Pedro Porto Buarque de Gusmão

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"In God we trust; all others must bring data."
- W. Edwards Deming

Research Experiences

09/2020–current **Senior Research Associate**,
University of Cambridge, Machine Learning Systems Lab, under the supervision of Professor Nicholas Lane.

- I investigate the efficiency and scalability of Federated Learning solutions as part of the *REDIAL: Re-thinking Efficiency in Deep Learning under Accelerators and Commodity Processors* project. I also help develop the Flower Federated Learning Framework.

11/2017–09/2020 **Postdoctoral Research Associate**,
University of Oxford, Research Group, under the supervision of Prof. Niki Trigoni and Prof. Andrew Markham.

- I investigated and developed location-based services for firefighters using inertial sensors and thermal cameras. This position was funded by the NIST project *Pervasive, Accurate, and Reliable Location-based Services for Emergency Responders.*

Education

03/2013–02/2017 **Ph.D. in Electronic and Communications Engineering**,
Politecnico di Torino, Turin, Italy.

- **Thesis Title:** *Feature Extraction Using MPEG-CDVS and Deep Learning with Application to Robotic Navigation and Image Classification.*

09/2007–07/2009 **M.Sc. in Telecommunications Engineering**, *Double Degree*,
Final Mark: 110/110, Politecnico di Torino, Turin, Italy.

- **Thesis Title:** *Compressive Sampling.* This work was a first analysis on the use of Compressive Sampling for video compression.

02/2004–12/2010 **B.Sc. in Electrical Engineering-Telecommunications**,
Final Mark: 7.1/10, University of São Paulo, São Paulo, Brazil.

- **Thesis Title:** *A System for Image Recognition Using SURF Descriptors.*

Research Interests

- **Federated Learning:**
  I study the scalability for this new and exciting privacy-preserving technique of directly neural networks on edge devices.

- **Computer Vision:**
  Image sensors produce rich and detailed information about the world. Being able to extract useful, high-level scene descriptions is one of my research goals.
- **Reliable Navigation Systems:**
  Standard navigation systems, such as GPS, are either not reliable or not precise enough for critical operations. I am interested in studying and developing reliable navigation system for mission-critical operations.

Teaching Experiences

2020-current **Lecturer**, Deep Neural Networks, Software Engineering Programme, University of Oxford, Oxford, UK.

Date **Teaching Assistant - University of Oxford**, Internet Of Things, AIMS courses University Oxford, Oxford, UK.

Technical Skills

- **Programming**
  C, C++ - Intermediate
  Python - Advanced
  PyTorch - Advanced
  MATLAB - Advanced

Languages

- **Portuguese:** Native Language
- **Italian:** Advanced
- **English:** Advanced

References

- **Prof. Niki Trigoni**
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  University of Oxford
  Oxford, United Kingdom
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- **Prof. Andrew Markham**
  Department of Computer Science
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∘ **Prof. Nicholas Lane**
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Publications and Patents

Pre-prints

[1] M. R. U. Saputra, C. X. Lu, P. P. de Gusmao, B. Wang, A. Markham, and N. Trigoni, "Graph-based thermal-inertial slam with probabilistic neural networks," *arXiv preprint arXiv:2104.07196*, 2021.

[2] Y. Almalioglu, M. Turan, A. E. Sari, M. R. U. Saputra, P. P. de Gusmão, A. Markham, and N. Trigoni, "Selfvio: Self-supervised deep monocular visual-inertial odometry and depth estimation," *arXiv preprint arXiv:1911.09968*, 2019.

[3] A. Mathur, D. J. Beutel, P. P. B. de Gusmão, J. Fernandez-Marques, T. Topal, X. Qiu, T. Parcollet, Y. Gao, and N. D. Lane, "On-device federated learning with flower," *arXiv preprint arXiv:2104.03042*, 2021.

Conferences

[1] W. Wang, P. P. de Gusmao, B. Yang, A. Markham, N. Trigoni, K. Zhou, C. Chen, B. Wang, M. R. U. Saputra, N. Trigoni *et al.*, "Radarloc: Learning to relocalize in fmcw radar," in *IEEE International Conference on Robotics and Automation*, 2020.

[2] C. X. Lu, M. R. U. Saputra, P. Zhao, Y. Almalioglu, P. P. de Gusmao, C. Chen, K. Sun, N. Trigoni, and A. Markham, "milliego: single-chip mmwave radar aided egomotion estimation via deep sensor fusion," in *Proceedings of the 18th Conference on Embedded Networked Sensor Systems*, 2020, pp. 109–122.

[3] M. R. U. Saputra, P. P. B. de Gusmao, C. X. Lu, Y. Almalioglu, S. Rosa, C. Chen, J. Wahlström, W. Wang, A. Markham, and N. Trigoni, "Deeptio: A deep thermal-inertial odometry with visual hallucination," *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 1672–1679, 2020.

[4] J. Wahlström, M. Kok, P. Porto Buarque de Gusmão, T. E. Abrudan, N. Trigoni, and A. Markham, "Sensor fusion for magneto-inductive navigation," *IEEE Sensors Journal*, vol. 20, no. 1, pp. 386–396, 2020.

[5] J. Wahlström, P. Porto Buarque de Gusmão, A. Markham, and N. Trigoni, "Map-aided navigation for emergency searches," in *2019 15th International Conference on Distributed Computing in Sensor Systems (DCOSS)*, 2019, pp. 25–32.

[6] Y. Almalioglu, M. R. U. Saputra, P. P. B. d. Gusmão, A. Markham, and N. Trigoni, "Ganvo: Unsupervised deep monocular visual odometry and depth estimation with generative adversarial networks," in *2019 International Conference on Robotics and Automation (ICRA)*, 2019, pp. 5474–5480.

[7] M. R. U. Saputra, P. P. B. de Gusmao, S. Wang, A. Markham, and N. Trigoni, "Learning monocular visual odometry through geometry-aware curriculum learning," in *2019 International Conference on Robotics and Automation (ICRA)*, 2019, pp. 3549–3555.

[8] M. R. U. Saputra, P. Gusmao, Y. Almalioglu, A. Markham, and N. Trigoni, "Distilling knowledge from a deep pose regressor network," in *2019 IEEE/CVF International Conference on Computer Vision (ICCV)*, 2019, pp. 263–272.

[9] W. Wang, M. R. U. Saputra, P. Zhao, P. Gusmao, B. Yang, C. Chen, A. Markham, and N. Trigoni, "Deeppco: End-to-end point cloud odometry through deep parallel neural network," in *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2019, pp. 3248–3254.

[10] S. T. H. Rizvi, G. Cabodi, P. Gusmao, and G. Francini, "Gabor filter based image representation for object classification," in *2016 International Conference on Control, Decision and Information Technologies (CoDIT)*, 2016, pp. 628–632.

[11] P. P. B. de Gusmão, S. Rosa, E. Magli, S. Lepsøy, and G. Francini, "Loop detection in robotic navigation using mpeg cdvs," in *2015 IEEE 17th International Workshop on Multimedia Signal Processing (MMSP)*, 2015, pp. 1–6.

[12] S. Lepsøy, G. Francini, G. Cordara, and P. P. B. de Gusmão, "Statistical modelling of outliers for fast visual search," in *2011 IEEE International Conference on Multimedia and Expo*, 2011, pp. 1–6.

Patents

[1] G. Cordara, G. Francini, S. Lepsoy, and P. P. B. De Gusmão, "Method and system for comparing images," Patent, Apr. 14, 2015, uS Patent 9,008,424.

[2] G. Francini, S. Lepsoy, and P. P. B. De Gusmão, "Convolutional neural networks, particularly for image analysis," Patent, Feb. 6, 2020, uS Patent App. 16/081,693.