



UNIVERSITY: Public University of Navarre (UPNA)

WIT AREA:

- Automotive, Mechatronics and Advance Manufacture**
- Health**
- Energy**
- IA**

WIT PROGRAMME'S RESEARCH LINE NAME: Improving deep learning-based computer vision methods using ensembles and advanced information fusion techniques.

DOCTORAL PROGRAMME: Doctorate in Science and Industrial Technologies
<https://www.unavarra.es/escuela-doctorado/doctorate-programs/current-plan/science/doctorate-in-science-and-industrial-technologies?languageld=1>

COMPLETE DESCRIPTION OF THE LINE

Deep learning has produced a true revolution in the world of computer vision. From convolutional neural networks and reaching transformers, there have been many problems where deep learning techniques have significantly improved the results that existed up to that moment. However, there are still problems where the results are far from what is expected. For this reason, it is interesting to explore different techniques that have been previously applied to general machine learning techniques, such as the combination of models to outperform individual ones, that is, ensembles. They has been applied, for example, to deal



with complex multiclass problems or with imbalanced data. Moreover, they can be also extended to deal with multi-task problems, where different sub-problems (classification or regression) are solved at simultaneously. Therefore, the proposal is to improve existing models by training and combining several models in an intelligent fashion, with special emphasis in the combination phase.

RESEARCH GROUP NAME: Approximate Reasoning and Artificial Intelligence

COORDINATOR:

- Last and first name; link to the “Portal of scientific production”: Bustince, Humberto.
https://academicos.unavarra.es/CawDOS//jsf/seleccionActividades/seleccionActividades.jsf?id_pers=278&idioma=es&elmeucv=N
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MEMBERS OF THE LINE RESEARCH:

Daniel Paternain (Tutor)

Mikel Galar

José Antonio Sanz

Aránzazu Jurío

Mikel Sesma



ANOTHER RESEARCH LINES OF THE GROUP:

- Information Fusion and aggregation techniques
- Decision making
- Computer vision
- Machine learning
- Data Mining
- Deep learning

▪ Entities involved in research lines and contact person:

✓ Academic entities:

Universidade de Tras-os-montes e Alto Douro, Vila Real (Portugal): Pedro Melo-Pinto

Slovak University of Technology, Bratislava (Slovakia): Radko Mesiar

University of Ostrava, Ostrava (Czech Republic): Irina Perfilieva

University of Nottingham, Nottingham (United Kingdom): Isaac Triguero

Ghent University, Ghent (Belgium): Daniel Peralta

Wroclaw University, Ghent (Belgium): Michael Wozniak

Virginia Commonwealth University, Richmond (United States of America): Bartosz Krawczyk and Alberto Cano

University of Granada, Granada (Spain): Alberto Fernández

✓ Industrial entities:

Neuraptic AI (<https://www.neuraptic.ai/>): Mikel Elkano

Tracasa Instrumental (<https://itracasa.es>): Carlos Aranda



- Joint supervision of doctoral thesis with international universities or non-academic institutions:

“Behavioral analysis in Cybersecurity using Machine Learning. A study based on graph representation, class imbalance and temporal dissection” by Francesco Zola (Vicomtech)

“Aggregation and pre-aggregation functions in fuzzy rule-based classification systems” by Giancarlo Lucca (Universidade Federal do Rio Grande, Brazil)

“Admissible interval-valued overlap functions in fuzzy rule-based classification systems” under development by Tiago Da Cruz Asmus (Universidade Federal do Rio Grande, Brazil)

Currently in process:

“Deep Learning for Earth Observation” by Christian Ayala (Tracasa Instrumental)

“Continual Learning for ENAIA Machine Learning Plataform” by Enrique Hernández (Neuraptic AI)

“Development of intelligent technologies in Industry 4.0: Automatic Quality Assessment and Maintenance” by Luis Iñiguez (KWD Automotive)

“Development of Machine Learning models for improving Indoor Air Quality (IAQ)” by Peio Garcia (InBiot)

- Brief group overview

The Artificial Intelligence and Approximate Reasoning Research Group (GIARA) began its trajectory focusing on mathematical modelling, especially in the



context of Fuzzy Set Theory. The experience accumulated in this line generated different theoretical-practical research, mostly based on machine learning and/or computer vision. This research has led to advances in areas as varied as automatic control, food safety, geospatial data processing, health, big data or convolutional/deep neural networks. Beyond the academic impact, the ability to connect mathematical theory with advanced technical tools has led to applied developments in industrial, agrobiotechnology and medical environments. To date, GIARA has generated more than 400 indexed articles, collaborating with more than 200 different authors, and maintains active projects with researchers from 4 continents.

- Link of the group to the “Portal of scientific production”

https://academicos.unavarra.es/CawDOS//jsf/seleccionActividades/seleccionActividades.jsf?id_pers=7828&idioma=es&elmeucv=N

- Pictures, links... to academic or industrial partners (if any)

<https://itracasa.es/investigacion-desarrollo-innovacion/>

<https://www.neuraptic.ai/>

ACADEMIC REQUIREMENTS: Computer Science

ADDITIONAL REQUIREMENTS: Knowledge in image processing, computer vision and machine learning