Antonio Guillen-Perez

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Innovative AI Research Scientist with a Ph.D. and extensive expertise in **Deep Reinforcement Learning (DRL)**, **autonomous systems**, and **sustainability**. Over 5 years of experience in AI, specializing in DRL applications in **multi agents coordination** and **sustainability**. Demonstrated success in advancing the field through significant contributions to leading AI conferences like NeurIPS and IEEE/CVF CVPR.

EXPERIENCE

Hewlett-Packard Enterprise - AI Labs — Milpitas-San Jose, CA
Research Scientist — *Sep 2022 - Now*

- Actively leading research initiatives in **Deep Reinforcement Learning** applied to sustainable computing, focusing on optimizing energy consumption and reducing carbon footprint in data centers.
- Pioneering in the development of **AI-based sustainable cooling solutions** and advanced **CFD surrogate models** for data centers, emphasizing real-time temperature optimization and energy saving.
- Led initiatives using **6Sigma and other CFD tools** to develop **surrogate models** for data center cooling, integrating DRL for real-time optimization and energy reduction.
- Spearheading the implementation of **multi-agent reinforcement learning systems** for comprehensive and real-time control of data center operations, contributing to significant advancements in green computing.
- Engaging in innovative research on **Bayesian Optimization** and **Machine Learning Model Robustness**, enhancing the effectiveness of adversarial attacks and deep learning models in complex, high-dimensional problems.
- Additionally, contributing insights and expertise to broader AI research efforts within the team, including projects on image classifier robustness, large language model refinement, and adversarial black-box attacks.

Polytechnic University of Cartagena — Cartagena, Spain
Associated Professor — *Sep 2021 - Jun 2022*

- **Subject**: *Communication Network Theory*
- Mathematical foundations of network optimization, **Network optimization** algo., **Karush–Kuhn–Tucker** conditions.
- Formulate, interpret and numerically solve routing, capacity, congestion control and node and link topology problems.

Polytechnic University of Cartagena — Cartagena, Spain
Associated Professor — *Sep 2021 - Jun 2022*

- **Subject**: *Distributed Systems and Services*
- **Distributed systems and services**: communication between remote processes, synchronization, coordination, and agreement techniques.
- Characteristics and operation of various types of distributed services, such as file sharing, chat, and video conferencing.

Dolphin Wave — Startup — Murcia, Spain
ML Engineer and Data Scientist — *Feb 2018 - Sep 2018*

- Build ML **predictive models** for mobility research of people in closed environments using **WiFi & BLE RSSI**.
- Develop a **Deep Learning Multivariate Time Series Forecasting** technique with Transformers for item demands using **Tensorflow**.
- Visualization of **univariate and multivariate clusters** of people mobility and their prediction for business intelligence (BI) tools.

Polytechnic University of Cartagena — Cartagena, Spain
Research Fellow in the Department of Information and Communications Technologies — *Sep 2014 - Sep 2018*

- Development of several distributed, proactive, autonomous, and intelligent traffic control systems, able to adapt the **traffic** signaling intervals.
- Analysis on **multi-agent systems** for intelligent traffic control in urban scenarios.
- Development of different systems for security and optimization tasks in urban environments (**generative models** (GANs, VAE, Glow), segmentation, object detection & classification (YoLo), tracking).

Education

- **Polytechnic University of Cartagena** Cartagena, Spain
  Ph.D. in Computer Science, Autonomous Vehicles, and Wireless Communications; CUM LAUDE. Sep 2018 - Jun 2022
  - **Thesis Title**: "Contribution to Enhancing the Cognitive Capability of Intelligent Transportation Systems Using Artificial Intelligence". **Link**: doi:10.31428/10317/11206.
  - Focused on advancing Intelligent Transportation Systems (ITS) through AI and DRL, emphasizing urban traffic management and Connected Autonomous Vehicles (CAVs) interactions.
  - Developed cognitive agents using **Multi-Agent Deep Reinforcement Learning (MADRL)** for efficient urban traffic system management, significantly reducing waiting time at intersections by over 90%.
  - Implemented advanced communication systems (**5G/6G**) for CAVs and ITS interoperability, establishing robust control policies and contributing to safer and sustainable urban mobility.
  - Innovated in **Learning-from-Demonstrations (LfD)** to expedite MADRL-based system training, achieving up to 6x faster training times.
  - Enhanced an AI-based traffic intersection control system using genetic algorithms, reducing vehicle waiting times by up to 80% and pollutant gas emissions by 20%.
  - Published research in journals and conferences, contributing significantly to the field of AI and DRL in ITS. (e.g., Sensors, IEEE Transactions on Vehicular Technology, IEEE Access, NeurIPS).

- **University of California, Davis** Davis, CA
  Predoctoral Stay - Associated Researcher Jun 2021 - Jan 2022
  - Research on the **AI applied to Healthcare**.
  - Early detection of throat cancer by **biomarkers** analysis using **NN** specialized in **signal processing** such as LSTM, **transformers**, and **attention mechanisms**.
  - I obtained an accuracy of over **90%** and I have opened a new **research path** for new platforms capable of **detecting** an infinite **number of diseases**.

- **Polytechnic University of Cartagena** Cartagena, Spain
  Master in Electrical, Electronic, and Communications Engineering Sep 2016 - Sep 2018
  - Specialization in **Communications Systems and Networks** (Antennas, RADAR, SAR).
  - Analog and Digital Signal Processing, Fourier Transform, and Digital Communications.
  - Performance analysis of wireless networks formed from **UAVs** using the IEEE 802.11ac standard.
  - Design and development of a **wireless sensor network** for the monitoring of pollutant gases in cities.

- **Polytechnic University of Cartagena** Cartagena, Spain
  Bachelor's Degree in Electrical, Electronics, and Communications Engineering Sep 2012 - Sep 2016
  - Design and development of a radio-frequency communication system for the monitoring of pollution levels in a city.
  - Development of a platform for the integration of IoT sensors in Smart Cities.
  - Analysis of the use of IoT sensors in Smart Cities.

Related Research

Journal Articles

- Guillen-Perez, A., & C.,M.-D., *Multi-Agent Deep Reinforcement Learning to Manage Connected Autonomous Vehicles at Tomorrow's Intersections*, 2022. IEEE Transactions on Vehicular Technology, doi:10.1109/TVT.2022.3169907.

- Guillen-Perez, A., & C.,M.-D., *Learning from Oracle Demonstrations – A new approach to develop AIM control algorithms based on MADRL*, 2022, IEEE Access, doi:10.1109/ACCESS.2022.3175493.

- Guillen-Perez, A., & C.,M.-D., *AIM5LA: A Latency-Aware Deep Reinforcement Learning-Based AIM for 5G Communication Networks*, 2022, Sensors, doi:10.3390/s22062217.

- K.,H.-J., & Guillen-Perez, A., *et al.*, *Fused Raman spectroscopic analysis of blood and saliva delivers high accuracy for head and neck cancer diagnostics*, 2022. Nature Sci Rep, doi:10.1038/s41598-022-22197-x.

- Guillen-Perez, A., *et al.*, *A Comparative Performance Evaluation of Routing Protocols for Flying Ad-Hoc Networks in Real Conditions.* Appl. Sci. 2021, 11, 4363. doi.org/10.3390/app11104363.

- Guillen-Perez, A., *et al.*, *Intelligent IoT systems for traffic management: A practical application.* IET Intell Transp Syst. 2021; 15: 273– 285. doi.org/10.1049/itr2.12021.

- Guillen-Perez, A., & C.,M.-D., *Pedestrian characterisation in urban environments combining WiFi and AI.* Int. J. Sens. Net. 2021; 37: 48– 60. doi.org/10.1504/IJSNET.2021.117964.

- Guillen-Perez, A., *et al.*, *Flying Ad Hoc Networks: A New Domain for Network Communications.* Sensors 2018, 18, 3571. doi.org/10.3390/s18103571.

- M.-C.,J.-M. & Guillen-Perez, A., *et al.*, *A Comparative Study of Web Content Management Systems.* Information 2018, 9, 27. https://doi.org/10.3390/info9020027.

Conference Proceedings

- Guillen-Perez, A., *et al.*, *Real-time Carbon Footprint Minimization in Sustainable Data Centers with Reinforcement Learning*, NeurIPS 2023 Workshop. Link.

- Guillen-Perez, A., *et al.*, *Enhancing Data Center Sustainability with a 3D CNN-Based CFD Surrogate Model*, NeurIPS 2023 Workshop. Link.

- Guillen-Perez, A., *et al.*, *A Configurable Pythonic Data Center Model for Sustainable Cooling and ML Integration*, NeurIPS 2023 Workshop. Link.

- Guillen-Perez, A., *et al.*, *Sustainable Data Center Modeling: A Multi-Agent Reinforcement Learning Benchmark*, NeurIPS 2023 Workshop. Link.

- Guillen-Perez, A., *et al.*, *Benchmark Generation Framework with Customizable Distortions for Image Classifier Robustness*, 2023 IEEE/CVF Winter Conference on Applications of Computer Vision (WACV). Link to Preprint.

- Guillen-Perez, A., *et al.*, *N-Critics: Self-Refinement of Large Language Models with Ensemble of Critics*, NeurIPS 2023 Workshop. Link to Preprint.

- Guillen-Perez, A., *et al.*, *PyDCM: Custom Data Center Models with Reinforcement Learning for Sustainability*, BuildSys 2023. Link to Preprint.

- Guillen-Perez, A., *et al.*, *RTDK-BO: High Dimensional Bayesian Optimization with Reinforced Transformer Deep Kernels*, IEEE CASE 2023 conference, 2023. New Zealand. Link.

- Guillen-Perez, A., *et al.*, *Concurrent Carbon Footprint Reduction (C2FR) Reinforcement Learning Approach for Sustainable Data Center Digital Twin*, IEEE CASE 2023 conference, 2023. New Zealand. Link.

- Guillen-Perez, A., *et al.*, *Reinforcement learning based black-box adversarial attack for robustness improvement*, IEEE CASE 2023 conference, 2023. New Zealand. Link.

- Guillen-Perez, A., *et al.*, *Robustness with Query-efficient Adversarial Attack using Reinforcement Learning*, IEEE/CVF CVPR Workshops, 2023. Canada Link.

- Guillen-Perez, A., *et al.*, *RL-CAM: Visual Explanations for Convolutional Networks Using Reinforcement Learning*, IEEE/CVF CVPR Workshops, 2023, Canada. Link.

- Guillen-Perez, A., *et al.*, *Robustness with Black-Box Adversarial Attack using Reinforcement Learning*, 37th AAAI SafeAI Workshop, 2023. USA. Link.

- Guillen-Perez, A., & C.,M.-D., *RAIM: Reinforced Autonomous Intersection Management*, In 34th Conference (NeurIPS) 2020 - Challenges of Real-World RL Workshop, Virtually.

- Guillen-Perez, A., & C.,M.-D., *How super-resolution can help connected autonomous vehicles*, VI doctoral conferences UPCT, University of Murcia. 2020. Oral communication.

- Guillen-Perez, A., & C.,M.-D., *Counting and locating people in outdoor environments: a comparative experimental study using WiFi-based passive methods*, In AMCSE 2018 - Int. Conf. on Appl. Math., Compt. Sci. and Sys. Eng.. 2019. doi.org/10.1051/itmconf/20192401010.

- Guillen-Perez, A., & C.,M.-D., *A WiFi-based method to count and locate pedestrians in urban traffic scenarios*, In 2018 14th Int. Conf. on Wire. and Mob. Comp., Net. and Comm.(WiMob). 2018. doi.org/10.1109/WiMob.2018.8589170.

- Guillen-Perez, A., *et al.*, *WiFi networks on drones*, In 2016 ITU Kaleidoscope: ICTs for a Sust. World (ITU WT). 2016. doi.org/10.1109/ITU-WT.2016.7805730.

Skills

- **Programming Languages and Environments:** Advanced: Python, Jupyter Notebook. Intermediate: Java, Matlab. Experience with collaborative development environments like GitHub and GitLab.
- **Artificial Intelligence and Machine Learning:** Expertise in Deep Learning (Pytorch, TensorFlow, Keras), Deep Reinforcement Learning (RLLib, OpenAI Gym, Gymnasium, Stable Baselines), and advanced AI techniques including Multi-Agent Systems, autonomous vehicles, imitation learning (IRL, LfO, LfD), Meta-Learning, Zero-Shot Learning. Skilled in Machine Learning algorithms (Scikit-Learn, XGBoost).
- **Data Science, Analysis, and Visualization:** Proficient in Data Wrangling (Numpy, Pandas), Advanced Data Visualization (Matplotlib, Seaborn, Plotly), and creating compelling graphics and figures for research dissemination. Experienced in statistical analysis (StatsModels, Scipy) and model interpretability (Captum). Familiarity with large-scale data processing (Dask, Polar, Spark).
- **CFD and Sustainability:** Experienced in using CFD tools like 6Sigma, and thermal and energy modeling for energy efficiency projects. Proficient in developing AI-driven solutions for sustainability, focusing on energy reduction and environmental footprint minimization.
- **Software and Tools:** Competent in version control (Git), IDEs (VS Code, Spyder, PyCharm), and cloud platforms (Amazon Web Services, Google Cloud Platform). Practical experience with containerization using Docker for deploying AI applications.
- **Research Tools and Documentation:** Proficient in using LaTeX for research documentation, publication, and presentation. Experienced in preparing high-quality scientific papers, reports, and presentations.

Advanced Coursework and Specializations

- **Deep Reinforcement Learning:** Focused studies in cutting-edge techniques and applications, including:

  - *Deep Reinforcement Learning Nanodegree* (Udacity) - Comprehensive coverage of advanced DRL algorithms and their practical applications.
  - *Practical Reinforcement Learning* (Coursera) - Hands-on experience with RL techniques and frameworks.
  - *Practical Deep Reinforcement Learning for Coders v.1* (fast.ai) - Focused on implementation and coding aspects of DRL.

- **Computer Vision & Time Series Analysis:** In-depth courses exploring the latest trends in AI, including:

  - *Time Series Forecasting* (Udacity) - Techniques for analyzing and forecasting time series data.
  - *Sequences, Time Series, and Prediction* (deeplearning.ai) - Advanced methods in sequence modeling for predictive analysis.
  - *Convolution Neural Networks in TensorFlow* (deeplearning.ai) - Practical skills in building and training CNNs using TensorFlow.
  - *Deep Learning Specialization* (deeplearning.ai) - A series of courses covering a broad range of deep learning topics.

References

- **Prof. J. Sebastian Gomez-Diaz** UC Davis, US
  Professor and MS Program Director, Electrical and Computer Eng. *Email: jsgomez@ucdavis.edu*

- **Soumyendu Sarkar** Hewlett-Packard Enterprise (HPE)
  Senior Distinguished Technologist, AI Research *Email: soumyendu.sarkar@hpe.com*

- **Prof. Maria Dolores Cano Banos** Polytechnic University of Cartagena (UPCT), Spain
  Professor and Lead Researcher, R&D Group in AI and Networking *Email: mdolores.cano@upct.es*