



UNIVERSITY: Public University of Navarre (UPNA)

WIT PROGRAMME'S RESEARCH LINE NAME: Multifactorial analysis of early metabolic syndrome using machine learning

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?languageId=1>

COMPLETE DESCRIPTION OF THE LINE

The metabolic syndrome is related to some of the main causes of death in Spain. This syndrome is characterized by a variety of precursors (improper diet, smoking, sedentary lifestyle,...), and is also related to increased probabilities of a list of adverse consequences (diabetes, cardiovascular accident,...). In the present context, there is an increasing incidence of the precursors, which draws an alarming mid-term horizon.

This line proposes the use of state-of-the-art machine learning techniques to profile patients affected by metabolic syndrome. Specifically, it intends to use advanced techniques for the global and detailed analysis of medical histories, conventional analytics and socioeconomic context, in order to highlight the factors (or combination of factors) with influence in the proneness to be affected by metabolic syndrome.

This line intends to produce results in two different areas. Firstly, in preventive medicine, by identifying groups and profiles more likely to suffer metabolic syndrome, thus helping the design and development of corrective actions. Secondly, in terms of precision medicine, helping the correct diagnosis and treatment of already affected patients.



RESEARCH GROUP NAME:

Grupo de Investigación en Inteligencia Artificial y Razonamiento Aproximado (GIARA).

COORDINATOR:

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MEMBERS OF THE LINE RESEARCH:

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- Fco. Javier Fernández Fernández (UPNA)
- Carlos López Molina (UPNA & NavarraBiomed, Tutor)
- Idoia Labayen Goñi (UPNA, Tutora)
- Félix Sánchez-Valverde Visú (NavarraBiomed & CHN)
- Javier Campión Zabalza (Making Genetics)
- Gonzalo Rodríguez Ordóñez (Nasertic)

ANOTHER RESEARCH LINES OF THE GROUP: short description of each of them

- Fuzzy Set Theory and Approximate Reasoning
- Information aggregation and fusion operators
- Machine Learning, Neural Networks and Deep Learning



- Industrial, agronomic and medical image processing
- Medical and biotech data analysis
- Clustering and classification based on fuzzy rules

▪ Entities involved in research lines and contact person:

✓ Academic entities:

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- Vicomtech (R. Orduna, rorduna@vicomtech.org)
- Joint supervision of doctoral thesis with international universities or non academic institutions:
 - Sesma-Sara, Mikel, *Generalized forms of monotonicity in the data aggregation framework*, H. Bustince (UPNA), R. Mesiar (Sloval Technical University) Universidad Pública de Navarra 2019.
 - De Miguel Turullols, Laura, *Computing with uncertainly truth degrees: a convolution-based degrees*. H. Bustince (UPNA), B. De Baets (Ghent University), 2017.
 - Paternain Dallo, Daniel *Optimization of image reduction and restoration algorithms based on penalty functions and aggregation techniques*, H. Bustince (UPNA), F.J Fernández (UPNA), G. Beliakov (Deakin University), 2013.
 - Lopez Molina, Carlos, *The Breakdown structure of edge detection: Analysis of individual components and revisit of the overall structure*. H. Bustince (UPNA), B. De Baets (Ghent University), 2012.
- Group review

The Artificial Intelligence and Approximate Reasoning Research Group (GIARA) began its trajectory focused on mathematical modeling, especially in the context of Fuzzy Set Theory. The experience gained in this line generated different theoretical-practical research, mostly based on machine learning and/or computer vision. This research has led to advances in topics as varied as automatic control, food safety, big data or convolutional/deep neural networks. Beyond the academic impact, the ability to connect mathematical theory with advanced technical tools has led to developments applied in industrial, agrobiotechnology and medical environments. To date, GIARA has generated



more than 400 indexed articles, collaborating with more than 200 different authors, and it is actively involved in projects with researchers from 4 continents.

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

<https://academicos.unavarra.es/CawDOS/?id=1adf33dba1eb5382&idioma=es&tipo=actGrupo>

- Pictures, links... to academic or industrial partners
 - UPNA: www.unavarra.es
 - NavarraBiomed: www.navarrabiomed.es
 - CHN: www.idisna.es/conocenos/instituciones/complejo-hospitalario-de-navarra
 - Making Genetics: www.making-genetics.eu/es/
 - Nasertic: www.nasertic.es

CANDIDATE REQUISITES

Degree in Computer Sciences or Mathematics

The candidate shall ideally have some experience in bio-related projects and/or developments. Also, needs to be open to integration in a multidisciplinary team involving different experts in the field.