



**UNIVERSITY: Universidad Pública de Navarra (UPNA)**

**WIT PROGRAMME'S RESEARCH LINE NAME:** Multifactorial study and profiling of oncological patients using Deep Learning and Big Data

**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**

Advances in molecular biology related to cancer, in areas such as genomics or proteomics, has brought various benefits to patients. Firstly, a more specific characterization of each type of tumor. Also, the possibility of administering specific treatments based on the particular characteristics of the tumor. This new paradigm in the approach to patients is what we call precision medicine.

While precision medicine largely relies in genetics, it also involves the multifactorial analysis of different sources of information e.g. the clinical, radiological or pharmacological aspects of each patient. This materializes in a list of challenges, e.g. the extraction of data from the computerized medical record systems and the normalization of highly heterogeneous data from a variety of sources. Despite the difficulties, this line proposes the use of deep learning and Big Data techniques for the analysis of complex oncological profiles. These analyzes may be the key to identifying subgroups of patients with similar tumors and clinical situations, for which we can identify the best specific treatments. This should entail direct improvements both in the early detection of tumors, through the localization of risk groups, and in the individualized treatment of the patients themselves.



## 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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- Ruth Vera (CHN & NavarraBiomed, Tutor)
- F.J. Fernández (UPNA & NavarraBiomed)
- Roberto Tagliaferri (U. Salerno)
- Gonzalo Rodríguez Ordoñez (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:

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  - Vicomtech (R. Orduna, [rorduna@vicomtech.org](mailto: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 (Slovak 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, agrobiotechnological 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 (if any)

- UPNA: [www.unavarra.es](http://www.unavarra.es)
- NavarraBiomed: [www.navarrabiomed.es](http://www.navarrabiomed.es)
- CHN: [www.idisna.es/conocenos/instituciones/complejo-hospitalario-de-navarra](http://www.idisna.es/conocenos/instituciones/complejo-hospitalario-de-navarra)
- Nasertic: [www.nasertic.es](http://www.nasertic.es)
- <https://www.making-genetics.eu/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.