

CV Date	07/09/2023
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Part A. PERSONAL INFORMATION

First Name	Oscar		
Family Name	Garnica Alcázar		
Sex	Male	Date of Birth	
ID number Social Security, Passport			
URL Web			
Email Address		CVN Link	
Open Researcher and Contributor ID (ORCID)		0000-0001-5064-2587	

A.1. Current position

Job Title	Profesor Titular de Universidad		
Starting date	2007		
Institution	Universidad Complutense de Madrid		
Department / Centre	ARQUITECTURA DE COMPUTADORES Y AUTOMAT. / F. INFORMATICA		
Country	Spain	Phone Number	
Keywords	Artificial intelligence; AI hardware accelerators; Design of digital integrated circuits; Intelligent electronic devices; AI-based personalized medicine		

A.2. Previous positions (Research Career breaks included)

Period	Job Title / Name of Employer / Country
2005 - 2007	PHYSICAL ASIC ENGINEER
2002 - 2005	PROFESOR ASOCIADO TIPO 3
2003 - 2005	SENIOR ASIC DESIGN ENGINEER /
2002 - 2002	PROFESOR ASOCIADO TIPO 2
2000 - 2001	ASIC DESIGN ENGINEER
1998 - 2000	PROFESOR ASOCIADO TIPO 2

A.3. Education

Degree/Master/PhD	University / Country	Year
Ciencias físicas	Universidad Complutense de Madrid / Spain	2001
Licenciado en Ciencias Físicas Especialidad Electrónica	Universidad Complutense de Madrid / Spain	1992

Part B. Description of relevant aspects of your trajectory that reflect your interdisciplinary profile

My research settles on three main areas.

1. **AI Hardware Accelerators:** The first pillar of my research involves designing AI hardware accelerators, both for wearable applications and high-performance systems in data centers. On one hand, I work on **low-power wearable implementations of AI techniques** (mainly, neural networks) on FPGA technology, particularly for glucose level prediction in diabetes management. These circuits are **wearable** or **embedded** in sensors and acquire real-time data from these sensors and smart

devices worn by the person. On the other hand, I work on reducing the **power consumption of high-performance AI hardware accelerators** in data centers. These systems have diametrically different requirements than those presented above and consume large amount of energy, so its reduction has implications for **energy efficiency** and **environmental impact**.

2. **Artificial Intelligence (AI) methods.** In this area, I work in the proposal of new AI methods, including evolutionary algorithms, tree-based models, and neural networks, to address the challenges posed by strongly unbalanced sparse datasets. These datasets are common in biomedical research, and my work aims improve their processing and analysis to provide for unbiased predictions. I work proposing new techniques for data balancing, synthetic data generation, hyperparameter tuning of AI methods, handling heterogeneous data types within the same dataset, such as time series and images, and new AI methods adjusted to the characteristics of these datasets.

3. **Personalized Medicine with AI.** The third pillar of my research involves applying AI methods to create personalized predictive models in biomedicine. I have applied these methods to **create personalized predictive models of glucose levels** and hypo/hyperglycemia events in people with **diabetes** in time horizons ranging from 30 to 120 minutes (national and private projects in collaboration with the Hospital Universitario Príncipe de Asturias and the Hospital de Toledo), the **prediction of obesity** using demographic and genetic data (GENOBIA project of the Community of Madrid involving five hospitals), the **prognosis** of hospitalized patients with **COVID-19** (Hospital Universitario de Fuenlabrada) which improves the use of hospital resources and focuses attention on those patients with the worst prognosis, and the **prediction of bacteremia in hospitalized patients** (Hospital Universitario de Fuenlabrada). In all cases, there is interaction with the user, whether the patient or the physician, and particularly in the case of physicians, the generation of interpretations (**interpretability**) of the results of the models is mandatory in most of the cases. These models contribute to personalized medicine by tailoring treatments to individual patient characteristics. These methods are also being applied in the automotive insurance industry (industrial PhD in collaboration with the company Biztools S.A: and with client one of the main insurance companies in Spain) and in the development of new materials (CAM project in collaboration with CNIM); all fields in which data sets share similar characteristics as medical data sets in terms of their imbalance, sparsity and presence of biases.

In summary, my research spans AI techniques for handling challenging datasets, personalized medicine applications, and the development of AI hardware accelerators, all with the goal of advancing knowledge and improving various fields, including healthcare and environmental sustainability.

Part C. RELEVANT ACCOMPLISHMENTS

C.1. Most important publications in national or international peer-reviewed journals, books and conferences

AC: corresponding author. (n° x / n° y): position / total authors. If applicable, indicate the number of citations

- 1 **Scientific paper.** Félix Tena; Oscar Garnica; Juan Lanchares; Jose Ignacio Hidalgo. 2023. An LSTM-based Neural Network Wearable System for Blood Glucose Prediction in People with Diabetes. IEEE Journal of Biomedical and Health Informatics. pp.1-12. <https://doi.org/10.1109/JBHI.2023.3300511>
- 2 **Scientific paper.** Marta Botella Serrano; J. Manuel Velasco; Almudena Sánchez-Sánchez; Oscar Garnica; J. Ignacio Hidalgo. 2023. Evaluating the influence of sleep quality and quantity on glycemic control in adults with type 1 diabetes. Front. Endocrinology. 14. <https://doi.org/10.3389/fendo.2023.998881>
- 3 **Scientific paper.** Daniel Parra; Alberto Gutierrez-Gallego; Oscar Garnica; J. Manuel Velasco; Khaoula Zekri-Nechar; José J. Zamorano-León; Natalia de las Heras; J. Ignacio Hidalgo. 2022. Predicting the Risk of Overweight and Obesity in Madrid —A Binary Classification Approach with Evolutionary Feature Selection. Applied Sciences. MDPI. 12-16. <https://doi.org/10.3390/app12168251>
- 4 **Scientific paper.** Velasco, Jose Manuel; Botella-Serrano, Marta; Sánchez-Sánchez, Almudena; et al; Hidalgo, José Ignacio. 2022. Evaluating the Influence of Mood and Stress on Glycemic Variability in People with T1DM Using Glucose Monitoring Sensors and Pools. Diabetology. 3-2, pp.268-275. ISSN 2673-4540. <https://doi.org/10.3390/diabetology3020018>
- 5 **Scientific paper.** Contador, S; Colmenar, JM; Garnica, O; Velasco, JM; Hidalgo, JI. 2021. Blood glucose prediction using multi-objective grammatical evolution: analysis of the "agnostic" and "what-if" scenarios. GENETIC PROGRAMMING AND EVOLVABLE MACHINES. ISSN 1389-2576. <https://doi.org/10.1007/s10710-021-09424-6>
- 6 **Scientific paper.** Tena, F; Garnica, O; Lanchares, J; Hidalgo, JI. 2021. Ensemble Models of Cutting-Edge Deep Neural Networks for Blood Glucose Prediction in Patients with Diabetes. SENSORS. 21-21. <https://doi.org/10.3390/s21217090>
- 7 **Scientific paper.** Contador, S; Velasco, JM; Garnica, O; Hidalgo, JI. 2021. Glucose forecasting using genetic programming and latent glucose variability features. APPLIED SOFT COMPUTING. 110. ISSN 1568-4946. <https://doi.org/10.1016/j.asoc.2021.107609>
- 8 **Scientific paper.** Garnica, O; Gomez, D; Ramos, V; Hidalgo, JI; Ruiz-Giardin, JM. 2021. Diagnosing hospital bacteraemia in the framework of predictive, preventive and personalised medicine using electronic health records and machine learning classifiers. EPMA JOURNAL. 12-3, pp.365-381. ISSN 1878-5077. <https://doi.org/10.1007/s13167-021-00252-3>
- 9 **Scientific paper.** Pachon, SC; Serrano, MB; Alcazar, OG; Cabo, JMV; Zurimendi, AA; Martinez, RR; Villaizan, EM; Perez, JIH. 2021. Identification of blood glucose patterns in patients with type 1 diabetes using continuous glucose monitoring and clustering techniques. ENDOCRINOLOGIA DIABETES Y NUTRICION. 68-3, pp.170-174. ISSN 2530-0180. <https://doi.org/10.1016/j.endinu.2019.12.011>
- 10 **Scientific paper.** Garnica, O; Lanchares, J; Velasco, JM; Hidalgo, JI; Botella, M. 2020. Noise spectral analysis and error estimation of continuous glucose monitors under real-life conditions of diabetes patients. BIOMEDICAL SIGNAL PROCESSING AND CONTROL. 61. ISSN 1746-8094. <https://doi.org/10.1016/j.bspc.2020.101934>
- 11 **Scientific paper.** Garnica, O; Lanchares, J; Hidalgo, JI. 2020. Optimal Runtime Algorithm to Improve Fault Tolerance of Bus-Based Reconfigurable Designs. IEEE TRANSACTIONS ON VERY LARGE SCALE INTEGRATION (VLSI) SYSTEMS. 28-4, pp.914-925. ISSN 1063-8210. <https://doi.org/10.1109/TVLSI.2019.2961782>
- 12 **Scientific paper.** Hidalgo, JI; Botella, M; Velasco, JM; et al; Lanchares, J. 2020. Glucose forecasting combining Markov chain based enrichment of data, random grammatical evolution and Bagging. APPLIED SOFT COMPUTING. 88. ISSN 1568-4946. <https://doi.org/10.1016/j.asoc.2019.105923>
- 13 **Book chapter.** Oscar Garnica Alcázar; José M. Ruiz Giardín; J. Ignacio Hidalgo Pérez. (1/3). 2023. Artificial Intelligence-Based Predictive, Preventive, and Personalised Medicine Applied to Bacteraemia Diagnosis. Microbiome in 3P Medicine Strategies. Advances in Predictive, Preventive and Personalised Medicine. Springer. 16, pp.9-41. https://doi.org/10.1007/978-3-031-19564-8_2

C.3. Research projects and contracts

- 1 **Project.** Inteligencia artificial sobre aceleradores hardware especializados y sistemas empotrados para el tratamiento personalizado de precisión de la diabetes (ARISHPEDIA. Óscar Garnica Alcázar. (Universidad Complutense de Madrid). 01/01/2023-31/12/2025.
- 2 **Project.** Sistema wearable de inteligencia artificial para la toma de decisiones de personas con diabetes. Juan Lanchares Dávila. (Universidad Complutense de Madrid). 01/02/2023-31/12/2024.
- 3 **Project.** Desarrollo de técnicas avanzadas de inteligencia artificial para optimización de coste y minimización de riesgo de compañías aseguradoras. Consejería de Educación, Ciencia, Universidades y Portavoces. JOSÉ IGNACIO HIDALGO PÉREZ. (Universidad Complutense de Madrid). 01/01/2021-31/12/2023. 117.388,17 €.
- 4 **Project.** Sistema adaptativo bioinspirado para el control glucémico basado en sensores y accesorios inteligentes. Ministerio de Economía y Competitividad. JOSÉ IGNACIO HIDALGO PÉREZ. (Universidad Complutense de Madrid). 01/01/2019-31/12/2021. 105.512 €.
- 5 **Project.** Desarrollo de un sistema para mejora del control de la diabetes mellitus basado en inteligencia artificial. OSCAR GARNICA ALCAZAR. (Universidad Complutense de Madrid). 01/01/2019-01/07/2021. 20.000 €.
- 6 **Project.** Diseño, mediante inteligencia artificial, de algoritmos predictivos para la identificación de individuos en riesgo de desarrollar sobrepeso/obesidad y sus patologías asociadas: aportación del análisis genético. Comunidad de Madrid. ANTONIO LÓPEZ FARRÉ. (Universidad Complutense de Madrid). 01/01/2018-31/12/2020. 800.000 €.
- 7 **Contract.** Desarrollo de un entorno de verificación basado en UVM para módulo SPI Computadoras, Redes e Ingeniería SAU (CRISA). ANTONIO OSCAR GARNICA ALCAZAR. 01/05/2016-17/06/2017. 2.900 €.
- 8 **Contract.** Metodologías y herramientas para el diseño de circuitos integrados Investing Profit Wisely, S.L.. ANTONIO OSCAR GARNICA ALCAZAR. 01/09/2015-30/09/2015. 420 €.
- 9 **Contract.** Ingeniería de verificación de SEOSAT/Ingenio DCU Computadoras, Redes e Ingeniería SAU (CRISA). ANTONIO OSCAR GARNICA ALCAZAR. (Computadoras, Redes e Ingeniería SAU (CRISA)). 21/03/2011-31/07/2011. 15.714 €.
- 10 **Contract.** Desarrollo de distintos bloques de proceso para FPGA INDRA SISTEMAS, S.A.. JUAN LANCHARES DAVILA. (INDRA SISTEMAS, S.A.). 23/11/2009-24/05/2010. 32.500 €.
- 11 **Contract.** Ingeniería de verificación de la FPGA CE de Sentinel-3 CPE Computadoras, Redes e Ingeniería SAU (CRISA). ANTONIO OSCAR GARNICA ALCAZAR. (Computadoras, Redes e Ingeniería SAU (CRISA)). 12/02/2009-03/12/2010. 51.904 €.

C.4. Activities of technology / knowledge transfer and results exploitation

- 1 **Patent of invention.** José Ignacio Hidalgo Pérez; Oscar Garnica Alcázar; Juan Lanchares Dávila; Francisco Fernández de Vega; José Manuel Velasco Cabo; Francisco Chávez de la O; Jorge Alvarado Díaz; Javier Hidalgo García. P202230016. Método y sistema para predicción de valores de glucosa y generación de alertas de hipoglucemia e hiperglucemia Spain. 12/01/2022. Universidad Complutense de Madrid.
- 2 **Patent of invention.** Marta Botella Serrano; JOSÉ MANUEL COLMENAR VERDUGO; ALFREDO CUESTA INFANTE; ANTONIO OSCAR GARNICA ALCAZAR; JOSE IGNACIO HIDALGO PEREZ; JUAN LANCHARES DAVILA; Esther Maqueda Villaizán; JOSE LUIS RISCO MARTIN; José Antonio Rubio García. Método para el modelado del nivel de glucemia mediante programación genética P201331726 Spain. Universidad Complutense de Madrid.