

Pedro Gomes

Permission to work: UK (pre-settled), Europe

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Summary

I am a final-year PhD student at the University College of London. My area of expertise is in modelling complex systems such as social networks, 3D multimedia or molecules using **graphs-based representations and geometric methods**

Education

PhD University College London, under supervision of Dr.Laura Toni	London, UK Mar. 2020 - Mar.2024
Masters in Computer Science. University of Coimbra & Politecnico di Torino (Final Mark of A+ on the European Grading Scale)	Coimbra, Portugal, & Torino, Italy Mar. 2020 - Dec.2019
Bachelor in Electrical and Electronic Engineering. University of Coimbra	Coimbra, Portugal Set. 2020 - Mar.2024

Work Experience

Intern - Trading and Development Team at Instinet, Nomura Bank. <ul style="list-style-type: none">I investigated and designed algorithms for latency-sensitive electronic (via FPGA) trading.I developed a method to learn graph representations of circuit topology from RTL (VHDL) code. Using my graph representation, I implemented optimization algorithms to find the most efficient placement of the circuit on an FPGA board and the ideal routing to meet time constraints.Skills used: Company Workflow(Jira, Confluence), Python and Algorithm Optimization.	London, UK June. 2023 - Sep. 2023
Consultant - DSTL: Defence Science and Technology Laboratory <ul style="list-style-type: none">I taught practical machine learning at DSTL on how to design and develop computer vision models.	Salisbury, UK Mar. 2020 - Apr. 2023
Teaching Assistant - University College London, <ul style="list-style-type: none">I taught <i>Digital Signal Acquisition and Processing</i> and <i>Applied Machine Learning</i> Master degree courses, as well as supervised several final year projects.	London, UK Apr. 2020 - Oct. 2023
Research Assistant - Portuguese Institute of Telecommunications <ul style="list-style-type: none">I developed video compression tools for Light Field Images using block-matching algorithms.Skill used: Matlab, C++ and digital signal processing techniques (e.g., Fourier Transforms)	Coimbra, Portugal Aug. 2017 - Aug. 2020

PhD Research

Point Cloud Motion Forecasting via Graph-based Machine Learning <ul style="list-style-type: none">I created a large-scale synthetic dataset of dynamic point clouds by manipulating 3D graphic objects (FBXs, wavefront OBJ and 3D meshes) via Blender software.I developed a graph-based neural network able to extract relevant information from unstructured point cloud data and forecast the dynamic behaviour (motion) of future framesSkill used: Blender, TensorFlow/PyTorch, SQL, ML System design, 3D computer-vision techniques.	London, UK Feb. 2020 - Dec. 2023
Millimeter-wave Radar Data Processing <ul style="list-style-type: none">I acquired a novel large-scale dataset of 3D indoor scenes using low-cost millimetre-wave radar attached to the autonomous (RL) robot, and curated the data to be useful for ML development.I implemented and investigated the performance of state-of-art ML frameworks (PointNets, MeshNet, GNNs, Transformers) in a novel type of data from which they were not designed.I designed a graph-based transformer architecture to address the specific challenges (noise and sparsity) present 3D millimetre-wave data.Skills used: ROS, PyTorch, SLAM, Docker, Git, Development lifecycle, Computational Geometry	London, UK & Bari, Italy July. 2022 - Dec. 2023
Eimeria Vaccine Development and Protein Modelling <ul style="list-style-type: none">I used graph representations of molecules (protein structures) to learn 1-D embedding, which can be used to quantify the structural difference between different molecules.Skills used: Basic Biology, Unsupervised Learning, Clustering, Inter-disciplinary collaboration	London, UK Jan. 2023 - Jan. 2024
Machine Learning Explainability <ul style="list-style-type: none">I performed extensive data visualization of key components of ML frameworks from features PCA, the activation function reaction to all possible inputs, to back-propagation gradients;I developed a technique for feature disentanglement to visualize what is learned at each layer of a graph neural network and understand the impact of each input dimension on the learned embedding.Skills used: Matplotlib, Python Libraries, dimensional reduction, Statistics for ML,	London, UK Dec. 2022 - Jul. 2023
Scalable Coding of Light Field Images <ul style="list-style-type: none">I created a compression framework for Light Field images using HEVC video coding algorithms	Coimbra, Portugal May. 2019 - Nov. 2019

Awards, Grants & Committees

- Merit Award is given to the top (3%) best students of each course at the University of Coimbra
- Best Doctoral Symposium Paper Award at ACM MMSys'2021.
- FCT Grant for FlexLif project: Development of efficient, scalable light field image coding methods
- CISCO Grant: Development of novel machine learning architectures for graph-based data
- Reviewer for IEEE Transactions on Image Processing (TIP),
- Reviewer for ACM Conference on Multimedia (ACM MM) and ACM Multimedia and Systems (ACM MMSys)
- Reviewer for IEEE International Conference on Image Processing (ICIP)

Skills

- **Programming Languages:** C, C++, Python, SQL, Verilog, Linux Shell, Matlab, R., (Libraries: Tensorflow, PyTorch, NumPy, Pandas)
- **Multimedia Processing:** Image, Video, Point Cloud, mmWaves, 3D graphics, HEVC, FFmpeg, Blender, OpenCV
- **Geometric Methods:** Shape analysis, Topology, Differential geometry, Discrete Geometry, Functional mapping, Geometric deep learning
- **Statistical Method for ML:** Bayesian methods, Graphical models, Dimension reduction, Clustering, Classification, Regression techniques.
- **Deep Learning:** Graph Neural Networks (GNN), Natural Language Processing (NLP), Forecasting models, Explainability, Large Language Models (LLM), Generative AI
- **Databases:** SQL, MongoDB, Oracle, AWS scripting/building tools
- **Electronics and Embedded systems:** Circuit design, Computer Architecture, FPGAs
- **Others:** Latex, GitHub/Git/GitLab, Jenkins, Confluence,
- **Language and interests:** English (fluent IELTS), Portuguese (native) and Spanish; AI, Cinema, Stand-up Comedy, 5-a-side Football.

Publications

- Gomes, P.,Brescia, W., Toni, L., & Cicio, L. (2023). *Millimeter-wave project (title TBH)*. (2 papers submitted at ACM Conference one to IEEE Journal)
- Gomes, P., Rossi, S., & Toni, L. (2023). *AGAR: Attention Graph-RNN for Adaptive Motion Prediction of Point Clouds of Deformable Objects*. (accepted at ACM Transactions on Multimedia Computing, Communications, and Applications)
- Baptista. R, Gomes, P., Marugan-Hernandez, V., Blake, D., Tomley, F., Toni, L., & Xia, D.(2023) *Network Representation of Host-Pathogen Interactomes With Machine Learning For Eimeria Vaccine Development* In British Society of Parasitology Conference.
- Gomes, P., Rossi, S., & Toni, L. (2022).*Explaining Hierarchical Features in Dynamic Point Cloud Processing*, In Proceedings of the 2022 IEEE Picture Coding Symposium (PCS)
- Gomes, P. (2021).*Graph-based network for dynamic point cloud prediction*. In *Proceedings of the ACM Multimedia Systems Conference (ACM MMSys)*
- Gomes, P., & da Silva Cruz, L. A. (2019). *Pseudo-sequence light field image scalable encoding with improved random access*. In Proceedings of the European Workshop on Visual Information Processing (EUVIP)