

#1 OCTOBER 2021

DaSCI news



THE QUARTERLY NEWSLETTER OF THE
ANDALUSIAN RESEARCH INSTITUTE IN DATA SCIENCE AND COMPUTATIONAL INTELLIGENCE (DASCI)



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One of Europe's most advanced
Artificial Intelligence centers

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LETTER FROM THE DIRECTOR

Francisco Herrera

Welcome to the bulletin of the Andalusian Research Institute in Data Science and Computational Intelligence (DaSCI Institute).

DaSCI Institute arises as an initiative of the universities of Granada, Jaén and Córdoba to promote the work of a group of Andalusian researchers in Artificial Intelligence (AI), with a special focus on the areas of data science, computational intelligence and AI technological applications. DaSCI begins as a common project, full of hope, and we want it to become a robust and thriving reality.

The AI has come out of the academy. Research has gone from the laboratories to be among us, in our daily lives. AI is now one of the technologies that is having the great impact on our lives as individuals and as a society. AI is among the four general-purpose technologies that have driven the four industrial revolutions. The impact of AI is transversal in all areas, and we witness a continuous presence of AI in the media that shows its importance and growing impact.



The DaSCI Institute aims to promote research, innovation and knowledge transfer in AI to our socioeconomic environment, sharing common objectives, knowledge and infrastructures with the other Andalusian agents. To do this, we have the strength of our researchers and we have designed a strengthening plan with 5 axes: the training of Phd, the promotion of our research areas internationalization, knowledge transfer, scientific dissemination and professional training in AI.

DaSCI NEWS is a periodical publication edited by the Andalusian Research Institute in Data Science and Computational Intelligence (DaSCI)

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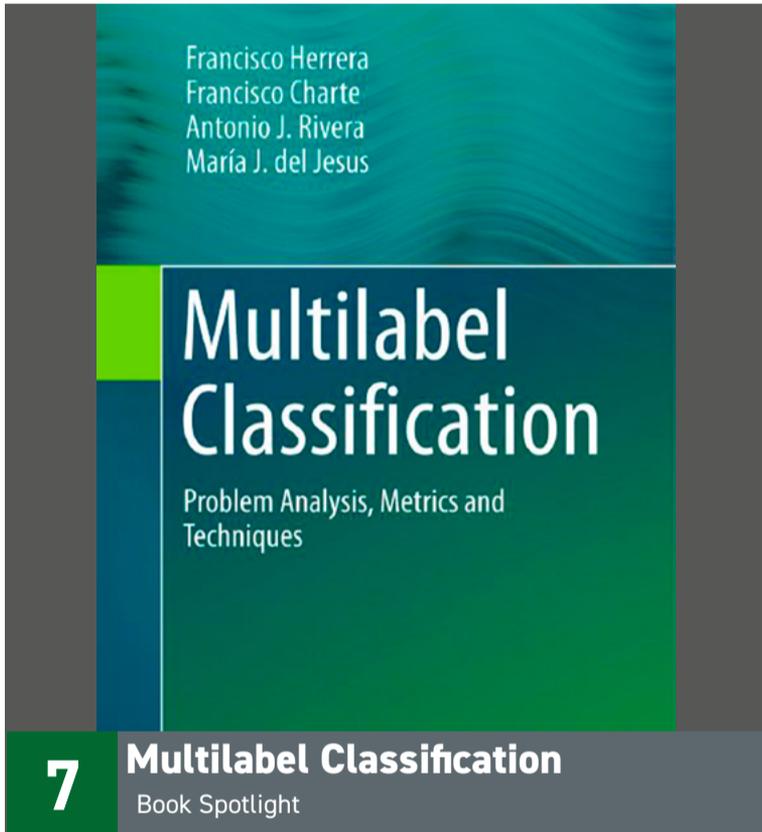
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Greetings from Vice-Rectorates of Research of the three Universities

Universities of Granada, Jaén and Córdoba.

Enrique Herrera

Vice-rector for Research and Knowledge Transfer
University of Granada, UGR



Gustavo Reyes

Vice-rector for Research
University of Jaén, UJA



Enrique Quesada

Vice-rector for Research and Territorial Development
University of Córdoba, UCO



As Vice-Rectors with competence in matters of research and innovation of the Universities of Granada, Jaen and Cordoba, we greet you and welcome you to the Andalusian Research Institute in Data Science and Computational Intelligence (DaSCI).

This Institute is the result of the commitment to excellence in research promoted by the universities of Granada, Jaen and Cordoba, with the aim of encouraging research, innovation and knowledge transfer in Artificial Intelligence to our socioeconomic environment.

The Institute is the result of the commitment to excellence in research promoted by the universities of Granada, Jaén and Córdoba

A research of quality, whose impact must be measurable and evaluated in terms of societal impact or enhancement, and which can only be understood today as the necessary step to give rise to social processes of Research, Development and Innovation (R+D+i).

The newsletter

This newsletter aims to be a vehicle for disseminating the advances achieved at the Institute as well as other topics of interest related to Artificial Intelligence, both from a scientific and technological perspective. We hope you enjoy the contents of this publication, and that it will be a convenient vehicle to learn about the work carried out by our researchers.

Kind regards.

About the DaSCI Institute

In DaSCI we try to surpass our scientific production year after year, creating synergies with companies and training present researchers for greater innovation in the future, internationalization and scientific collaboration is one of our strengths.

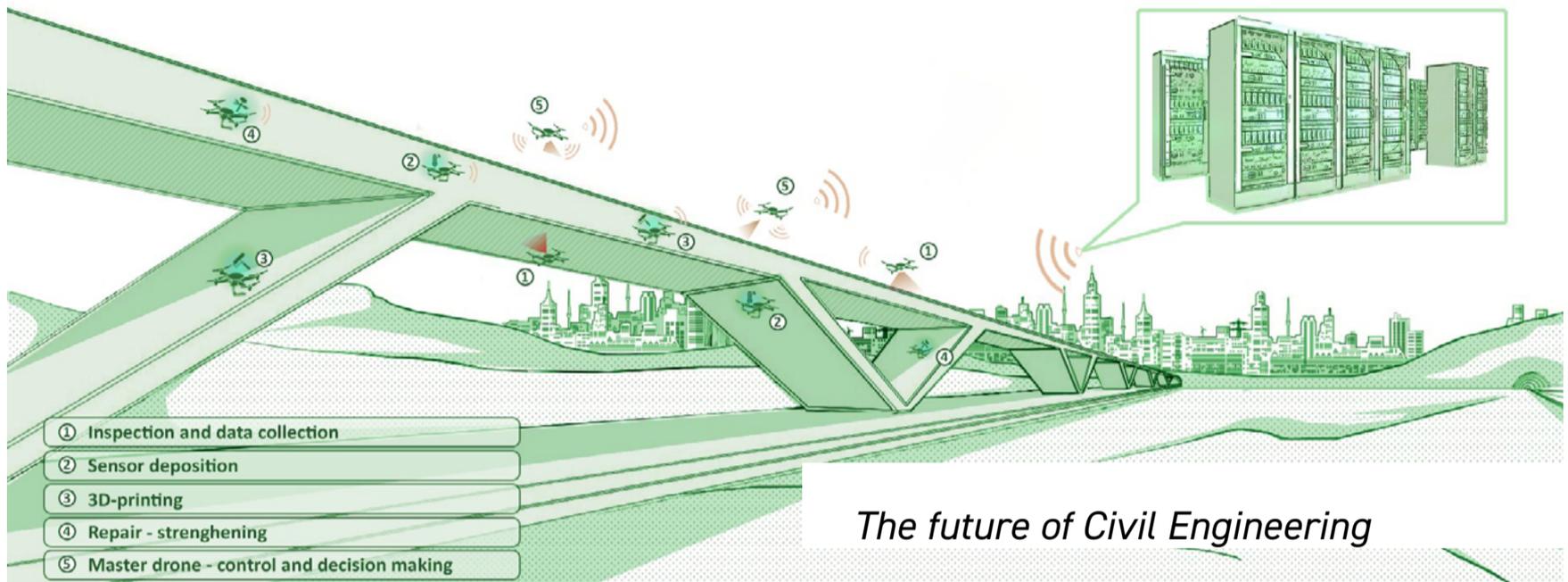
Our staff is made up of 85 doctors, 3 collaborators, 2 international collaborators, 3 Ramón y Cajal PhDs, 1 Marie Curie PhDs, 4 Juan de la Cierva PhDs, and 93 students in training of which 37 are foreigners.

In these last four years, we have 788 publications in international research journals, 53 coordination of research projects in international, national, regional and local areas, and 44 transfer contracts to the industrial and commercial sector. In total, 37 theses have been read.

Brief Lecture

Artificial Intelligence and Civil Engineering

Juan Chiachío and Manuel Chiachío



The future of Civil Engineering

The most advanced countries are seeing the onset of a new industrial revolution brought about by digital technologies such as artificial intelligence, remote sensing and robotics.

The civil engineering industry, which comprises the construction and management of large infrastructures (roads, railways, bridges, power plants, dams, ports, etc.), is being part of this revolution, due to the relatively low cost of digitalisation technologies in relation to the huge construction and management costs of the infrastructures.

The amount of real-time data and information coming from monitored infrastructures is expected to increase exponentially in the coming decades.

The amount of real-time data and information coming from monitored infrastructures is expected to increase exponentially in the coming decades. This information has the potential to reduce by billions the national expenditure on infrastructure operation and maintenance. Furthermore, it is speculated that these data will change the way in which 21st century infrastructures are designed, built and operated.

However, although a significant progress is being carried out in this direction, we are not yet in such a state of data abundance that will allow an autonomous and predictive management of infrastructures as *ciber-physical* entities. The complexity, the enormous size, as well as the variability and uncertainty inherent to the behaviour of infrastructures, make the acquisition of relevant data for accurate prognostics a challenge in itself. In the meantime, state-of-the-art methodologies such as *physics-enriched artificial intelligence* are emerging as candidates to fill this initial "data gap".

In particular, over the last century, civil engineering has greatly benefited from the theoretical and scientific advances carried out in the fields of Mechanics, Hydraulics, Electricity, Geotechnics, etc. Emerging tools such as the Physics-Informed Artificial Neural Networks have the potential to exploit all this valuable scientific knowledge to reliably predict the medium and long-term behaviour of our infrastructures, and thereby, their degradation and maintenance needs. Subsequently, in a future scenario of data abundance, these data will not only be valuable to make long-term predictions that have not been possible so far. Also, these will be useful to improve the available physics-based models and even to discover new scientific knowledge based on them.



In this context, the aim of DaSCI in this research field is to contribute to this revolution by working at the interface between civil engineering and artificial intelligence, and leading at an academic level the development of groundbreaking methodologies for the civil engineering industry of the 21st century.

In a future scenario of data abundance, these data will be useful to improve the available physics-based models and discover new scientific knowledge

News

AI Lab Granada

One of the most advanced Artificial Intelligence centers in Europe will be located in Granada.



DaSCI is a key stakeholder of the new AI Lab Granada, a ground-breaking initiative promoted by UGR, Minsait (Indra) and Google

Granada will have the jewel in the crown of artificial intelligence. Google Cloud and Minsait (Indra) have joined forces to develop, together with the University of Granada, AI Lab Granada, which will be one of the largest and most advanced artificial intelligence development centres in Europe.

The centre will host more than 100 scientists with PhDs in Artificial Intelligence, mostly **DaSCI** members, as well as 165 consultants, developers and researchers. Eight of the ten most cited university researchers in Spain in the field of Artificial Intelligence will work there, some of whom are among the main international benchmarks in this field. It will also promote from the outset an ecosystem of startups and entrepreneurship that will foster the transfer and exchange of knowledge, technologies and use cases.

As a technology partner, Google Cloud will provide the suite of its Artificial Intelligence and advanced analytics solutions to complement the centre's cloud computing and storage capabilities. This approach will enable the creation of an AI and advanced analytics marketplace for the development of next-generation decision-making models. In addition, thanks to this collaboration, Google Cloud experts will participate in the different activities, tutorials and events organised by the centre, as well as in training for different audiences. Google Cloud will also award Cloud Credits, which will be used in projects developed within the centre and technical training sessions.

Minsait will be in charge of managing AI Lab Granada, contributing highly qualified professionals and its own OnesaitPlatform to the project, which operates on the products

and solutions that the Indra company markets worldwide to accelerate the digital transformation of companies and institutions.

AI Lab Granada will also promote an ecosystem of startups and innovative entrepreneurship

The centre is open to entities that want to promote the development of their own products and services, based on access to the highest level of knowledge and development achieved by Artificial Intelligence through the specialised resources of AI Lab Granada.

Book Spotlight

Multilabel classification

Problem Analysis, Metrics and Techniques

Francisco Herrera, Francisco Charte, Antonio J. Rivera, Maria J. del Jesús

Classification of data patterns into different categories that are not mutually exclusive, through a model usually generated by means of supervised learning techniques, is a problem that has generated a large volume of publications in the last decade.

The first three chapters of this book begin with a comprehensive introduction to the problem of multi-label classification and the most common techniques for addressing this task, as well as a detailed description of the metrics used to characterize this type of datasets and to evaluate the results produced by classifiers. In addition, a list of the multi-label datasets most frequently used in scientific studies is provided.

After the first chapters, which introduce the problem on which this title focuses, an exhaustive review of the methods published in the literature is carried out. By grouping them into three chapters according to the approach they take to the task, they describe algorithms based on data transformation techniques, on the adaptation of classical methods and also on ensembles.

A third block contains monographic chapters dealing with specific aspects such as the use of correlation between labels, high dimensionality, which in multi-label data affects not only input variables but also output ones, or the obstacle represented by the imbalance between the labels assigned to data samples.

Each of these topics is analyzed and accompanied by one or more solutions designed by the authors, including algorithms published in leading journals.

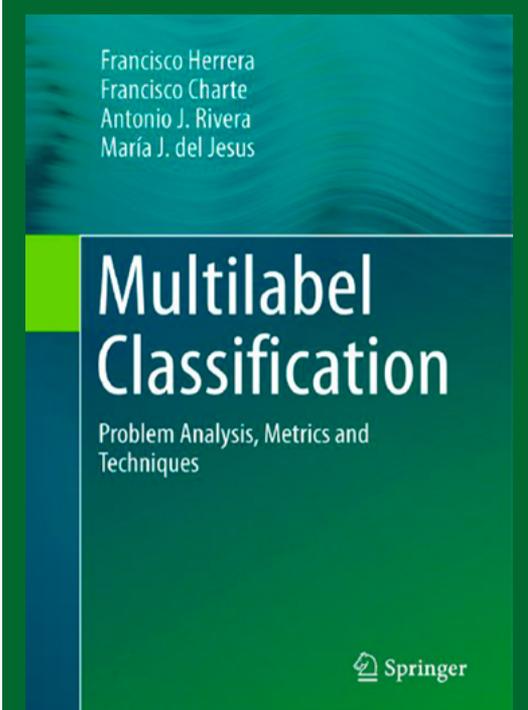
The final part of the book describes software for the familiar R environment, developed by the authors, designed to facilitate work with multi-label datasets.

The package's functionality, accessible for the most part both from the command line and from a graphical interface, facilitates the exploration of this type of data, as well as the application of basic transformations.

The book, whose table of contents is given below, has a website associated with it (<https://github.com/fcharte/SM-MLC>) which offers different resources: links to data repositories, software tools, implementation of algorithms, etc.

1. *Introduction*
2. *Multilabel Classification*
3. *Case Studies and Metrics*
4. *Transformation-Based Classifiers*
5. *Adaptation-Based Classifiers*
6. *Ensemble-Based Classifiers*
7. *Dimensionality Reduction*
8. *Imbalance in Multilabel Datasets*
9. *Multilabel Software*

Technical sheet



Title
Multilabel Clasificación.
Problem Analysis, Metrics
and Techniques

Authors
Francisco Herrera
Francisco Charte
Antonio J. Rivera
María J. del Jesús

Publisher
Springer

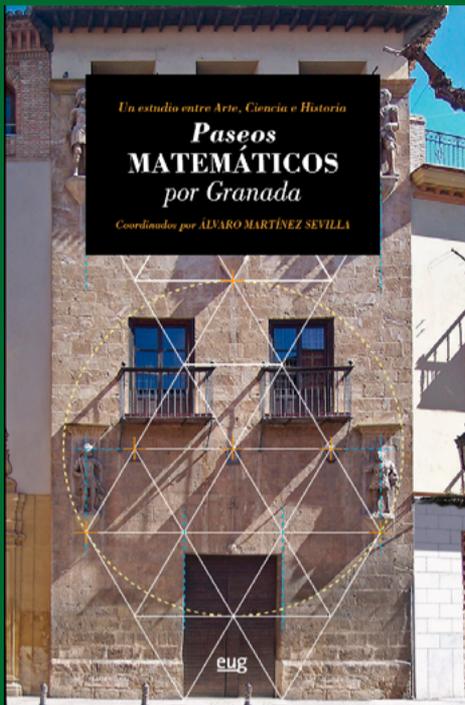
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Technical sheet



Title Paseos Matemáticos por Granada. Un estudio entre Arte, Ciencia e Historia

Author Álvaro Martínez Sevilla

Publisher Universidad de Granada

Year 2017

Pages 416 + DVD

ISBN 978-84-338-60-7

URL https://editorial.ugr.es/static/Emangement/*/detalle_libro/paseos-matematicos-por-granada

Book Spotlight

Paseos matemáticos por la Granada

Un estudio entre Arte, Ciencia e Historia

Álvaro Martínez Sevilla

This book presents a study between Art, Science and History. It contains perhaps the first proposal for a systematic study of mathematics that it can be found in the monumental heritage of a city. With 22 Walks that contain the analysis of many monuments, it reveals how they show functional mathematics (which have allowed a construction effective in its architectural purposes), decorative (mathematics that have served with its geometric arrangement to make more beautiful the building) or symbolic (mathematics that expresses with an universal language a sense of programmatic proposal which wants to transcend its epoch).

These mathematics have always been present and have linked from the science to the monumental heritage. Numerous treaties on geometry and architecture are the base on which most of these monuments were built. But without a user guide, the lack of practice of these rules in the most recent architecture has led us to forget their existence and the way to recognize them. It is not just a matter of seeing mathematical figures in a building, but of finding the latent design guidelines that make it be considered more beautiful or symbolically significant. In this way, it has been extremely useful different software programs, symbolic computing programs and graphic representation, but the most relevant has been the GeoGebra program. With a long history, this dynamic geometry software is capable of interacting with reality, drawing mathematical layers on images. This characteristic allows us to use methods which also use the AI, such as, obtaining information from reality that is then processed through expert knowledge or finding the patterns that are under the building. The dynamic nature of this software makes the exploration of such patterns very flexible, saving scaling, orientation and adaptation tasks.

With more than 700 images in total and more than 400 built with mathematical layer, the book contains a great variety of mathematics present in monumental architecture which includes examples of remarkable proportions, uses of conics and special curves, tessellations, modulation of facades or plants, symmetries, homotheties, functional constructive analysis, significant measurements on images, use of geometric places and regular graphic design structures, among other questions of a

mathematical nature. All of them located in the historical-artistic context, interpreted according to their monumental style and historical time which builds a story about the monument mixing mathematics, history of science, art and technology as complementary disciplines for a more complete understanding of the analyzed monument.

From the point of view of Artificial Intelligence, the book provides two possible directions of use. On the one hand, it allows working with a first database on mathematical elements in historical architecture. These more than 400 explicit mathematical layers constitute an expert knowledge that can be used for the training of Machine Learning systems or for the characterization in mathematical terms of monumental artistic styles. On the other hand, it is the motivation for the beginning of a series of continuation works provoked by the questions that we can ask ourselves about them. One of them is: How can we geometrically characterize a historical-artistic style so that it is easy or even automatic to determine it in a building? And this without having any other added knowledge about its place, author or date of construction. The first answer has come with the MonuMAI system on Monuments, Mathematics and Intelligence Artificial, which is capable of determining with high precision 4 artistic styles (Gothic, Renaissance, Baroque and Hispano-Muslim) through a previous training with 15 elements characterized by their geometric appearance. The system has been completed by a research group led by F. Herrera at the DaSCI Institute and translated into an app available to the public.

Another question that we can ask ourselves is how can we interact with a monument automatically in such a way that we can recognize or recreate the mathematical elements that may be in it? Some partial solutions are already being given to this question through techniques such as Computer Vision or Augmented Reality and in which members of the DaSCI or other research groups of the University of Granada participate. In short, we have a book on mathematical dissemination that combines science, technology and art into entertaining story and that aims to flank a door from mathematics to technologies associated with AI and monumental heritage.

Paper Spotlight

A comprehensive analysis of deep regression

S Lathuilière, P Mesejo, X Alameda-Pineda, R Horaud

IEEE transactions on pattern analysis and machine intelligence 42 (9), 2065-20811, September 2020.

Since its emergence in 2012, the popularity of deep learning has grown exponentially. In particular, the number of scientific papers applying deep networks to computer vision tasks –the branch of AI dedicated to solving visual perception problems– is unapproachable.

There are a large number of deep models, where small changes in the network architecture or in the preprocessing of the data that produce remarkably different results, making it very difficult to identify methods that significantly outperform others. This

situation motivates the present study, in which a systematic evaluation of standard deep regression techniques is carried out, that is, convolutional neural networks with a final layer of linear regression.

In fact, this is the first exhaustive and systematic analysis of techniques of deep regression, where experiments are performed with four classic vision problems, different architectural variants, and confidence intervals are provided for median performance. Surprisingly, the variability due to data

preprocessing generally overshadows modifications in the network architecture. Our results reinforce the hypothesis that a properly tuned general-purpose network (e.g. VGG-16 or ResNet-50) can produce results close to the state of the art without resorting to more complex and elaborate regression models.

DOI:

[10.1109/TPAMI.2019.2910523](https://doi.org/10.1109/TPAMI.2019.2910523)

Paper Spotlight

Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI

A Barredo, N Díaz-Rodríguez, J Del Ser, A Bennetot, S Tabik, A Barbado, S Garcia, S Gil-Lopez, D Molina, R Benjamins, R Chatila, F Herrera.

Information Fusion, V.58, 82-115.

The last years have been characterized by an upsurge of opaque automated decision systems, such as Deep Learning models.

Although they have great generalization and prediction skills, their functioning does not allow detailed explanations of their behaviour to be obtained. As opaque machine learning models are increasingly being employed to make important predictions in critical environments, the danger is to create and use decisions that are not justifiable or legitimate.

The research displayed in this study, with over **600 citations since January 2020**, includes a

review of concepts related to the explainability of AI methods (XAI), a comprehensive analysis of the XAI literature organized in two taxonomies, and a discussion on potential implications of XAI and privacy in data fusion contexts.

We identify Responsible AI as a concept promoting XAI and other AI principles in practical settings.

Although notions such as humancentered AI, ethics, trustworthiness, fairness, safety, privacy and transparent AI, are all specially linked in order to attain responsible AI, we

advocate for explainability to be one of the key pillars that will facilitate the dialog among disciplines, and the required AI regulation on each sector. This was put in evidence in the latest coordinated plan of the EU on Artificial Intelligence (April 2021) review by the European Commission; where explainability in AI can and should act as a vehicle for the uptake of AI systems that act responsibly.

DOI:

[10.1016/j.inffus.2019.12.012](https://doi.org/10.1016/j.inffus.2019.12.012)

Paper Spotlight

Evolution of genetic networks for human creativity

I Zwir, C Del-Val, M Hintsanen, K M Cloninger, R Romero-Zaliz, A Mesa, J Arnedo, R Salas, G F Poblete, E Raitoharju, O Raitakari, L Keltikangas-Järvinen, G A de Erausquin, I Tattersall, T Lehtimäki, C R Cloninger.

Molecular Psychiatry (2021).

DOI:

[10.1038/s41380-021-01097-y](https://doi.org/10.1038/s41380-021-01097-y)

Creativity, the 'secret weapon' of Homo sapiens was a great advantage over Neanderthals, playing an important role in their survival.

This is considered by an international team of scientists, led by the University of Granada

(UGR), which has identified for the first time a set formed by 267 genes that differentiate Homo Sapiens from Neanderthal.

It is creativity that confirms Homo Sapiens advantages beyond the purely cognitive ones, favoring a greater adaptation to the environment than the hominids that are now extinct, by providing them with greater resistance to aging, injury and disease. This finding is the result of an interdisciplinary research that combines Artificial Intelligence, Molecular Genetics, Neurosciences, Psychology and Anthropology.

The genes identified as unique to Homo sapiens are part of a larger group of 972 related to personality in healthy adults. Most of the genes that distinguish modern humans from Neanderthals and chimpanzees are RNA regulatory genes and not protein-coding genes. Using genetic markers, gene expression data and brain magnetic resonance imaging integrated based on Artificial Intelligence techniques, the scientists were able to identify the regions in which those genes and the genes with which they interacted were overexpressed.

Up To Date

Latest PhD Theses

March 10, 2020

Big Data Ensembles for Classification and Smart Data

Diego Jesús García Gil

The thesis addresses different topics: standard supervised classification, noise filtering and unbalanced classification. All of them revolving around a common denominator, ensemble methods in Big Data to obtain Smart Data. For this purpose, several scalable and distributed techniques have been developed using a platform for distributed computing, called Apache Spark.

Directors: Dr. **Salvador García** and Dr. **Francisco Herrera**

Qualification: *Oustanding Cum Laude with International Mention*

July 30, 2020

Preprocessing and Ensemble Approaches for Singular Problems: Monotonic and Imbalanced Classification

Sergio González Vázquez

This thesis proposes new solutions for unbalanced classification and classification with monotonic constraints, both independently and jointly. These proposals follow two different approaches: i) Design of robust classifiers, and ii) Development of techniques based on preprocessing to obtain Smart Data. The proposals presented in this thesis have empirically demonstrated to address the singular supervised problems posed, covering specific aspects and needs of them.

Directors: Dr. **Salvador García** and Dr. **Francisco Herrera**

Qualification: *Oustanding Cum Laude with International Mention*

September 9, 2020

Multi-label classification models for heterogeneous data: an ensemble-based approach.

José María Moyano Murillo

The first objective of this thesis is to perform an experimental study and categorization of ensemble-based multi-label classification methods, providing recommendations to select the best method for each problem. On the other hand, methods based on evolutionary algorithms are proposed to build ensembles of multi-label classifiers, obtaining a significantly better and more consistent performance than those existing in the literature.

Directors: Dr. **Eva L. Gibaja**, Dr. **Krzysztof J. Cios** and Dr. **Sebastián Ventura**

Qualification: *Oustanding Cum Laude*

April 16, 2021

Data Preprocessing for Label Distribution Learning

Manuel González López

Label Distribution Learning (LDL) is a general learning framework that maps an instance to a distribution over a set of labels rather than to a single or multiple labels. The overall objective of this thesis is the refinement of current LDLtype classification algorithms using different data pre-processing strategies and techniques. Each of these techniques has been studied, extended to meet the constraints of an LDL-type problem, implemented and evaluated on the available data sets.

Directors: Dr. **Salvador García** and Dr. **José Ramón Cano**

Qualification: *Oustanding Cum Laude*

Industry Interview

“AI will have a transforming role in our societies”

We start the DaSCI Industry Interview series with the participation of José Luis Flórez, Director of Artificial Intelligence at Minsait (Indra) and President of Dive Computer Vision.

DaSCI: José Luis, thank you for participating in this first edition of the DaSCI News. Let ask you: what specific AI-related technologies do you consider to be the main strengths at Minsait?

José Luis Flórez: Minsait's strategic vision with respect to AI is not based on a technological approach, because we consider technology to be a mere instrument, so we focus more on the aims, which have to do with identifying specific use cases in which we can have an impact: helping to make better decisions, optimising processes or making organisations more sensitive to what is happening in their environment. In this sense, the great challenge of AI lies in the creation of open collaborative ecosystems that bring together talent, which is scarce in relation to demand and dispersed, with business problems. Once an AI application area and the talent capable of improving a process has been identified, it is the turn of the technology. In this sense, federated learning on the one hand, and deep learning on the other, the former more linked to cooperation and the latter to increasing perceptive capacity, are two of the areas in which we are investing the greatest effort.

Could you briefly comment on a project that Minsait is particularly proud of because of the impact that AI has had on the environment?

We are particularly proud of all the projects in which AI enables an improvement in people's

quality of life or environmental sustainability. In the first case, everything related to preventive health management and improved diagnostic capacity; in the second, waste management, identification of environmental risks or increased energy efficiency.

We see technology as a mere tool, so we look more at the aims (...) identifying concrete use cases where we can have an impact.

In terms of research, Minsait collaborates with the scientific community in general to jointly discover new AI techniques or applications. Which projects could you highlight?

We are participating in innovative projects linked to, among many other activities: diagnosis of pathologies; sustainability, through the optimisation of waste management processes; care of dependent and chronically ill people, through monitoring systems; initiatives for the creation of collaborative platforms between data scientists and companies, through federated and differential privacy models; protecting our democratic health, through measures for the identification of information poisoning.



José Luis Flórez

PhD in Economics and Mathematician.

His professional career has always been linked to the application of algorithms and machine learning methods to help organisations in making decisions based on data analysis. His field of research has been focused on the simulation of propagations, both from an epidemiological and sociological perspective, using large graph analysis techniques.

He currently leads the AI strategy of Minsait (Indra), which aims to bring to the market not only AI solutions, but also a new form of consultancy, in which talent collaborates in providing value through an open model of relationships in an ecosystem involving both startups and freelancers.

How is Indra's relationship with DaSCI and which of the existing or planned collaborations are you most excited about?

There is a very close relationship with DaSCI through the University of Granada and eDIH Andalusia. In this sense, we are particularly excited about the development of closer public-private collaborations aimed at innovation with real impact, in which we collaborate with DaSCI, the University of Granada, with several of the biggest technological giants and a good number of startups with differential capabilities and technologies in AI.

In your opinion, what is necessary to successfully create and develop a world-class innovation ecosystem in AI?

AI will play a transformative role in our societies, even in our cultures, and that change is at the very beginning of the beginning. We

The change will be so profound that it will turn us into something else, as people and as a society.

AI will play a transformative role in our societies, even in our cultures, and that change is at the beginning of the beginning.

have the capacity and the obligation to lead the creation of products, based on AI, with the ability to compete internationally. To do this we need to bring together quality talent in sufficient quantity to have critical mass, which among other things, allows us to attract even more talent, and we need to build on the unrivalled capabilities of the tech giants to be able to build on the state of the art. We need to help make AI an industry in our country.

To conclude this interview, we would like you to do a bit of visionary thinking: will our society be transformed in 5 or 10 years by AI? In what sense?

It is already changing. It changes society because it changes people and the way they communicate and collaborate. It is also unprecedented that machines can execute cognitive tasks, it changes everything. When

I say people change, I mean that a person with a simple mobile phone becomes what we could call an "augmented human being", with access to any kind of information at any time. The change will be so profound that it will turn us into something else, both as individuals and as a society. Communication also changes radically when any person becomes a means of communication in itself. Finally, machines with cognitive capabilities will change the dynamics of work, health and leisure.

We are particularly excited about the development of closer public-private collaborations aimed at innovation with real impact, in which we collaborate with DaSCI.

Thank you very much for your participation in this interview, José Luis.



minsait
by Indra

Minsait, an Indra company, is a leading digital transformation and Information Technology consultancy in Spain and Latin America. Minsait has a high degree of specialisation and sector knowledge, which it complements with its high capacity to integrate the core world with the digital world, its leadership in innovation and digital transformation, and its flexibility.

As a result, it focuses its offer on high-impact value propositions, based on end-to-end solutions, with a notable segmentation, which enables it to achieve tangible impacts for its clients in each industry under a transformational approach. Its capabilities and leadership are shown in its portfolio of products under the name Onesait, and its transversal service offer.

DaSCI Predoc Experiences

Edna Bernal

The opportunity to do a doctorate at the University of Jaén emerged from the collaborative project funded by the Marie Curie Action (Research and Innovation Staff Exchange) of the H2020 European Program entitled: "REMIND": The use of computational techniques to improve compliance to reminders within smart environments. The main objective of the project is the creation of an international and intersectoral network that facilitates the exchange of personnel to advance the development of reminder technologies that can be deployed in intelligent environments, as a form of support for people with dementia. The project involves 16 partners from 10 countries, including companies, foundations, and universities from different parts of Europe, Latin America, and Asia.

In the development of the REMIND project, in 2017 I carried out the first mobility to the University of Jaén and, with the advice and support of Dr. Macarena Espinilla, and Dr. Javier Medina of the ASIA research group (Advances in Intelligent Systems and Applications). In this mobility, I was able to expand my knowledge in specific disciplines related to software computing and smart environments, to generate synergies mainly concerning the applicability and search for technological solutions. In addition, another result of this mobility focused on the collaboration of projects with potential for technology transfer to Colombia, identifying global needs in the two countries and proposing solutions that allow the generation of an academic proposal to improve the quality of life of the population, from a softcomputing application approach and intelligent environments for the elderly.

In my first mobility to the University of Jaén, the proposal arose to carry out an analysis of the advances worldwide and, especially in Colombia and Spain, focused on the technologies used to monitor people with no or very limited mobility considering the problem of pressure ulcers. This type of ulcer is considered an adverse event, in addition to an alarming epidemic hidden under the sheets of patients at different levels of care, consequently identifying them as a critical situation in the care of these patients. For this, the Neurobase Neurorehabilitation Center in Jaén was used as the promoter of the proposal, with a team of specialists and very deep knowledge of the problem.

At the state of the art, the contribution of technology is considered very valuable in the prevention and treatment of pressure ulcers.

Although it had been carried out indirectly in the development of support surfaces such as mattresses, cushions, heels, mittens, as well as in techniques for treatment. However, nowadays, with the easiest access to technological tools, it has been observed that these allow direct contributions, not only in the construction of support elements but also in the monitoring and treatment of pressure ulcers. Despite the problem's impact and the potential of technology, there are not many technology-based works aimed at improving the care and monitoring of posture changes for the prevention of pressure ulcers based on technology and artificial intelligence techniques.

We have achieved an important collaboration between research groups, which has allowed us to generate research and innovation projects in Colombia and Spain

To deepen our research, the financial support of the European project allowed us to carry out two international mobilizations, the first to the University of Halmstad (Sweden) and the second to the University of Florence (Italy), through which I could nurture my knowledge in different related disciplines, such as smart environments and applications, smart devices with sensors, and methodologies for the recognition of activities. It was this knowledge generated the proposal aimed at the implementation of monitoring and follow-up methodologies for the prevention of pressure ulcers.

The proposed methodologies are based on the classification of postures in bed, in addition to an approach based on diffuse logic to calculate the priority of postural changes. The main components of this proposal refer to i) inertial sensors attached to clothing, which describe the orientation of patients and are installed in areas of the body in a non-invasive way; ii) a datadriven model for position recognition, which segments inertial data and position classification; iii) an approach based on diffuse logic, which calculates the priority of postural changes for each body area according to a defined protocol and with the time elapsed since the previous position in bed; and iv) a reminder to alert caregivers when the priority of the posture change reaches a configurable threshold.

In my personal experience, I consider that we have achieved an important collaboration between research groups, which has allowed us to generate research and innovation projects in Colombia and Spain, to satisfy the future health care demands of the elderly population; improve their quality of life, reduce healthcare costs, and complement the specific needs of patients such as elderly. During these four years, we have also participated in different research initiatives, projects, congresses, and international seminars with my thesis directors, Dr. Macarena Espinilla and Dr. Javier Medina, who have guided me to generate academic proposals and technological solutions to support global health issues.

Finally, one of the challenges of our proposal is the technology transfer to Colombia, intending to be able to carry out a pilot project. For this, visits were made to different medical centers, to identify specific needs, obtaining as a result that the methodologies developed in my doctoral thesis could be a significant support to this problem in my country. The idea is to manage funding from the Colombian government through national calls that allow us to carry out such piloting, with the support of researchers from the ASIA research group at the University of Jaén.

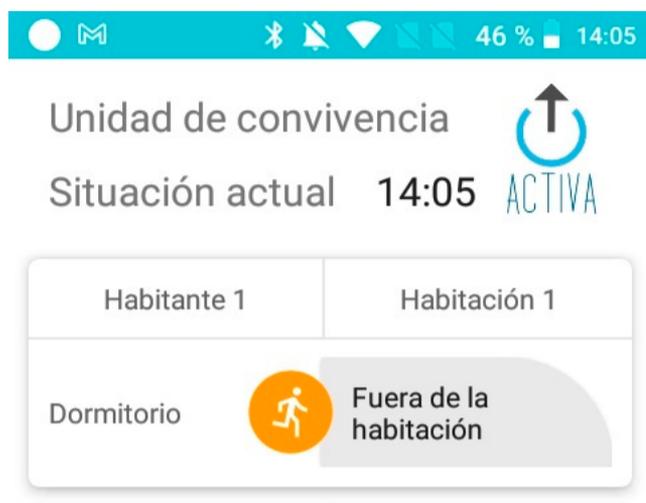


I was born in Colombia, I am a systems engineer from the Pedagogical and Technological University of Colombia (UPTC), since 2014 I am a teacher and researcher at the National Open and Distance University (UNAD), currently a candidate for a doctorate in Technologies of the Information and Communication (ICT) of the University of Jaén, with an investigation entitled: *New methodologies for the classification of postural changes through sensors*. Its objective is to design and implement a remote monitoring methodology based on machine learning techniques for determination of postures, integrating a wearable device that helps caregivers to know the times and positions objectively.

Project Spotlight

Activa Project

Intelligent decision system based on activity recognition in the operational environment of aging.



Fortunately, we live in a society where life expectancy has gradually increased. In the last decade, there has been an increase of approximately 25% of people over 65 years of age residing in senior centres. This fact entails facing new challenges such as the care of this population range due to the high occupancy that will exist in the near future in homes for the elderly.

The University of Jaén and the Ageing Lab Foundation are working on the challenge described through the **ACTIVA project**, whose title is 'Intelligent decision system based on the recognition of activities in the operational environment of aging' funded by the State Program for R+D+i Oriented to the Challenges of Society, in the category of "Health, demographic change and welfare".

In the initial phase of the research project, **new activity recognition models were consolidated with artificial intelligence techniques** to identify the activities carried out by elderly people within an environment and detect anomalies that may arise through sensor data located in the environment. Halfway through the project, the challenge faced by the research team was to implement these models in an integrated system called Intelligent System ACTIVA (SI-ACTIVA), which will be validated in a real environment with elderly people, specifically, a retirement home with double rooms.

SI-ACTIVA involves a complex architecture that handles a huge flow of sensor data that are processed with artificial intelligence techniques to cope with the uncertainty derived in two ways. The first one by the generation of noise or communication failures and, the second one, by the performance of each person's activities and considering possible anomalies.

To deploy SI-ACTIVA, **non-invasive smart devices** with presence sensors, as well as opening and closing sensors on doors and closets, which collect a set of sensor data on the interactions that take place in each of the rooms, are placed in each of the rooms of the residence. To associate these interactions that occur in the room with the person performing them, each resident wears a lightweight activity wristband that emits a signal. Beacons are placed in the environment near the sensors to collect data regarding the strength of the wristband signal, so the stronger the signal received, the closer the person is to the beacon. In this way, the system can recognize who is in the room performing the interactions.

The SI-ACTIVA's central server wirelessly receives the real-time data set collected in the residence where it is intelligently processed in different stages. First, the activations of the sensors in the room are associated to a resident, performing an analysis of the wristband signals. Subsequently, the activations are analyzed to **recognize the daily life activity performed by that resident**. Finally, and more complex, it is detected if there is any anomaly in the resident's activity according to his or her behavior.

SI-ACTIVA's n for caregivers communicates with the central server to receive the knowledge extracted from the intelligent processing. In this way, **caregivers can track** the locations and activities of each resident, receiving a notification in the event of an anomaly.

The value provided by the intelligent system is, on the one hand, to reduce the stress of caregivers when monitoring the activities and possible anomalies of the residents in an

instantaneous, automated and optimized way and, on the other hand, with equal importance, to **provide greater welfare and safety to the elderly**.

Technology and artificial intelligence techniques are offered to the elderly in a transparent way in this project, being the elderly people the main beneficiaries. Moreover, in a transversal way, during the development of the Intelligent System, a **worthy and positive intervention model** has been followed proposed of the Ageing Lab Foundation.

In the final period of the project, once the intelligent system has been developed, the final details are being finalized to **deploy the system in Macrosad's residence** for the elderly located in the province of Jaén during 2021 summer.

RESEARCHERS

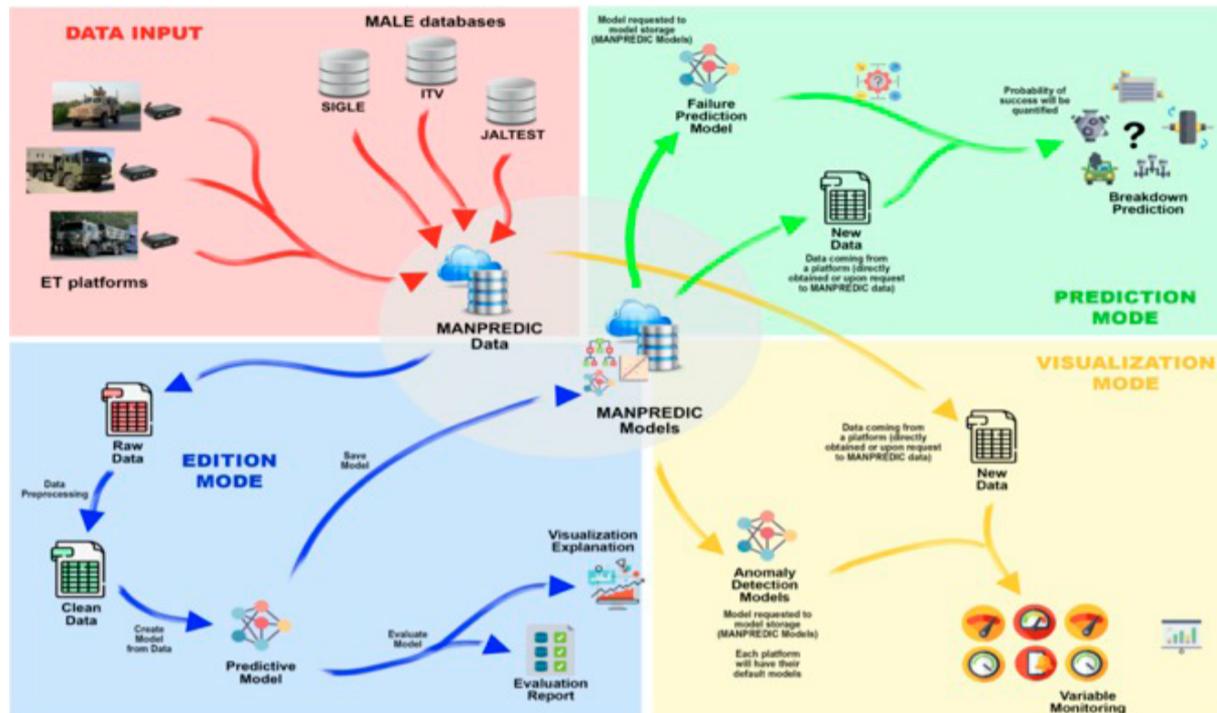
Cruz Lendínez, Alfonso
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González López, Lucía
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Funding Programme	State Program for R&D&I Oriented to the Challenges of Society.
Funding Entity	State Research Agency. Ministry of Science, Innovation and Universities
Principal Researcher	Macarena Espinilla Estévez
Start	01/01/2019
End	31/12/2021
Partners	University of Jaén Ageing Lab Foundation

Project Spotlight

MANPREDIC Project

Predictive maintenance for terrestrial platforms.



Currently, the amount of data extracted from industrial production processes and devices or machinery implied has exponentially increased due to the proliferation of sensors, events and alarms that collect a large amount of information. In this context, predictive maintenance has emerged as an essential application where data processing and analysis improves the operation time of equipment and its efficiency in the industry.

Machine learning methods appear as relevant proposals in many predictive maintenance applications. Thus, it can be found proposals based on supervised learning for predicting failure modes or the remaining useful life of the system. Also, proposals based on unsupervised learning has been used to find hidden structures within the data, such as interactions between components. The main challenges in this area are related to the development of more robust and accurate proposals that could work in environments with high dimensionality and few labelled data.

For more than ten years, different armies have been interested in predictive maintenance and have included programs to develop equipment and models for predictive maintenance for different military platforms. The main objective of this project is the development of a system that supports the predictive maintenance of the Spanish Army's land platforms (MALE, Mando de Apoyo Logístico del Ejército de Tierra). This system would serve as an aid to detect when, where and why a failure is likely to occur in vehicles, so that maintenance or replacement

of components is carried out just before that a breakdown occurs. In this way, the useful life of the components is lengthened and the costs derived from unscheduled maintenance are reduced.

The following functionalities are being addressed in this project:

- **Development of a specific monitoring system** for the corresponding land platforms which includes a system for data collection in real time and its transmission to a database management system that connects to the rest of the subsystems. These subsystems are responsible for processing this information to generate the corresponding alerts used in the predictive maintenance process.

- **Development of diagnostic models** based on the application of data analysis techniques which use as input the information acquired by monitoring systems and other available data sources. For land platforms which are studied, it is analyzed the data that affect the safety and life of the engine, logistics footprint and driving guidelines.

- **Development of a computer system** making use of the models obtained in the previous step and the information provided in real time by the data collection system and the rest of the data sources generates diagnoses that are used as assistance to the decision making in relation to the maintenance of these land platforms.

RESEARCHERS

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- Sarsa Rubio, Antonio
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Funding Programme	Cooperation Program in Scientific Research and Development in Strategic Technologies
Funding Entity	Ministry of Defence
Principal Researcher	Sebastián Ventura Soto
Start	01/10/2019
End	31/10/2021
Partners	University of Córdoba

Project Spotlight

iScience Project

Discovery of the hidden and complex relationships in the development and transfer of knowledge through intelligent techniques.



Currently, innovation, development and research activities, and in particular science and technology, generate large amount of information derived from the scientific method, such as articles, theses, patents, clinical trials, among others. In fact, the total volume increases year by year, following a constant growth pattern.

In this sense, the global system of science and technology can be understood as a complex structure in which academic and industrial actors, and the global knowledge generated, relate to each other, and can be represented as a network or graph, which we will call the Graph of Knowledge (GRAKO). Within this structure, there are many complex relationships between the different types of nodes or objects of the GRAKO, producers of knowledge. Thus, there can be nodes related to people (researchers), institutions, countries, documents, concepts, magazines, etc. Between these, different types of relationships can be established. Thus, some of the relationships may be visible and/or simple, and others may be complex and/or hidden. Furthermore, in the GRAKO, relationships are heterogeneous and dynamic, i.e., relationships are not only established between two nodes of the same type, but maybe involved in different types of nodes, and these may change over time. In this sense, the meta-science called "Science of Science", allows us to define, model, analyze and interpret the GRAKO using tools from statistics, sociology, computer science, artificial intelligence and complex systems.

Although GRAKO has been studied from a bibliometric perspective, it is now necessary to design and develop new models, algorithms and software tools capable of extracting hidden knowledge from large volumes of information with a multitude of heterogeneous and dynamic relationships between its components. In this sense, the GRAKO has similar characteristics to Big Data, such as volume, veracity and variety.

Therefore, the main objective of this project is to define and model the GRAKO, discover the actors and objects that are part of it, model the conceptual, social and intellectual relationships that occur within it, design techniques capable of managing and storing it, develop communication interfaces with the information sources that feed it, design advanced analysis techniques, create new ways of visualization, design and implement new software tools that can work with it, model new ways of exploiting its information, as well as perform a formal validation between the abstract entity society and the industrial fabric. These actions will be aimed at solving the challenges related to the following aspects of GRAKO: information sources, reproducibility, traceability, representation models, visualization and analysis techniques, software tools and the relationship with industry and society.

Ultimately, the achievement of this project will generate within and interdisciplinary knowledge that will serve as both a procedural and operational basis in each of the fields of application. Through the use of the techniques and tools developed, an adequate transfer of knowledge to industry and society will be guaranteed.

RESEARCHERS

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Funding Programme State Program for R&D&I Oriented to the Challenges of Society.

Funding Entity State Research Agency. Ministry of Science, Innovation and Universities

Principal Researcher Manuel Jesús Cobo Martín
José Antonio Moral Muñoz

Start 01/06/2020

End 31/05/2024

Partners University of Cádiz
University of Granada

Project Spotlight

CUSTODES Project

Intelligent systems for image processing and threat detection in conflict scenarios.



The aim is the analysis and development of a technology demonstrator based on Artificial Intelligence for the automation of image processing, the identification of different types of objects and anomalies for threat and conflict environments, and support in decision-making, to demonstrate that data analysis technologies based on Artificial Intelligence (Deep Learning in particular) are suitable for these tasks.

In the coming years, the Spanish Army will have to operate in unpredictable, dynamic, unstable and increasingly complex environments. This, together with rapid technological advances, the possibility of access to civilian and military technologies by potential adversaries and threats, as well as the hyperconnectivity, great influence and omnipresence of the media and social networks, requires an evolution in the concept of its brigades. In this sense, the needs of future brigades in the area of intelligence require a three-dimensional area within which the command has complete "situational awareness" based on the available means (reconnaissance vehicles, ground surveillance vehicles, tactical remotely piloted aircraft systems (RPAS), aerial observation platforms and unmanned ground vehicles (UGV) and unattended sensors). All these dispersed sensors must be integrated in a significantly automated and intelligent way. Artificial Intelligence techniques allow predictive models to be generated from this information that can be used to automatically identify elements of interest for Defence with precision.

The objective is to develop a technology demonstrator to show that data analysis technologies based on Artificial Intelligence techniques, in particular Deep Learning,

are suitable for the automatic identification of vectors of interest and anomalies, and for decision support. To this end, the following functionalities will be addressed:

- An integrated geographic information system (GIS), where the user can draw areas and download satellite images from different providers.
- Automatic information fusion from different sources, obtaining a Curated Image Library and applying image pre-processing methods and features for knowledge extraction with Artificial Intelligence techniques.
- Automated identification and recognition of objects in static or video images based on the information from the curated image library, allowing the training of the system to obtain an Intelligent Classification Model.
- Automatic retrieval of images containing a given object. The intelligent classification model will allow to process new images and classify the objects that appear in them.
- Detection of anomalous activities based on comparative image analysis using the Automated Anomalies Detection model to detect changes.
- Decision support through indications of the interest or danger of the objects detected in the images. The Decision Support System will evaluate the level of potential risk represented by the objects detected in a classified image using an associative scheme between object types and alarm levels.

RESEARCHERS

- Carmona del Jesus, Cristóbal José*
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Funding Programme	Cooperation Program in Scientific Research and Development in Strategic Technologies
Funding Entity	Ministry of Defence
Principal Researcher	Maria José del Jesús Díaz
Start	05/11/2019
End	15/10/2021
Partners	University of Jaén University of Granada

DaSCI in media

DaSCI researchers coordinate a multidisciplinary team that has been able to demonstrate that creativity allowed Homo sapiens to survive Neanderthal.



A multidisciplinary team of scientists from different areas of knowledge, Artificial Intelligence (AI), Molecular Genetics, Neurosciences, Psychology and Anthropology, led by the University of Granada (UGR), has found new and important data on the genetic differences that allowed Homo Sapiens to displace Homo Neanderthalensis (Neanderthal) and the chimpanzee in the past.

The research has identified for the first time a set of 267 creativity-related genes that acted as the “secret weapon” to prevent Homo sapiens from becoming extinct.

Igor Zwir, Coral del Val, Rocío Romero, Javier Arnedo and Alberto Mesa, from the Department of Computer Science and Artificial Intelligence at the University of Granada (UGR), the Andalusian Inter-University Institute for Research in Data Science and Computational Intelligence (DaSCI) and the Institute for Biosanitary Research of Granada (IBS Granada), together with Robert Cloninger (Washington University in St. Louis), Ian Tattersall (American Museum of Natural History in New York) and collaborators from the Young Finns Study (Finland) and the Menninger Clinic (Houston).

Twelve DaSCI researchers have been included in the ranking of the world’s top 2% scientists.

The “World Scientist: World’s Top 2% Scientists” is a list created by a group of researchers coordinated from Stanford University, which has recently been published in the prestigious journal Plos Biology, and in which the world’s elite in the world of scientific research are included.

Among the authors recognised in the area of Artificial Intelligence and Image Processing are Francisco Herrera, Director of the Institute (among the 300 best in the world in this area) and other members of the Institute such as Enrique Herrera-Viedma, Luis Martínez, Salva García, Cristóbal Romero, Rosa M. Rodríguez, Óscar Cordón, Sebastián Ventura, Francisco J. Cabrerizo, Jesús Alcalá, Julián Luengo and Javier Ramírez.

Los 59 excelentes e influyentes investigadores de la UGR con impacto internacional

La institución universitaria granadina es la que está mejor posicionada entre las andaluzas en el ranking elaborado por la Universidad de Stanford



ANDREA G. PARRA Granada Miércoles, 3 marzo 2021, 13:43

DaSCI in media

Macarena Espinilla, DaSCI researcher, is involved in the telemedicine project 'RED - Core', finalist of SaluDigital awards

The 'RED - Core' system has been devised to remotely monitor patients, so that they can recover in their usual environment, performing the prescribed exercise in a wrist device that has a sensor to measure their heart rate constantly, thus increasing the number of patients being attended.

Through artificial intelligence techniques implemented by the University of Jaén, the device notifies the heart rate that the patient must reach for the exercise to be effective and improve their health.

The programme has a mobile application that allows you to consult the sessions carried out, view the patient's progress and the reference values established by the health staff. As it is hosted in the cloud, it allows cardiology professionals to monitor users and maintain contact with them through a messaging channel, in order to resolve possible doubts or provide them with health advice.

In December 2020, the project also won second prize in its category in the WINnovAnda call for innovative talent from the Andalusian Regional Government.

Un proyecto de telemedicina del Hospital de Jaén y la UJA finalista de 'SaluDigital'

1 mayo, 2021

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Andalucía | europa press

Manuel Cobo, DaSCI researcher, has participated in the design of the first computer system that can help screenwriters to write a blockbuster story.

Researchers from the Universities of Granada and Cadiz, including DaSCI researcher Manuel Cobo, have used artificial intelligence techniques to develop a computer system that can be used by screenwriters to predict which plot twists may or may not work with audiences in their film. The tool is based on tropes. The research team has devised a methodology for visualising how they are related, understanding them and, above all, inferring which combinations would or would not be successful for the creative processes.



Andalucía | europa press | MailOnline | THE TIMES | EL MUNDO

Up To Date

DaSCI Webinars



Pablo Mesejo Santiago, Nuria Rodríguez Barroso, and Eugenio Martínez Cámara, who are DaSCI members, are the coordinators of the DaSCI Seminars, and they have the intention of continuing inviting top-tier researchers in artificial intelligence for sharing their latest advances with the members of DaSCI, and encouraging DaSCI PhD students to present their most important research results.

DaSCI Seminar is the name of the series of seminars organised by DaSCI. The Seminar series is in first term a training tool for DaSCI members, in particular for PhD students, and in second term a strategy to meet top-tier researchers to start with them a research collaboration relationship.

DaSCI Seminar began the 26th of October of 2020 with a talk about Reinforcement Learning by PhD. Sergio Guadarrama, who works as a research scientist in Google. The seminar was highly attended by DaSCI researchers, which served to show that the seminar format was adequate to bring DaSCI members closer to cutting-edge lines of research and pose new scientific problems to work on and continue to contribute with original and innovative solutions. These good brivations were an incentive to organize more than 20 seminars in the first season of Webinars DaSCI.

The DaSCI Webinars are structured in three categories with the aim of maximising its utility and contributions to DaSCI members and the artificial intelligence community. The three categories are:

DaSCI Online Seminar: Its aim is to present cutting-edge research lines in order to contribute to the innovative capacity of the leading team of that research line in DaSCI, or to promote it if it is not defined. Top-tier researchers have participated in the 9 Online Seminars of the first season of DaSCI Webinars. We have invited prestigious researchers, such as PhD Xavier Alameda-Pineda from the European Lab for Learning and Intelligent Systems (ELLIS), who illustrated us about variational autoencoders, and other renowned scientists like PhD Prelav Nakov, who spoke about mis and disinformation, PhD Stéfhane Lethuilière, who showed us how to generate videos and images

with deep learning models, and PhD Bryan Perozzi, who talked us about graph-based neural networks.

DaSCI Online Lectures: They are reserved to Spanishs researchers could share their latest research advances, regardless they are DaSCI members. We highlight the talk given by Professor David Camacho from the Polytechnical University of Madrid, of the researchers Javier Valls and Francisco Lara from the University of Granada with a presentation on the Ethics and Law of Artificial Intelligence, of PhD Natalia Díaz with a talk on explainable artificial intelligence models, and of PhD Humberto Bustince with a lecture on the application of aggregation functions in deep learning models. In this seminar category, not well-known artificial intelligence applications have also been discussed, as it is the case of the application in agriculture, which was exposed by our DaSCI colleague PhD Salvador Gutiérrez.

DaSCI Online Readings: These seminars are given by the DaSCI PhD students, and they expose their last research works or their research lines. The goal is the training of PhD students in presenting their research work, which is crucial in Academia. Two doctoral students participate in each session of Online Readings, having organised a total of six sessions in the first season, in which the main lines of DaSCI research have been addressed, such as: the application of anomaly detection models in industrial problems, application of deep learning models to the processing of X-rays on COVID-19, the application of sentiment analysis to decision-making models, and the use of deep learning models to the automatic recognition of architectural styles.

The second season of the DaSCI Webinar has already started with the Online Lecture by Eugenio Martínez Cámara, in which he presented the DaSCI research line on Federated Learning. The purpose of this new season is to continue contributing to the scientific advancement of DaSCI through the invitation of the world's leading researchers in artificial intelligence, and with a greater participation of doctoral students, in order for them to receive advice from DaSCI researchers and advance their skills in exposing and advocating for their scientific work.

DaSCI Webinars bring our researchers a closer look into cutting-edge lines and pose new scientific problems to work on

Up To Date

SintonIA: a podcast from DaSCI

@SintonIA_DaSCI - Artificial Intelligence (AI) on air.

This is the title of the new podcast of the Andalusian Institute for Data Science and Computational Intelligence (DaSCI), launched on 15 March.

The programme is part of the institute's communication and dissemination strategy and, according to its authors, aims to bring to the general public what lies behind the technologies that are shaping the present.

Hosted by computer scientists Rocío Romero and Francisco Jesús Martínez, @SintonIA_DaSCI talks about statistics, neural networks, data science,

practical applications and the latest advances at the institute in a friendly and light-hearted way.

Each episode includes references to short news items, an in-depth topic and interviews with experts in the field.

First season covered eight different topics, from Women in IT to fake news or e-health, and with an important presence of women.

SintonIA will be also a broadcast space to make it visible the important work that is being done by dozens of women in DaSCI and other related research institutes in STEM.



SintonIA episodes Season 1



- E1** *Women in computing*
Guests: CLAUDIA SALADO, NURIA RODRÍGUEZ and ROSA VENZALÁ
- E2** *Your face sounds familiar*
Guest: GUILLERMO GÓMEZ TRENADO
- E3** *They listen to us, but do they understand us?*
Guest: EUGENIO MARTÍNEZ CÁMARA
- E4** *An episode very "mono" (pun with "monkey"/"cute" in Spanish)*
Guest: CORAL DEL VAL MUÑOZ
- E5** *Fake news*
Guest: PRESILAV NAKOV
- E6** *Regression and complexity*
Guest: PABLO MESEJO SANTIAGO
- E7** *Connected Health*
Guest: MACARENA ESPINILLA
- E8** *Black? boxes*
Guest: NATALIA DÍAZ RODRÍGUEZ

"Making a deep fake costs as much investment as it would take to detect it"

GUILLERMO GÓMEZ TRENADO
SintonIA S1E2



"Not only female role models are needed, but also male support from teachers and peers"

NURIA RODRÍGUEZ
SintonIA S1E1



<https://sl.ugr.es/SpotifySintonIA>



<https://www.spreaker.com/show/sintonia-la-ia-en-las-ondas>