

# Mikel Val Calvo, Ph.D.

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## About me

2023 ■ **As a Postdoctoral Researcher**, my focus lies on data processing and the use of machine learning and deep learning techniques to deliver high-impact solutions. During the last year, I have participated in a project for the University of Murcia funded by BASF, in which I have developed database integration systems in graphs using language models such as ChatGPT and OpenAI libraries. This experience has further strengthened my expertise in implementing and experimenting with various approaches to introduce AI/ML solutions. I am well-versed in cutting-edge technologies such as object-oriented programming, PyTorch, image processing, real-time sensor signal processing, and machine learning. My work has been published in peer-reviewed scientific journals, showcasing my proficiency in visual neuroprosthesis development and human-robot interaction through multimodal emotion recognition using physiological signals. With a unique blend of software engineering knowledge for machine learning projects and science-oriented technical skills, I bring a valuable perspective to any team.




## Research Experience

- 2023 – Present ■ **Postdoctoral Researcher**, Universidad de Murcia. In my current role, I am responsible for developing systems based on Large Language Models (LLMs) using libraries such as OpenAI and LangChain. I am actively engaged in a primary project focused on creating a semi-automatic system that translates structured databases into knowledge graphs, aimed at enhancing data interoperability and utilization. This work enables me to leverage my expertise in machine learning and deep learning to devise innovative solutions that improve data accessibility and utility. Additionally, I assume project management responsibilities and collaborate with cross-functional teams to ensure the successful implementation and deployment of AI/ML solutions.
- 2020 – 2022 ■ **Postdoctoral Researcher**, Neuroprosthesis and Visual Rehabilitation Unit of the Bio-engineering Institute, University Miguel Hernández of Elche. As a postdoctoral researcher, I led a team in the development and validation of a cortical visual neuroprosthetic device. My responsibilities encompassed scheduling and designing experimentation protocols, developing customized software for executing these protocols, and creating a wearable system prototype for image processing and electrical stimulation coding via brain-attached electrodes. Proficient in machine and deep learning projects employing computer vision for neuroprosthetic devices, I excel in team leadership, custom software development, and prototype creation for complex undertakings.



## Research Experience (continued)

- 2017 – 2020  **PhD student**, Department of Electronics, Computer Technology and Projects, Univ. Polit cnica de Cartagena, Cartagena, Spain. My PhD project focused on developing a machine learning system for emotional human-robot interaction. Specifically, I designed and implemented a system that utilized computer vision and an ensemble of deep learning models for facial expression recognition, as well as machine learning models for emotion estimation through physiological signal analysis. Employing a multimodal emotion estimation pipeline approach, the system enabled accurate emotional state estimation of humans interacting with the robot. I effectively presented my findings at multiple international conferences, highlighting my expertise in machine learning, computer vision, and emotional analysis.
- 2016 – 2017  **Assistant researcher**. Department of Electronics, Computer Technology and Projects, Univ. Polit cnica de Cartagena, Cartagena, Spain. As a research assistant, I contributed to a project focused on controlling the behavior of a robot using a biological neuroprocessor. The neuroprocessor consisted of a culture of neurons connected to an amplifier, which, in turn, was connected to the robot. The robot employed a computer vision algorithm for center of mass detection, enabling obstacle-free navigation. The neural culture received inputs and generated outputs based on its current state, which the robot decoded as actions to be taken. This project provided valuable experience in neuroprocessing, robotics, and computer vision.
- 2015 – 2016  **Analyst programmer**. Neuroprosthesis and Visual Rehabilitation Unit of the Bio-engineering Institute, University Miguel Hern ndez of Elche. I programmed an algorithm for center of mass detection using computer vision techniques. This algorithm facilitated obstacle-free navigation for the robot. The project was implemented using the Robot Operating System (ROS) development platform, which enhanced my proficiency in programming algorithms for robotic navigation and deepened my understanding of ROS. Additionally, I gained significant experience in computer vision through the implementation of the algorithm. Overall, this project helped me develop a strong understanding of computer vision and its applications in robotics.



## Education

- 2017 – 2020  **Ph.D., UNED-UPCT-UMH**  
Thesis title: *EMOTIONAL HUMAN-ROBOT INTERACTION USING PHYSIOLOGICAL SIGNALS*.
- 2016 – 2017  **M.Sc. Advanced A.I. of the UNED**
- 2010 – 2015  **B.Sc. Software engineering of the UNED**

## Skills







- Languages  Fluent in English, Spanish, and Basque (reading, writing, and speaking). Conversational abilities in Valencian.
- Teamwork  Demonstrate strong interpersonal skills that facilitate effective collaboration and problem-solving within diverse teams. Experienced in decision-making, organization, critical thinking, and efficient time management, enabling successful handling of unexpected situations.

## Skills (continued)

- Data Processing  Exhibit exceptional proficiency in various domains, including machine learning, deep learning, object-oriented programming, data analysis, and data visualization. Skilled in developing and implementing advanced machine learning algorithms and deep learning models, with a focus on Python programming.
- Programming  Proficient in PyTorch, Scikit-Learn, Pandas, Scipy, and Numpy. Currently expanding my knowledge to include the deployment of Large Language Model (LLM)-based systems.

## Supplementary Education

### Certification

- 2023  **ChatGPT Prompt Engineering for Developers.** Awarded by deeplearning.ai at Coursera.
- 2018  **Certified Neural Networks and Deep Learning.** Awarded by deeplearning.ai at Coursera.
-  **Certified Convolutional neural networks.** Awarded by deeplearning.ai at Coursera.
-  **Certified Improving deep neural networks: Hyperparameter tuning, Regularization and Optimization.** Awarded by deeplearning.ai at Coursera.
-  **Certified Structuring Machine Learning Projects.** Awarded by deeplearning.ai at Coursera.
-  **Certified Sequence Models.** Awarded by deeplearning.ai at Coursera.

## References

### Prof José Manuel Ferrández-Vicente

Professor

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### Prof José Ramón Álvarez-Sánchez

Professor

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Departamento de Inteligencia Artificial.

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## Research Publications

### Journal Articles

- 1 Lozano, A., Calvo, M. V., Alegre-Cortés, J., López, F. D. L. P., Álvarez-Sánchez, J. R., Ferrandez, J. M., & Fernandez, E. (n.d.). Towards a deep learning model of information encoding and decoding of in vitro neuronal cultures responses to electrical stimulation.
- 2 Grani, F., Val-Calvo, M., Peco, R. L., Doblado, A. R., Waclawczyk, D., Ruiz, R. M., Soo, L., Sanchez, C. S., Ortiz, M. V., & Jover, E. F. (2023). Advantages of bidirectional cortical visual prostheses. *IBRO Neuroscience Reports*, 15, S948–S949.
- 3 López-Peco, R., Sanchez, C. S., Val-Calvo, M., Grani, F., Doblado, A. R., & Fernández-Jover, E. (2023). Development of an automatic classifier for intracortical microstimulation waveforms based on machine learning techniques. *IBRO Neuroscience Reports*, 15, S786–S787.
- 4 Ruiz, R. M., Soo, L., Val-Calvo, M., López-Peco, R., Grani, F., Waclawczyk, D., Doblado, A. R., Sanchez, C. S., & Fernández-Jover, E. (2023). A new environment for assessing orientation and mobility in persons with severe visual impairments. *IBRO Neuroscience Reports*, 15, S950–S951.






- 5 Val-Calvo, M., Alegre-Cortés, J., Peco, R. L., Sanchez, C. S., Fernández-Breis, J., & Jover, E. F. (2023). Automating electrophysiological record cleaning in visual cortical neuroprostheses using machine learning techniques applied to knowledge graphs. *IBRO Neuroscience Reports*, 15, S804.
- 6 Val-Calvo, M., Álvarez-Sánchez, J. R., Ferrández-Vicente, J. M., Díaz-Morcillo, A., & Fernández-Jover, E. (2020). Real-time multi-modal estimation of dynamically evoked emotions using electroencephalography, heart rate and galvanic skin response. *International Journal of Neural Systems*, 30(4), 2050013. <http://dx.doi.org/10.1142/S0129065720500136>
- 7 Benamara, N. K., Val-Calvo, M., Álvarez-Sánchez, J. R., Díaz-Morcillo, A., Vicente, J. M. F., Fernández, E., & Stambouli, T. B. (2020). Real-time facial expression recognition using smoothed deep neural networkensemble. *International Journal of Neural Systems*.
- 8 Bonomini, M. P., Calvo, M. V., Morcillo, A. D., Segovia, M. F., Vicente, J. M. F., & Fernández Jover, E. (2020). The effect of breath pacing on task switching and working memory.
- 9 Val-Calvo, M., Álvarez-Sánchez, J. R., Alegre-Cortés, J., de la Paz-López, F., Ferrández-Vicente, J. M., Fernández-Jover, E., & Val-Calvo, I. (2020). Frequency variation analysis in neuronal cultures for stimulus response characterization. *Neural Computing and Applications*, 32(9), 5027–5032.
- 10 Val-Calvo, M., Álvarez-Sánchez, J. R., Ferrández-Vicente, J. M., & Fernández-Jover, E. (2020). Affective robot story-telling human-robot interaction: Exploratory real-time emotion estimation analysis using facial expressions and physiological signals. *IEEE-access*, 8, 134051–134066. <https://doi.org/10.1109/ACCESS.2020.3007109>
- 11 Sorinasa, J., Fernandez-Troyano, J. C., Val-Calvo, M., Ferrández, J. M., & Fernandez, E. (2019). A new model for the implementation of positive and negative emotion recognition. *arXiv preprint arXiv:1905.00230*.
- 12 Val-Calvo, M., Álvarez-Sánchez, J. R., Ferrández-Vicente, J. M., & Fernández, E. (2019). Optimization of real-time eeg artifact removal and emotion estimation for human-robot interaction applications. *Frontiers in Computational Neuroscience*, 13, 80. <https://doi.org/10.3389/fncom.2019.00080>
- 13 Alegre-Cortés, J., Soto-Sánchez, C., Albarracín, A. L., Farfán, F. D., Val-Calvo, M., Ferrandez, J. M., & Fernandez, E. (2018). Toward an improvement of the analysis of neural coding. *Frontiers in neuroinformatics*, 11, 77.

## Conference Proceedings

- 1 Benedicto, G., Val, M., Fernández, E., Ferrer, F. S., & Ferrández, J. M. (2022). Autism spectrum disorder (asd): Emotional intervention protocol, In *International work-conference on the interplay between natural and artificial computation*. Springer.
- 2 Grani, F., Soto-Sanchez, C., Rodil Doblado, A., Grima, M. D., Farfan, F., Val Calvo, M., Soo, L., Waclawczyk, D., Ferrandez, J., Gonzalez, P. Et al. (2022). Performance evaluation of a real-time phase estimation algorithm applied to intracortical signals from human visual cortex, In *International work-conference on the interplay between natural and artificial computation*. Springer.
- 3 Val Calvo, M., Morollón Ruiz, R., Soo, L., Waclawczyk, D., Grani, F., Ferrández, J. M., & Jover, E. F. (2022). Horizon cyber-vision: A cybernetic approach for a cortical visual prosthesis, In *International work-conference on the interplay between natural and artificial computation*. Springer.
- 4 Waclawczyk, D., Soo, L., Val, M., Morollon, R., Grani, F., & Fernandez, E. (2022). The assessment of activities of daily living skills using visual prosthesis, In *International work-conference on the interplay between natural and artificial computation*. Springer.
- 5 Benamara, N. K., Val-Calvo, M., Álvarez-Sánchez, J. R., Díaz-Morcillo, A., Vicente, J. M. F., Fernández-Jover, E., & Stambouli, T. B. (2019). Real-time emotional recognition for sociable robotics based on deep neural networks ensemble, In *Understanding the brain function and emotions - IWINAC 2019, proceedings, part I*, Springer. [https://doi.org/10.1007/978-3-030-19591-5%5C\\_18](https://doi.org/10.1007/978-3-030-19591-5%5C_18)

- 6 Bonomini, M. P., Val-Calvo, M., Díaz-Morcillo, A., Vicente, J. M. F., & Fernández-Jover, E. (2019). Autonomic modulation during a cognitive task using a wearable device, In *International work-conference on the interplay between natural and artificial computation*. Springer.
- 7 Val-Calvo, M., Álvarez-Sánchez, J. R., Díaz-Morcillo, A., Ferrández Vicente, J. M., & Fernández-Jover, E. (2019). On the use of lateralization for lightweight and accurate methodology for eeg real time emotion estimation using gaussian-process classifier (J. M. Ferrández Vicente, J. R. Álvarez-Sánchez, F. de la Paz López, J. Toledo Moreo, & H. Adeli, Eds.). In J. M. Ferrández Vicente, J. R. Álvarez-Sánchez, F. de la Paz López, J. Toledo Moreo, & H. Adeli (Eds.), *Understanding the brain function and emotions*, Cham, Springer International Publishing.
- 8 Sorinas, J., Murcia, M. G., Minguillon, J., Sánchez-Ferrer, F., Val-Calvo, M., Ferrández, J. M., & Fernández, E. (2017). Setting the parameters for an accurate eeg (electroencephalography)-based emotion recognition system, In *International work-conference on the interplay between natural and artificial computation*. Springer.
- 9 Val-Calvo, M., Grima-Murcia, M., Sorinas, J., Álvarez-Sánchez, J., de la Paz López, F., Ferrández-Vicente, J., & Fernández-Jover, E. (2017). Exploring the physiological basis of emotional hri using a bci interface, In *International work-conference on the interplay between natural and artificial computation*. Springer.
- 10 Calvo, M., Ferrández-Vicente, J., De la Paz López, F., Alvarez-Sanchez, J., Cuadra Troncoso, J., & Fernández, E. (2016). Functional connectivity graphs in hippocampal cultures using tetanic stimulation for real time robotic control, In *Front. neurosci. conference abstract: Mea meeting*.

## Github Projects

- 1 Val-Calvo, M. (2023). Ontogenix: A comprehensive pipeline for enhanced ontology engineering using large language models.  <https://github.com/tecnomod-um/OntoGenix>
- 2 Val-Calvo, M. (2020a). Biosignals: General BVP, GSR, TMP and ACC experimentation in real-time, an open source software for physiological real-time experimental designs. Zenodo.  <https://github.com/mikelval82/Biosignals>
- 3 Val-Calvo, M. (2020b). Geert: General EEG experimentation in real-time, an open source software for BCI real-time experimental designs. Zenodo.  <https://github.com/mikelval82/GEERT>
- 4 Val-Calvo, M. (2020c). GePHYCAM: General physiological and camera for real-time recordings and processing. Zenodo.  <https://github.com/mikelval82/GePHYCAM>
- 5 Val-Calvo, M., & Alegre-Cortes, J. (2020). Neurosorter: A software tool that allows spikes to be discriminated from noise signals by using convolutional neural networks and spike sorting with the use of clustering methods.  <https://github.com/mikelval82/https://github.com/mikelval82/NeuroSorter-Interface>