corpus of Quechua Collao for automatic dimensional emotion recognition

Rosa Y. G. Paccotacya-Yanque[1,a], Candy A. Huanca-Anquise[1], Judith Escalante-Calcina[1], Wilber R. Ramos-Lovón[1], and Alvaro E. Cuno-Parari[1]

[1]Universidad Nacional de San Agustín de Arequipa, School of Computer Science, Arequipa, Peru
[a]Corresponding author: Rosa Y. G. Paccotacya-Yanque (rpaccotacya@unsa.edu.pe)

ABSTRACT

Automatic speech emotion recognition is an important research topic for human-computer interaction and affective computing. Over ten million people speak the Quechua language throughout South America, and one of the most known variants is the Quechua-Collao one. However, this language does not have an adequate corpus for automatic emotion recognition, which creates a barrier for Quechua speakers who want to use this technology. Therefore, the contribution of this work is the creation of a speech corpus in Quechua, using the Collao variant, which is made publicly available to the research community. The corpus is created from a set of words and sentences explicitly collected for this task, divided into nine categorical emotions. The annotation was performed on a discrete scale according to 3 dimensions: valence, arousal, and dominance. To demonstrate the usefulness of the corpus, we have performed speech emotion recognition using machine learning methods and neural networks.

Background & Summary

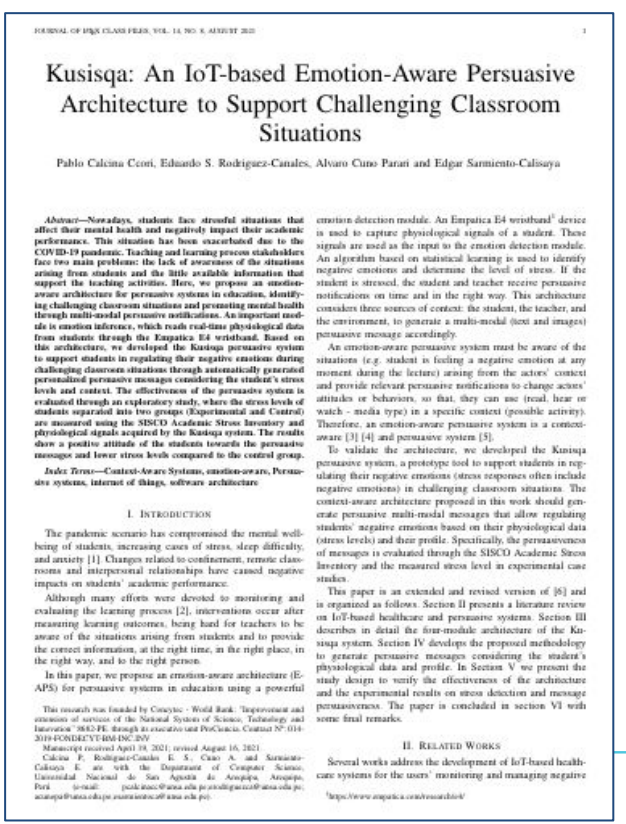
Studies have shown that AI is able to understand and express emotions, improving the quality and effectiveness of Human-Machine Interaction[1,2]. Speech emotion recognition (SER) is useful in affective computing applications such as patient in-home monitoring[3], early detection of psychiatric diseases and disorders[4–6], support diagnosis and treatment in military healthcare[7], recognize deceptive speech[8,9], or stress on it[10,11]. Furthermore, SER is used in call center conversations to categorize voice mail messages. Humans naturally can recognize emotions from facial expressions and speech. Experts claim that facial expressions are universal. However, speech is not; there are variations in the vocal signature for some emotions, e.g., anger. This situation is due to differences in the expression of emotions in different cultures and languages[12,13].

Quechua is a language spoken in seven countries in South America (Peru, Ecuador, Colombia, Bolivia, Argentina, Chile, and Brazil). In Peru, Quechua is considered a vital language. This means it was spoken before the diffusion of the Spanish language and it is used across the country. However, many variants of Quechua are in danger, given that there is a significant decrease in the importance of this language in Peru[14]. This is reflected in the lack of speech datasets of this language when compared, for example, to Spanish or English. There is no Quechua corpus focused on the emotion recognition field. Languages with data scarcity are known as low-resource languages (LRLs)[15], in this sense, Quechua is a low-resource language.

To the best of our knowledge, there are no works in the literature that focus on creating a corpus in Quechua for SER. However, there are few works that involve the creation of speech corpora for Quechua that deal mainly with automatic speech recognition (ASR). One of these works is Siminchik[16], a speech corpus for the preservation of Southern Quechua, intended to be used in speech recognition systems. It was created from radio programs and volunteers (native Quechua speakers) who made audio transcriptions. A Hidden Markov Model was used to perform ASR. Although Siminchik has a larger version[17] that was created by adding more data sources such as recordings of repetitions of audio prompts, readings of text prompts, and free speeches of native speakers, it still seems to be a work in progress[18]. Chacca et al.[19] used Mel-Frequency Cepstral Coefficients (MFCC), Dynamic Time Warping (DTW), and K-Nearest Neighbor (KNN) in an ASR system to recognize numbers in Quechua. For this, isolated words were recorded from 30 native speakers, between men and women, counting from 1 to 10. However, this database was limited as it contained only 300 audios.

Therefore, there is an emotion recognition gap for Quechua speakers. We aim to fill this gap by creating a speech corpus of Quechua Collao for automatic emotion recognition, evaluating it using machine learning techniques and deep neural networks, and making it publicly available. We selected the dimensional approach, based on valence, arousal, and dominance proposed in[20] to indicate people's state of feeling, as categorical emotions can be recovered from dimensional values[21]. Evaluation with machine learning techniques and neural networks will be useful as a baseline for other researchers who want to study the

[4]https://www.siminchikkunarayku.pe/



JOURNAL OF LATEX CLASS FILES, VOL. 14, NO. 8, AUGUST 2021 1

Kusisqa: An IoT-based Emotion-Aware Persuasive Architecture to Support Challenging Classroom Situations

Pablo Calcina Ccori, Eduardo S. Rodriguez-Canales, Alvaro Cuno Parari and Edgar Sarmiento-Calisaya

Abstract—Nowadays, students face stressful situations that affect their mental health and negatively impact their academic performance. This situation has been exacerbated due to the COVID-19 pandemic. Teaching and learning process stakeholders face two main problems: the lack of awareness of the situations arising from students and the little available information that support the teaching activities. Here, we propose an emotion-aware architecture for persuasive systems in education, identifying challenging classroom situations and promoting mental health through multi-modal persuasive notifications. An important module is emotion inference, which reads real-time physiological data from students through the Empatica E4 wristband. Based on this architecture, we developed the Kusisqa persuasive system to support students in regulating their negative emotions during challenging classroom situations through automatically generated personalized persuasive messages considering the student's stress levels and context. The effectiveness of the persuasive system is evaluated through an exploratory study, where the stress levels of students separated into two groups (Experimental and Control) are measured using the SISCO Academic Stress Inventory and physiological signals acquired by the Kusisqa system. The results show a positive attitude of the students towards the persuasive messages and lower stress levels compared to the control group.

Index Terms—Context-Aware Systems, emotion-aware, Persuasive systems, internet of things, software architecture

I. Introduction

The pandemic scenario has compromised the mental well-being of students, increasing cases of stress, sleep difficulty, and anxiety [1]. Changes related to confinement, remote classrooms and interpersonal relationships have caused negative impacts on students' academic performance.

Although many efforts were devoted to monitoring and evaluating the learning process [2], interventions occur after measuring learning outcomes, being hard for teachers to be aware of the situations arising from students and to provide the correct information, at the right time, in the right place, in the right way, and to the right person.

In this paper, we propose an emotion-aware architecture (E-APS) for persuasive systems in education using a powerful emotion detection module. An Empatica E4 wristband[1] device is used to capture physiological signals of a student. These signals are used as the input to the emotion detection module. An algorithm based on statistical learning is used to identify negative emotions and determine the level of stress. If the student is stressed, the student and teacher receive persuasive notifications on time and in the right way. This architecture considers three sources of context: the student, the teacher, and the environment, to generate a multi-modal (text and images) persuasive message accordingly.

An emotion-aware persuasive system must be aware of the situations (e.g. student is feeling a negative emotion at any moment during the lecture) arising from the actors' context and provide relevant persuasive notifications to change actors' attitudes or behaviors, so that, they can use (read, hear or watch - media type) in a specific context (possible activity). Therefore, an emotion-aware persuasive system is a context-aware [3] [4] and persuasive system [5].

To validate the architecture, we developed the Kusisqa persuasive system, a prototype tool to support students in regulating their negative emotions (stress responses often include negative emotions) in challenging classroom situations. The context-aware architecture proposed in this work should generate persuasive multi-modal messages that allow regulating students' negative emotions based on their physiological data (stress levels) and their profile. Specifically, the persuasiveness of messages is evaluated through the SISCO Academic Stress Inventory and the measured stress level in experimental case studies.

This paper is an extended and revised version of [6] and is organized as follows. Section II presents a literature review on IoT-based healthcare and persuasive systems. Section III describes in detail the four-module architecture of the Kusisqa system. Section IV develops the proposed methodology to generate persuasive messages considering the student's physiological data and profile. In Section V we present the study design to verify the effectiveness of the architecture and the experimental results on stress detection and message persuasiveness. The paper is concluded in section VI with some final remarks.

II. Related Works

Several works address the development of IoT-based healthcare systems for the users' monitoring and managing negative

[1]https://www.empatica.com/research/e4/

Engineering Context-Aware Persuasive Systems: A Scenario-based Approach for Understanding and Modeling Context in Persuasion

EDGAR SARMIENTO-CALISAYA*, PABLO C. CALCINA-CCORI*, and ALVARO CUNO*, Universidad Nacional de San Agustín de Arequipa, Perú

In the last decades, persuasive systems have been developed and applied in different domains (e.g. fund-raising, marketing, e-health, e-education) in order to influence the feeling, attitude or behavior of users through persuasive notifications - messages. Special thrust has been put on characteristics related to the application domain, psychological strategies used for persuasion and explicit user interaction with the system. However, there is a relatively limited discussion in the literature on how take advantage of context information to also enable implicit user interactions and personalized interventions, i.e., allowing the persuasive system to be aware of the persuasion context and intelligently adopt the persuasion strategy (message and mechanism) to this context at runtime - personalization.

The aim is the integration of context-awareness into persuasive systems engineering approaches. However, context-awareness raises a variety of software-engineering challenges. In this paper, we address these challenges by introducing a set of factors related to context and proposing a set of tasks and models to: 1) understand persuasion situations - context conceptualization, 2) determine what elements of the persuasion environment are relevant to sense context, 3) determine the rules for how the system should adapt the persuasion strategy in different persuasion situations, and 4) base the design on this insights. We also present an engineering approach that can be used in conjunction with these tasks, models and templates.

The proposal is illustrated through the development of a persuasive system for stress detection and management in students during challenging classroom situations. Additionally, the application of the proposal has been evaluated by a team of software engineers experienced with the field of intelligent, context-aware or IoT systems design.

The proposed approach will help practitioners and researchers to integrate context-awareness into persuasive systems in a systematic way, enabling personalization and improving persuasion.

CCS Concepts • Human-centered computing → Ubiquitous and mobile computing design and evaluation methods; • Software and its engineering → Requirements analysis; Software design engineering.

Additional Key Words and Phrases: persuasive system, context-aware system, context, context-awareness, emotion-awareness, requirements engineering, software architecture

ACM Reference Format:
Edgar Sarmiento-Calisaya, Pablo C. Calcina-Ccori, and Alvaro Cuno. 2022. Engineering Context-Aware Persuasive Systems: A Scenario-based Approach for Understanding and Modeling Context in Persuasion. In ACM, New York, NY, USA, 12 pages. https://doi.org/XXXXXXX.XXXXXXX

*Both authors contributed equally to this research.

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Conference acronym 'XX, June 03–05, 2022, Woodstock, NY
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ACM ISBN 978-1-4503-XXXX-X/18/06…$15.00
https://doi.org/XXXXXXX.XXXXXXX

1 INTRODUCTION

Nowadays, we are surrounded by technological products (hardware and software) designed to influence what we think, what we do, how we behave or what action we take in any situation. In this context, Persuasive Systems (PS) have been developed to influence, reinforce, change, or shape the feeling, attitude or behavior of users [26] [57]. That is, the change of attitude occur through interventions based on persuasive notifications, which come through internet, mobile or consumer electronic devices. Then, Persuasive Systems are Ubiquitous and Pervasive. Notifications are usually based on textual messages, which are designed using strategies like Cialdini's Principles of Persuasion [14].

Persuasion through textual messages has been used to promote positive attitude or change behavior in numerous domains such as environment and sustainability [52] [12] [68], e-commerce and marketing [43] [3] [42] [39], charity and donations [79] [81], health and well being [75] [44] [49] [76] [58] [43], office workplace environment [83] [82] [34] and even in the teaching-learning environments [29] [5] [19] [80] [28].

Although textual notifications are effective in some domains (Fig. 1a), in other ones, persuasive systems should be more intelligent and dynamically *personalize the persuasion strategy*, that is, system understands the persuasion situations arising from the users and provides the right information, at the right time, in the right place, in the right way, and to the right person (Fig. 1b).

Research in the literature and industry have mainly focused on explicit user interaction with persuasive systems, i.e. user leaves his/her current tasks to interact with the system. However, the availability of advanced sensing technologies and research on Implicit Human-Computer Interaction (iHCI) [66] [18] [32] and Context-Aware Systems (C-AS) [20] [25] [4] can enable a shift in persuasive systems from explicit interaction (Fig. 2a) towards an implicit interaction mode based on context (Fig. 2b), i.e., system is aware of the situations in which the user expects services and intelligently *personalize the persuasion strategy* at runtime without obstructing user's current tasks. Then, user's attitude can be changed in a progressive way.

Context-awareness allows the system to understand the situations in which the user expects services or functionalities delivered and in which way [4]. Therefore, a *Context-Aware Persuasive System (C-APS)* is aware of the persuasion situations arising from the user in his/her real context based on sensor data, and intelligently determines the notification mechanism (text, audio, video, cartoon, …), composes the persuasion message and provides relevant persuasive notifications to change user's attitudes, as in Fig. 3.

Despite C-APSs have successfully developed and deployed in industry and research, there is still dearth in research about how

KUSISQA: transferencia (equipos)

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Conclusiones

- Se ha cumplido a cabalidad todas las metas comprometidas entre el FONDECYT y la UNSA
- Se han formado recursos humanos capacitados en Inteligencia Artificial para el reconocimiento de emociones humanas
- Se ha promovido el desarrollo interdisciplinar (computación, psicología, educación, electrónica)

Recomendaciones

- Formalizar la creación de las líneas de investigación desarrolladas en el proyecto Kusisqa:
  - Ingeniería de Software experimental, convenio COPPE-UFRJ
  - Paralingüística Computacional
  - Internet de las Cosas
  - Machine Learning
- Crear laboratorios de investigación, que establezca el vínculo entre estudiantes, de las Escuelas de Pregrado y Posgrado que dirige la SCC.
- Difundir las investigaciones realizadas de la EPCC, SCC a la comunidad universitaria Agustina y a la comunidad regional.

Agradecimientos

Proyecto Concytec Banco Mundial

Integrantes

Monitoras Fondecyt

UNSA Vicerrectorado de Investigación

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UNSA investiga

Computer Science

Tesoreria

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Próximos pasos

Próximos pasos (corto plazo)

Pulseras E4 (US$ 2000 aprox.)

Smartwatch (US$ 350)

Próximos pasos (mediano plazo)

Proyecto
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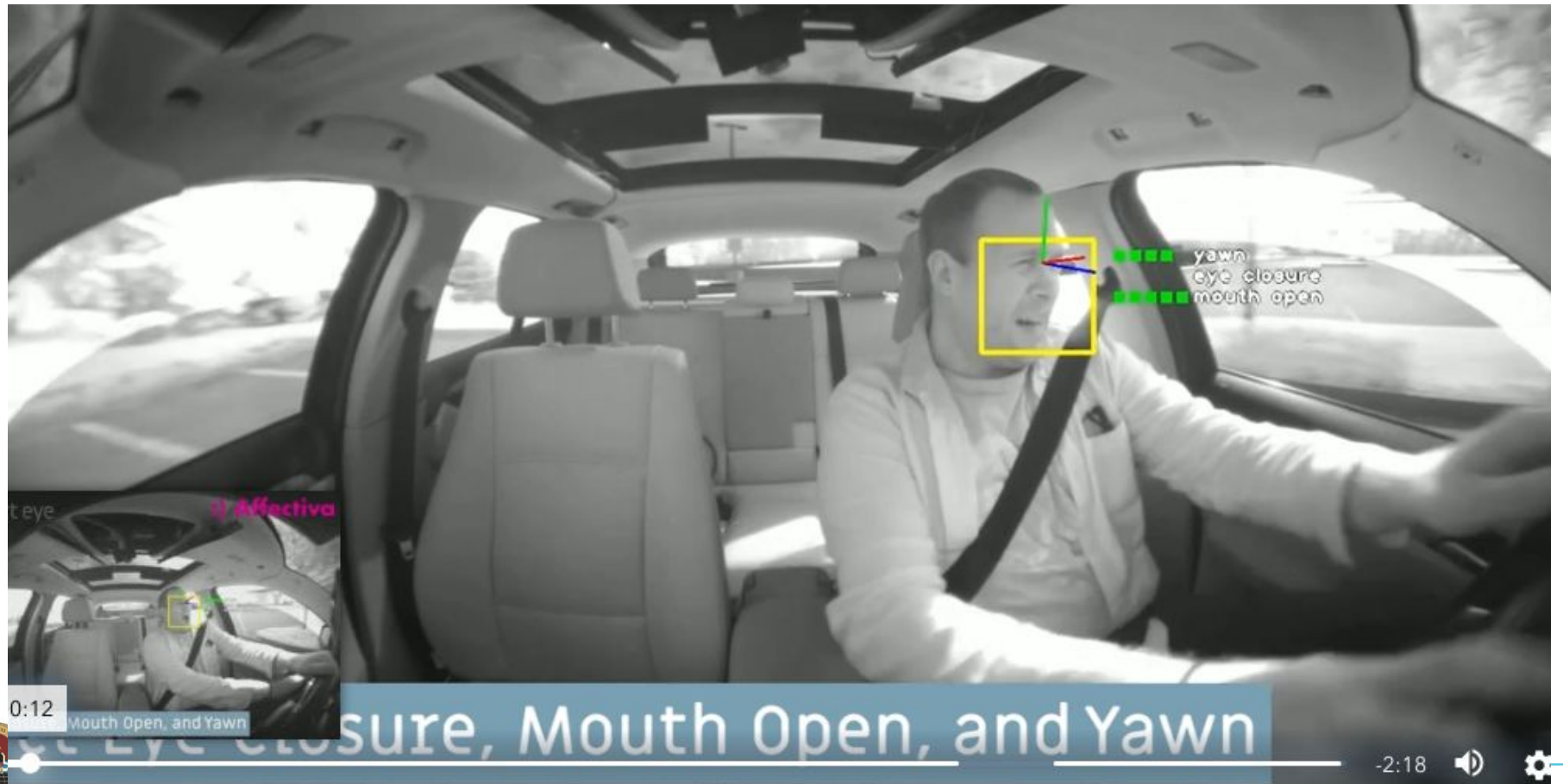
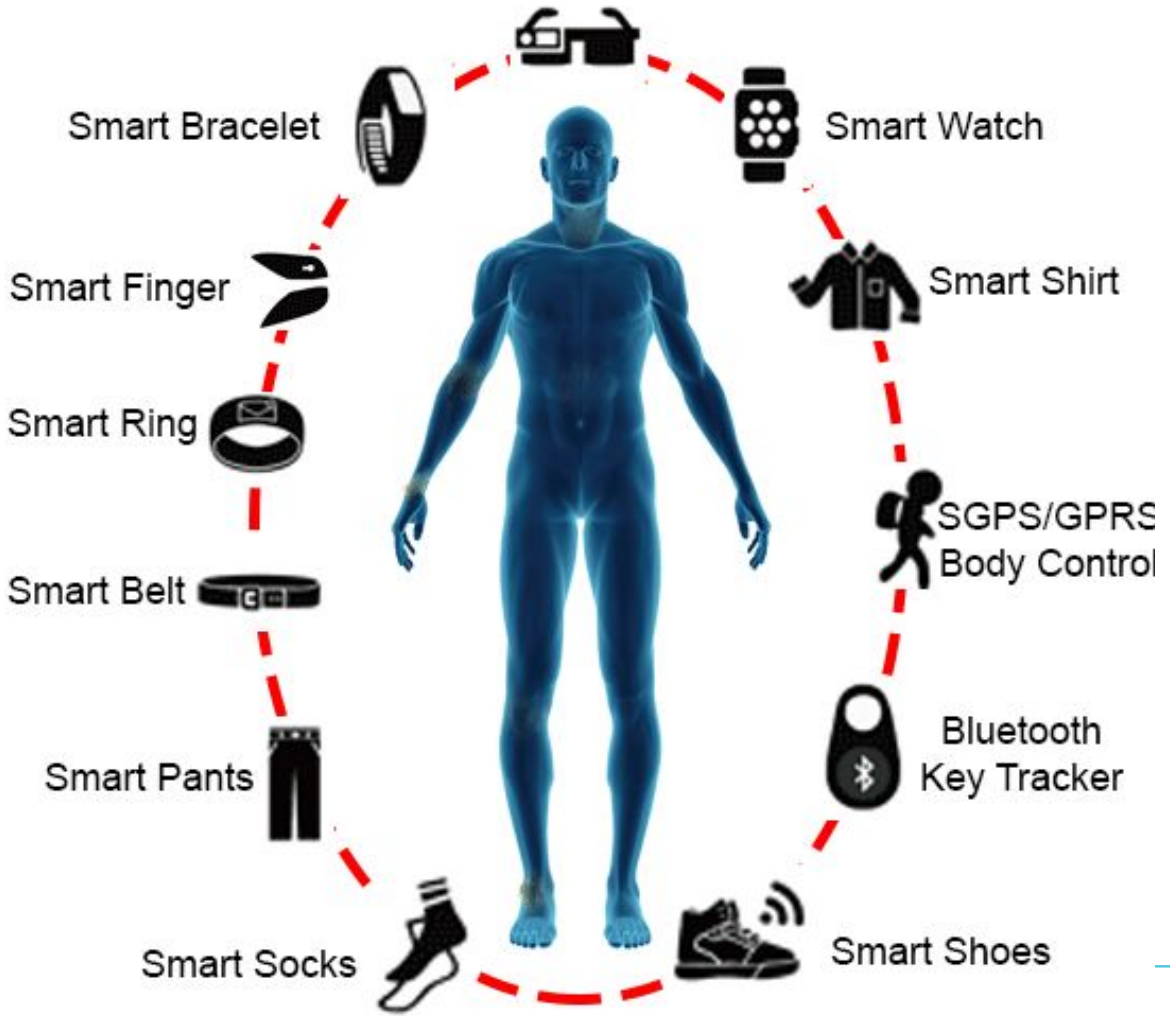


Próximos pasos (largo plazo)



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JUNTOS ESTAMOS TRANSFORMANDO EL PERÚ

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