

# Emotions and Activity Recognition. A computer vision approach for augmentation of psychosocial risk evaluation.

Computer vision assistance in psychosocial risk factor evaluation via emotions and activities monitoring.

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## Abstract

Psychosocial risk evaluation has played a dominant role in ensuring the wellbeing and health of people. Nevertheless, mechanisms such as interviews and questionnaires are susceptible to inaccurate or skewed results due to the lack of data that cannot be acquired during assessments. This work proposes an initial approach to identify activities and emotions that are implicitly queried by current evaluations and have the potential of being detected by cameras. By extracting features from video frames using computer vision, machine learning-oriented classifiers become feasible to conduct continuous and non-intrusive monitoring. Activities and emotions registering could provide additional data to support better-informed psychosocial risk evaluations.

## 1 Introduction

According to the World Health Organization, a risk factor is defined as any trait or exposure of an individual that could increase the probability of suffering any disease or injury[1]. Among different types of risk factors that can influence health, there are chemical[2]; biological[3]; environmental[4] and psycho-social. This last one, involves physical aspects of the environment, such as noise or temperature[5]; psychological aspects in people such as stress[6] and burnout caused by high workloads or persistent excess in working hours[7][8].

Throughout the last fifty years, several psycho-social assessment methods have been created by medical and psychology professionals, to allow quantitative and qualitative evaluation of psychosocial risk exposure. A psycho-social assessment is an evaluation of mental, physical, and emotional health[ ]. Usually, it takes the form of a series of questions and screening tools, covering many aspects of a person's life to get a picture of his or her mental state[ ]. With that information, professionals can draw recommendations about specific environmental issues or treatment plans[ ].

On the other hand, since the end of the eighties, artificial intelligence has been used for applications in (specify kind of industry) industry, aeronautics, autonomous driving. As it is evolving, it has allowed the manufacturing of many devices for producing and interpreting the text, recognize speech, and even generate entities such as eBay's virtual agents. Artificial intelligence sub-disciplines such as machine Learning provides algorithmic tools to analyze data, as well as to design, train, and deploy models into applications or processes. However, machine learning algorithms and other artificial intelligence approaches are still under research in other areas such as well-being and psycho-social evaluations.

The main goal of the present project is to identify a potential contribution of artificial intelligence to psychosocial risk assessment, by performing a state-of-the-art review of evaluation methods and current technological approaches to support them. This project will present implicit scenarios from questionnaires, where some artificial intelligence disciplines such as computer vision and machine learning, can be applied to obtain additional information for better informed assessments.

The present work is composed of seven sections, including the previous introduction. In section 2, we present the Psycho-social Risk Assessment (PRIA) advantages and limitations, as well as technological

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approaches that support some aspects of PRIA. In section 3, we show the problem statement by describing the keywords review about the gap between artificial intelligence and PRIA. Also, it states the motivation of the present work. Section 4 is devoted to the description of questionnaire items that have the potential of being measured by extracting data captured with surveillance cameras. Section 5 list a set of articles oriented to recognize activities and emotions via single and multi-mode systems. Therefore, it will show techniques and methodologic references for the design and implementation of architectures based on artificial intelligence. Section 6 presents a brief review of motion-capture libraries that can be a potential component for feature extraction. In section 7, experimentation of selected libraries will be shown, using public video databases. Finally, we conclude the presented material in Section 8.

## 2 Related work

Within the context of psychosocial risk factors, some variants may be inherent individually or together in a work environment. It is essential to clarify that the environments can be external when working outdoors and internal when working indoors. The most common types of risks for both cases are: Physical risks (also known as workplace risk) refer to aspects of the environment where the work takes place. Among the most significant aspects are noise, lighting, or the temperature of the environment[9][10]. Chemical risks are highly related to industrial environments where any worker may have contact with dust, gases, or abrasive products[11][12]. Biological risks involve contact with living things such as fungi, bacteria, or viruses, particularly by the interaction with people who may have a disease, infections, animals, or plants that may be carriers of a harmful organism[13][14]. Mechanical risks may be associated with some aspects of the work environment. It is related to heavy machinery usage or the development of an activity in which any person exposes to the effects of vibration [15][16]. Environmental type risks involve scenes or work, where there is a high probability of floods, storms, or contamination[17][18]. Finally, psychosocial risks occur in the normal execution of daily activities. These are strongly related to the work conditions, people’s interaction, and socio-demographic conditions. Among the most studied aspects, it is stress, monotony, and job fatigue due to excess hours worked[19][20]. As this last type of risk is the main focus of the present work, section 2.1 will present the evaluation methods.

### 2.1 Psychosocial Risk Assessment (PRIA)

Currently, some methods facilitate the evaluation of FRP developed from the integration of models and scales, which seek to qualify risk factors. In works such as Charria, Sarsosa, and Arenas[21] is suggested a taxonomy of mechanisms, taking into account the form in the information extracted and its scope. In this work, there are two large groups of questionnaires oriented to industrial hygiene and psychosocial factors. In the first group, evaluates aspects such as the work environment, the physical effects on workers, and details of hiring and remuneration. The assessments of these aspects use questionnaires that are carried out by an external agent to the organization, who seeks an objective evaluation of the situation. Some examples of this group are the Questionnaire for the Fifth European Survey on Working Conditions[] and the Quality of Life at Work Survey Questionnaire[]. In the second group, there are questionnaires oriented to psychosocial factors acquired through interviews or a self-report procedure. Interview questionnaires collect information related to job satisfaction, burnout, or bullying. On the other hand, self-report questionnaires extract information related to individual aspects of the person, such as the relationship between health and illness, aspects of daily life, and their social interactions. Some examples of this second group are the EAE Stress Assessment questionnaire[], the occupational burnout scale[], the Bocanument and Berján evaluation[], and the Demand-Control model[].

Concerning the groups of questionnaires mentioned, there are investigations which reveals that some conditions generate effects related to physical health such as musculoskeletal disorders[22] or the behavior of people such as sedentary lifestyle[23]. On the other hand, other studies show effects related to people’s mood[24] with mental health such as stress[25] and psychological disorders such as anxiety[26] or depression [27][28]. Although the psychosocial risk is widely related to work, it is not exclusive to these environments. Researches such as that of Abdullah Alotaibi[29], Christian Hederich[30], and Malarvili[31] address the relationship between sleep quality and stress in academic settings. Within the research carried out in the academic context, There are studies of the prevalence and correlation of depression, anxiety, and suicidal tendencies such as

Eisenberg's [32]. Other approaches, such as Danuta's[33], seek to identify the relationship of demographic aspects such as the students' place of residence as intervening variables in their state of health. It is also essential to show that in these scenarios, students are not the only actors prone to risk factors. Works such as that of Briones[34] and Pedditz[8] show a presence of stress and job exhaustion among teachers.

During the last years, many mechanisms have been developed in the form of questionnaires. These mechanisms have favored the improvement of interactions at work, the conditions of their organization, as well as the worker's abilities, needs, culture, and the personal situation outside of work, all of which, through perceptions and experiences, can influence health and performance and job satisfaction. However, the influence not only comes from the work environment[35] but also from the extra-work environment[36]. In this last aspect, psychosocial assessment methods seek to evaluate aspects such as time away from work activities, family relationships, the economy of the family group, commuting to work, among others. Some derivations or generalizations of the exposed evaluation methods have contributed to the improvement of well-being and good practices in the academic context, promoted or the development of a mechanism for the promise of stress management evidenced in Collen's work[37]. Other contributions have allowed approaches to identify the behaviors associated with happiness, well-being, and the stress perceived in university students[6].

The diversity of scenarios where evaluation methods play an essential role, in turn, entails a series of challenges of experimental validation, in which the aim is to establish correlation values of the aspects evaluated with the real scenario[38] or its factor structure[39]. Although there is high statistical support for several of the items raised within the questionnaires, it can be evidenced that the mechanisms and procedures are susceptible to variability and subjectivity in the measures[40][41]. Experimentations have the caveat that samples are related to a particular segment of the population. Also, some items in questionnaires assess relevant aspects of daily activities that are not observed by specialists in occupational safety and health that a. This last issue reduces the amount of evidence drastically to establish reference values[42].

## 2.2 Technologic approaches supporting PRIA

Some references have addressed some aspects related to the mental health of people in the workplace[43][44]. Some of these works have resulted in technological solutions for monitoring some specific aspects of psychosocial risk, ranging from the implementation of load controls on the extremities and other parts of the body based on sensors[45]. Other approaches focus on reducing accidents by detecting elements or obstacles that can generate an accident. Among these approaches, works that identify liquid spills or tools oriented to the environment can be noted[46]. On the other hand, to identify aspects related to the mental condition in people, approaches have been made through the use of artificial intelligence and computer vision. In some of these approaches, electroencephalogram images analysis is used to assess stress in people[47]. Other works such as those by Zack Zhu[48] or Raffaele Gravina[49], suggest alternative perspectives, based on the recognition of mood, from the capture of signals with portable electronic devices.

Other approaches address the capture and integration with other data sources, resulting in multimodal architectures[50][51], in which the processing of video images, text, signals, among others, is used to support the diagnosis of emotions[52]. Works such as that of Le Yang[53] and Poria Soujana[54] suggest the fusion of paralinguistic analysis, capturing interview responses, features of the face widely addressed[55][56], and eye movement[57]. Some approaches are oriented to detect the effects of psychosocial risk factors, such as stress by performance demands[58] and depression.

As technologies advance, there is plenty of benefits the research fields could acquire by adopting electronic devices to improve people's health in labor and academic environments. In these approaches, a significant contribution is evident in the analysis of voice patterns, and some aspects that are close related to psychosocial risk are addressed through research and implementation of sensors supported by some machine learning techniques. Nevertheless, even these advances represent significant potential for the manufacturing industry, construction, among others[59], there are studies such as that of Shall Mark's[60], where there is evidence of limitations for its adoption. Among the most significant implications there is cost affairs, the interruption of work activities, the intrusive nature represented in the discomfort with the devices and the privacy of people.

### 3 Problem statement

As mentioned in section 2, there are benefits and limitations in specific psychosocial risk assessment methods, and in the technological approaches using sensors that support some assessments. The limitations related to the interruption of people’s daily activities, in turn, entail an interpretation of cost and hindering of work in academic and labor fields. Furthermore, the intrusiveness associated with the use of electronic equipment for testing can provide data bias for testing. The latter corresponds to those cases in which the predisposition of people who are sometimes to electroencephalography, electromyography, or sensors aimed at measuring any skeletal muscle disorder is possible to the predisposition of the people evaluated. In addition to this, qualified personnel who are in charge of promoting the well-being and health of people do not have a detailed record of the risk factors that a particular person could be during the day.

According to these scenarios, a technological challenge can be seen, associated with data extraction, the cost attributed to the use of electronic equipment, and the bias implicit in them, corresponding to a technological challenge. In the works related in the section 2.2 and whose intervention was less intrusive, the focus was on facial recognition requiring close-up shots of the face. Additionally, although the evaluation was supported by measurement scales used in conventional evaluation methods, it can be seen that the extraction of information is strongly linked to the duration of the experimentation. Therefore, they lack continuous monitoring and can be recorded automatically. Another aspect of the problem that should be mentioned is the low number of works in which there is a conjunction between terms related to artificial intelligence and psychosocial risk assessment.

Table 1: Keywords related to psycho-social affairs.

Term.ID	Term	Search.Result	Total.Found
1	stress	302437	370
2	depression	101	186
3	anxiety	54469	38
4	sleep disorder	12516	19
5	eating disorder	11787	9
6	alcohol consumption	8370	4
7	burnout	7909	9
8	environmental risk	2497	12
9	eating habit	999	1
10	boredom	625	3
11	musculoskeletal disorder	463	1
12	tobacco consumption	404	0
13	drowsiness	324	24
14	biological risk	250	3
15	chemical risk	214	4
16	work fatigue	24	0
17	psychosocial	24057	10
18	psychosocial risk	672	2
19	psychosocial assessment	218	0
20	psychosocial evaluation	77	0
21	psychosocial factor	13	3
22	psychosocial risk factor	9	2

In the review carried out in the Web of Science browser, a date filter was applied to get articles published between 2000 and 2019. The quantities of search coincidences were extracted by using terms and keywords that are related to psychosocial risk factors. Additionally, the search for the above terms was executed by adding conjunction operators to terms and keywords related to artificial intelligence and machine learning. With the mentioned procedure, we expected to identify technological approaches where classification or regression tasks were defined to support psychosocial assessment. **Table 1**, shows the summary of amounts of work related to relevant topics in the context of them and their conjunction with terms related to AI. This evidence gives us an initial overview of technological contributions at the research level on issues that surrounds psychosocial risk factors.

During the searching procedure, we add specific terms. A low number of works related to assessment can be seen in conjunction with terms related to artificial intelligence. A keywords selection, coding, and mapping were performed before the executions of queries. The selected terms were *artificial intelligence*, *computer vision*, *machine learning*, *neural network*, *deep learning*, *random forest*, *SVM*, *decision tree*, *linear regression*, *logistic regression*, *naive bayes*, *markov chain*, *fuzzy logic*, and *ensamble models*. Each term was coded in ascending numbering from 1 to 14, using the letter “T” as a prefix (see **Table 2**). Although there was evidences of works that address topics that surround our topic of interest, Their scope was oriented to specific aspects with little or no reference in its use within an interstate psycho-social assessment.

Table 2: Number of articles found with terms conjunction.

Term.ID	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	Total.Found
1	7	4	77	198	12	8	11	4	4	5	0	5	14	21	370
2	5	0	75	63	7	3	7	6	3	10	0	1	2	4	186
3	5	1	17	6	0	0	3	1	0	5	0	0	0	0	38
4	0	1	9	8	1	0	0	0	0	0	0	0	0	0	19
5	0	0	2	2	0	0	1	2	0	2	0	0	0	0	9
6	0	0	1	0	1	0	0	1	0	1	0	0	0	0	4
7	1	0	0	5	0	0	0	0	1	1	1	0	0	0	9
8	0	0	2	3	2	1	1	0	0	1	0	0	2	0	12
9	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
10	0	0	2	1	0	0	0	0	0	0	0	0	0	0	3
11	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	2	13	3	1	3	0	0	1	0	0	1	0	24
14	0	0	1	1	0	0	0	1	0	0	0	0	0	0	3
15	0	0	1	1	1	0	0	1	0	0	0	0	0	0	4
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	1	0	2	2	0	2	0	1	0	2	0	0	0	0	10
18	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	1	0	0	2	0	0	0	0	0	0	0	0	0	0	3
22	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2

Given the prior statement, it is taking into account the lack of direct observation and the lack of automatic and intelligent follow-up and the intrusive limitations. The following question was issued as a motivation for this project *¿How to calculate indicators based on the detection of emotions and activities for monitoring and supporting the evaluation of psycho-social risk factors through automatic non-intrusive monitoring, using artificial intelligence techniques and computer vision?.*

Based on the research question, the present work will focus on the extraction of activities and emotions that are related to quantifiable aspects within the psycho-social assessment. There are activities and emotions, implicit in the validation questionnaires. Data corresponding to daily activities in work and academic contexts could be a valuable source of information that can complement evaluations by providing metrics and indicators, or complementing the information that is currently acquired through the support systems previously seen. In the next section, the activities and emotions will be addressed and how the information inherent in them could constitute a contribution to the gap of artificial intelligence and its implication in the psycho-social assessment.

## 4 Implicit Activities and emotions in PRIF-EM

From the review of the works related to the measurement of physical and psychological aspects in work and academic settings, a potential opportunity is found, for the use of artificial intelligence as a support component in the psycho-social assessment. The questionnaires currently used for quantitative and qualitative assessment implicitly contain activities, emotions, moods, and situations that the person providing the test answers may experience. In this project, we will limit ourselves to extracting the functional activities that are

to support the physical, social, and psychological well-being of a person and allows that person to function in society [1]. Additionally, they will extract the Instrumental Activity of Daily Living (IADL), which is defined as those activities that allow an individual to live independently in a community. according [1]. On the other hand, the emotions within the items of the questionnaires will be extracted, taking as reference the study of emotions by Paul Ekman [1].

## 4.1 Methodology of extraction

Como primer paso de la metodología de extracción se efectua un análisis detallado de los mecanismo empleados en las publicaciones. Entre las diferentes motivaciones para el uso de los mecanismos se encuentra la validación en un segmento de poblacion específico [1], el soporte metodológico y de cuantificación para la validación experimental [1] soportada [1] o la adaptación de todos o algunos de sus items en un contexto definido [1]. La motivación en este caso, será la de identificar los cuestionarios mencionados en artículos que establecen su enfoque en aspectos relacionados con los riesgos psicosociales en los contextos laboral y académico. Posterior a esto, se extraen los dominios de aplicación que agrupan los diferentes items o preguntas que son efectuadas a las personas evaluadas. Cada item es analizado, con el fin identificar las actividades, emociones y la frecuencia en la que se presentan. Para orientar la extracción de dichas actividades y emociones se toma como referencia el trabajo de Melzer [61] en el que se aborda el reconocimiento de emociones a partir de los movimientos corporales. Esta aproximación no sólo representa una referencia metodológica, sino que encaja con el alcance del trabajo para la identificación y caracterización de escenarios en los que se involucren las acciones realizadas por personas y que puedan ser capturadas mediante cámaras de video.

Dentro de las referencias seleccionadas se establece una separación en los dos contextos. Si bien el contexto laboral contiene una amplia variedad de articulos en los que se han desarrollado nuevos mecanismos y se han identificado posibles mejoras, en el ámbito académico se evidencia una cantidad considerable de situaciones que han traído la atención de expertos en medicina y psicología. Los aspectos evaluados en el ámbito académico no difieren del todo respecto los estudiados en el ámbito laboral, debido a que las variaciones están inclinadas en el lugar donde toman lugar y el rol que efectuan las personas en estos contextos. Se puede pensar que en este contexto académico existe una fuerte conexión con el laboral, en la medida que se encuentra el rol del cuerpo docente quienes en su labor de orientar a los estudiantes, pueden estar expuestos a los diversos factores de riesgo psicosocial de un lugar de trabajo. La tabla , muestra los mecanismos extraídos de los artículos seleccionados.

Author	Assesment mechanism or scale
Alotaibi-2020[62]	Pittsburgh Sleep Quality Index (PSQI) Kessler Psychological Distress Scale (K10)
Calderon-2019[63]	Ryff Scales of Psychological Well-being
Thomas-2019[64]	Perceived Scale Test (PSS) The Three-Factor Eating Questionnaire
Ben Ami-2018[65]	Survey of personal and social development
Moy-2014[66]	Smoking-alcohol consumption and physical activities (IPAQ) The job content questionnaire (JCQ) Depression-anxiety and stress scale (DASS)
Conley-2013[67]	Psychometric analysis and refinement of the Connor Davidson Resilience Scale (CD-RISC) The Dysfunctional Attitude Scale

Por su parte, se efectua la selección de artículos relacionados con el ambiente laboral (ver la tabla ). Para este escenario particular, se tomará como referencia la bateria de evaluación de factores de riesgo psicosocial, el cual es una adaptación de mecanismos existentes en adición a otros componentes desarrollados por el ministerio del trabajo en Colombia, en conjunto con la universidad pontificia javeriana. Esta referencia mostrará los pasos adicionales efectuados con los cuestionarios de valoración.

Author	Environment
Golonka-2019[68]	Maslach Burnout Inventory General Survey (MBI-GS)-NEO Five-Factor Inventory-Beck's Depression Inventory
Maeda-2016[69]	International Neuropsychiatric Interview
Najder-2016[70]	The Psychosocial Risk Scale (PRS)
Luca-2014[71]	Beck Depression Inventory (BDI)
Charria-2012[72]	Cuestionario Encuesta de Calidad de Vida en el trabajo Cuestionario para la Evaluación del Estrés-Batería para la evaluación de factores de riesgo psicosocial Utrecht Work Engagement Scale Cuestionario Psicosocial de Copenhagen (CoPsoQ)
Blanch-2010[73]	El cuestionario FPSICO El Cuestionario de Bienestar Laboral General
Rodríguez-2009[74]	Hipótesis de la tensión del trabajo Karasek
Boyes-2002[75]	Hospital Anxiety and Depression Scale-Short-form Supportive Care Needs Survey
Mausner-2000[76]	Quality of Employment Surveys

**The Fifth paragraph list dimensions and scope identificacion of the items in main PRIF-EM.**

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Mecanismo	año	Items	Temas
Cuestionario Encuesta de Calidad de Vida en el trabajo, aplicado en España por el Ministerio de Trabajo e Inmigración	2018	3	Trabajo prolongado o jornada extensa, Estrés, Ansiedad, Depresión, Problemas de sueño
Cuestionario para la Evaluación del Estrés, que hace parte de la batería para la evaluación de factores de riesgo psicosocial publicada por el Ministerio de la Protección Social en Colombia	2020	5	Trabajo prolongado Posturas inadecuadas Ausencia o presencia de descansos Estrés
Maslach Burnout Inventory (Edu y Labo)	2001	3	Trabajo prolongado, jornada extensa y condiciones
Escala de Desgaste Ocupacional[61]	2000	2	Trabajo prolongado o jornada extensa. Problemas de sueño Depresión
Utrecht Work Engagement Scale, que evalúa la experiencia de engagement y bienestar	2000	2	Trabajo prolongado o jornada extensa. Actividades de bienestar
Inventario de violencia y acoso psicológico en el trabajo	2000	1	Trabajo prolongado o jornada extensa
Perceived Scale Test (PSS) Cohen, Kamarck and Mermelstein	2000	1	Medición de la percepción del estrés
Depression, anxiety and stress scale (DASS21)	2000	5	Test de autovaloración de síntomas físicos
The Three-Factor Eating Questionnaire	2000	5	Cuestionario de tres factores de ingesta
The Kessler Psychological Distress Scale (K10)	2000	3	Destinado a producir una medida global de angustia basada en preguntas sobre ansiedad y síntomas depresivos
The Pittsburgh Sleep Quality Index (PSQI)	2000	1	Destinado a medir los hábitos de sueño



Figure 1: Example of a drowsiness scene.

Mecanismo	año	Items	Topicos
Survey of personal a social development	2000	5	Medir frecuencias de consumo de tabaco, alcohol y síntomas psicológicos

**The Sevent paragraph will introduce a table with the quantity of items that can be linked to emotions.** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodi consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Spanish Version of the CD-RISC Resilience Scale for Chronic Stress Situations[77] Beck Anxiety Inventory (BAI)[78]

**The sixth paragraph will introduce a table with the quantity of items which mentions any kind of activity.** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodi consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.



## 4.2 Activities and emotions inventory

This sections will introduce a table were is an inventory of activities and emotions that can be tracked by camera. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodi consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

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## 5 Artificial intelligence in activites and emotion recognition

Como se pudo evidenciar en la sección 4 existen actividades y emociones que pueden ser capturadas por cámaras y cuyo análisis puede constiuir una fuente significativa de datos en forma de métricas e indicadores para facilitar la evaluación psicosocial. No obstante la extracción de los datos así como su interpretación de forma automática constituye un reto tecnologico el cual ha si ampliamente abordado por disciplinas como computer vision[79]. adquirir, procesar, analizar y comprender las imágenes del mundo real . Esta disciplina ha traído nuevas oportunidades de aprovechamiento de datos en imágenes empleando algoritmos de machine learning y soportándose en algunos casos, en sistemas de cómputo de alto desempeño[].

### 5.1 Activities Recognition

**This paragraph will mention articles related to detection of Functional Activities.** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodi consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Acculturation, Depression, and Smoking Cessation: A trajectory pattern recognition approach[80] Driver's drowsiness detection using an enhanced image processing technique inspired by the human visual system [81] Driver drowsiness detection using mixed-effect ordered logit model considering time cumulative effect [82]

**This paragraph will mention articles related to Gait Analysis.** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodi consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum. Gait Analysis [83]

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## 5.2 Emotion Recognition

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Stress and anxiety detection using facial cues from videos [84] Challenge face recognition for emotions [85] HOURGLASS OF EMOTIONS [86] Adaptive Body Gesture Representation for Automatic Emotion Recognition[87] Emotion Recognition from Body Movement [88] Deep Learning Approach for Emotion Recognition from Human Body Movements with Feedforward Deep Convolution Neural Networks[89] A Brief Review of Facial Emotion Recognition Based on Visual Information [90] Automated Analysis of Facial Cues from Videos as a Potential Method for Differentiating Stress and Boredom of Players in Games [91] Extended Deep Neural Network for Facial Emotion Recognition [92] Automatic Depression Scale Prediction using Facial Expression Dynamics and Regression [93]

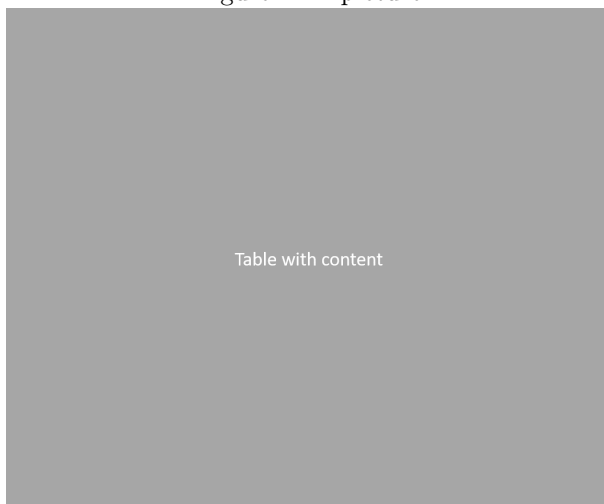
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From Pixels to Sentiment: Fine-tuning CNNs for Visual Sentiment Prediction [94]

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Figure 2: A picture



## 6 Feature extraction via computer vision

**This introductory paragraph describes the experimentation that is going to be carried out to determine if current motion capture libraries are capable to extract quality data to build descriptors for activity and emotions classifiers.** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodo consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

### 6.1 Motion capture libraries

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### 6.2 Experimentation and benchmarking

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**Parrafo para mencionar las actividades que se van a incluir en el experimento.** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodi consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Activities \* Eating and smoking habits \* Aggressive conduct \* Recurrent extensions of work shift or activities

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## 7 Results

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## 7.1 Activities results analysis

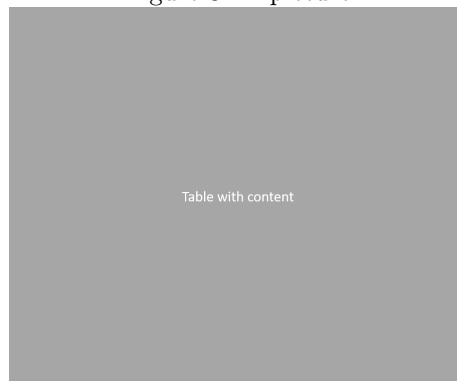
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**Aggressive conduct.** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodi consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

**Recurrent extensions of work shift or activities.** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodi consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

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Figure 3: A picture



## 7.2 Emotions results analysis

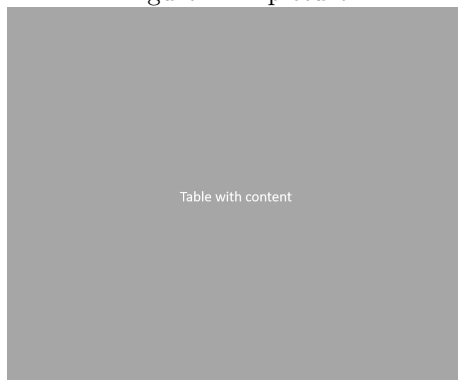
**Stress-related emotions.** Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquid ex ea commodi consequat. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

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Figure 4: A picture



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## 8 Conclusions

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