Miguel Xochicale

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Research Interests

My research interests are in the creation of Signal and Image Processing techniques in the context of Human-Robot Interaction, Wearables in Medicine, Ultrasound-Guided Interventions, Medical Robotics, and Research Software Engineering.

Education

The University of Birmingham — Birmingham, UK
Ph.D. in Computer Engineering — *Nov 2014 – Nov 2018*
Thesis: Nonlinear Analysis to Quantify Movement Variability in Human-Humanoid Interaction.
Supervisors: Professor Chris Baber and Professor Martin Russell
Thesis submission: 26/10/2018. Passed Viva: 11/01/2019. Awarded PhD degree: 12/07/2019.
Links: Thesis: Github: Website:

Institute of Astrophysics, Optics and Electronics (INAOE) — Puebla, México
M.Sc. in Signal Processing — *Sep 2004 – Sep 2006*
Thesis: Design of digital filters with fewer multipliers
Supervisor: Dr. Gordana Jovanovic Dolecek
Links: Thesis: Github:

Puebla Institute of Technology — Puebla, México
B.Eng. in Electronics — *Aug 1999 – Sep 2004*
Thesis: Speed control for a two-degrees-of-freedom Robot in LabVIEW.
Supervisor: M.Sc. José Esteban Torres León.
Links: Thesis: Github:

Professional Experience

King's College London — London UK
Research Associate in Software and Hardware Engineering — *Apr 2019 – Present*

- PI: Prof. Tom Vercauteren
- I am pushing forward the state-of-the-art of Ultrasound-Guidance Interventions where am involved in the development of a needle tip tracking system, real-time ultrasound image processing, quality management system (QMS) and clinical translation of medical devices as well as public engagement activities. Similarly, I am developing validation experiments with linear stages under Windows and GNU/Linux OSs, designing electronic PCBs and 3D printing holders, characterising ultrasonic transducers, and contributing to a Python library via GitHub. All the previous activities in collaboration with an amazing team of renowned clinicians, engineers, QMS specialists and researchers in KCL and UCL. Additionally, I am leading the preparation of two manuscripts. See more at ().

INAOE's Robotics Laboratory — Puebla, México
Research Assistant in Robotics — *Feb 2013 – Aug 2013*

- Advisor: Dr. Angélica Muñoz Meléndez
- I developed a Human-Robot Interaction for dancing activities based on a Patrolbot mobile robot and a single three-axial accelerometer. (see documents and code:).

Madero University — Puebla, México
Teaching Lecturer in Mechatronic Engineering — *Jan 2012 – Jan 2013*

- I proposed and supervised the following projects: Haptic Referee Glove, Lightmetre and Pychometre Sensors, Smart Irrigation, Persistent Of Vision Bicycle Wheel and a Delta Robot Structure (see documentation and code:).

- I proposed and designed a Mechatronic Laboratory which includes: (i) a benchmark for laboratories in mechatronics in México and Puebla, (ii) a 3D layout design and (iii) minimal requirements of hardware and software for the laboratory (see documentation and layout:).

INAOE Puebla, México
Research Internship in Robotics *Sep 2003 – Mar 2004*

- I implemented a speed control for a two-degree-of-freedom robot with microcontrollers PIC 16F84 & 16F877 communicated via RS-232 with Virtual Instruments on LabVIEW.

Teaching and Supervision Experience

King's College London London, UK
Teaching Associate *Jan 2020 – Present*

- Medical Robotics. Lecturer: Dr. Hongbin Liu *Jan 2021 – Apr 2021*
- Medical Robotics. Lecturer: Dr. Christos Bergeles *Jan 2020 – Apr 2020*

Supervision *Jan 2020 – Present*

Student: Alexander Mitton *Jan 2020 – Sep 2020*
M.Sc. Project: Vibro-tactile stimulator for dystonia research
Co-supervisors: C. Bergeles, V. Mcclelland and A. Worley

The University of Birmingham Birmingham, UK
Teaching Associate *Aug 2014 – Apr 2018*

- Engineering Maths 2. Lecturers: Professor Martin Russell, Dr Carl Anthony *Jan 2018 – Apr2018*
- Engineering Maths 2. Lecturer: Professor Martin Russell *Aug 2017 – Dec 2017*
- Computing for Engineering. Lecturer: Dr Sridhar Pammu *Aug 2017 – Dec 2017*
- Matlab Laboratories. Lecturer: Dr Edward Tarte *Jan 2017 – Apr 2017*
- Computing for Engineering. Lecturer: Dr Sridhar Pammu *Aug 2016 – Dec 2016*
- Small Embedded Systems. Lecturer: Professor Chris Baber *Aug 2016 – Dec 2016*

Supervision *Jun 2018 – Dec 2018*

Student: Dinghuang Zhang
M.Sc. Project: Human-Humanoid Tool Collaboration
Co-supervisor: Chris Baber.

Bilingual Hight School TECMilenio University Puebla, México
Teaching Associate *Aug 2013 – Dec 2013*

- Information Technology
- Euclidean Geometry
- Microsoft Office Access

Universidad Madero Puebla, México
Teaching Associate in Mechatronic Eng. *Jan 2012 – Dec 2012*

- Fundamentals of Automation
- Industrial Electronics
- Research Projects
- Metrology
- Physics
- Computer Integrating Manufacturing, and Power Electronics

Universidad Iberoamericana Puebla Puebla, México
Teaching Associate in Electronic Eng. *Jan 2007 – Dec 2011*

- Stochastic Processes
- Digital Signal Processing
- Analog Filters.

Instituto Tecnológico Superior de Atlixco Puebla, México

Teaching Associate in Mechatronic Eng. *Aug 2006 – Jun 2007*

- (01/2007 - 06/2007) Electronics I, Numerical Methods, and Electricity and Magnetism.
- (08/2006 - 12/2006) Electricity and Magnetism, and Electricity and Industrial Electronics

Publications

1. **M. Xochicale** and C. Baber, "Nonlinear methods to quantify movement variability in human-humanoid interaction activities," Mar. 2021. arXiv: 1810.09249 [eess.SP], Full Paper.
2. R. Montenegro, E. Corona, D. Badillo-Perez, A. Mandujano, L. Vazquez, D. Cruz, and **M. Xochicale**, "Air4children: Artificial intelligence and robotics for children," in *16th Annual Conference on Human-Robot Interaction (**HRI '21**)*, Feb. 2021. arXiv: 2103.07637 [cs.RO].
3. **M. Xochicale** and C. Baber, "Towards the analysis of movement variability in human-humanoid imitation activities," in *5th International Conference on Human Agent Interaction (**HAI '17**)*, Bielefeld, Germany, Oct. 2017, Poster Paper.
4. **M. Xochicale**, C. Baber, and O. Mourad, "Towards the quantification of human-robot imitation using wearable inertial sensors," in *12th Annual Conference on Human-Robot Interaction (**HRI '17**)*, Vienna, Austria, Mar. 2017, Poster Paper.
5. **M. Xochicale**, C. Baber, and O. Mourad, "Analysis of the movement variability in dance activities using wearable sensors," in *2nd International Symposium on Wearable Robotics (**WeRob '16**)*, Segovia, Spain, Oct. 2016, Poster Paper.
6. **M. Xochicale**, C. Baber, and O. Mourad, "Understanding movement variability of simplistic gestures using an inertial sensor," in *5th ACM International Symposium on Pervasive Displays (**PerDis '16**)*, Oulu, Finland, Jun. 2016, Poster Paper.
7. **M. Xochicale** and G. Jovanovic-Dolecek, "A new method for design narrow band lowpass fir filters using a scale function," in *2nd International Conference on Electronic Design (**ICED '06**)*, Veracruz, Mexico, Nov. 2006, Conference Paper.

Posters

1. **M. Xochicale**, "Open-cortex: A continuous integration framework for open scientific communication," in *1st Conference on Reproducibility, Replicability and Trust in Science (**RRTS '20**)*, Cambridge, England (Virtual Conference), Sep. 2020, Poster Abstract.
2. **M. Xochicale**, "Quantification of dynamic facial expressions with shannon entropy in human-humanoid interaction," in *1st Symposium on Machine Learning and Dynamical Systems (**MLDS '19**)*, London, UK, Feb. 2019, Poster Abstract.

Talks

1. **M. Xochicale** and C. Baber, "Nonlinear analysis to quantify human movement variability from time-series data," in *neuromatch 3.0 (**NMC3 '20**)*, Virtual Conference, Oct. 2020, Presentation Abstract.
2. **M. Xochicale**, "Quantifying movement variability with nonlinear dynamics for human-humanoid interaction," in *25th International Conference on Difference Equations and Applications (**ICDEA '19**)*, London, UK, Jun. 2019, Slices abstract.
3. **M. Xochicale**, "Quantifying the inherent chaos of human movement variability," in *15th Experimental Chaos and Complexity Conference (**ECCC '18**)*, Madrid, Spain, Jun. 2018, Presentation Abstract.
4. **M. Xochicale** and C. Baber, "Towards the analysis of movement variability for facial expressions with nonlinear dynamics," in *7th Consortium of European Research on Emotion Conference (**CERE '18**)*, Glasgow, Scotland, UK, Apr. 2018, Presentation abstract.

Skills

Programming Python[2014-present], R[2013-present], Robot Operating System (ROS)[2016-present], GNU-Octave (or MatLab)[2009-present], LaTeX[2006-present], C and C++[2015-present], Processing[2012-present], the shell[2010-present], GNU-emacs[2010-present], vim[2016-present], pandoc[2017-present], open-source enthusiast at GitHub (@mxochicale)[2015-present], and continuous integration and continuous delivery [2019-present].

Tools GNU/Linux Operating System user (e.g. OpenSuse, Debian and Ubuntu)[2005-present] Single-board computers and microcontrollers (e.g. NVIDIA Jetson Nano, RaspberryPi, BeagleBone, Arduino and PIC)[2010-present], Inertial Measurement Units (e.g. calibration, collection and data analysis)[2013-present], Web design (e.g. Github pages, Jekyll)[2015-present], and Graphic design (e.g. Inkscape, GIMP)[2014-present], CAD design (e.g. Autodesk invetor, blender, FreeCAD)[2015-present], Artificial Neural Networks (e.g. TensorFlow and PyTorch)[2017-present], and 3D printing (e.g., flsun, cura) [2019-present].

Languages Spanish[Native], English[Fluent], Chinese[Beginner]

Grants, Awards and Honours

- King's Public Engagement grant for the project "FETUS: Finding a fETus with an Ultrasound Simulator" led by myself and in collaboration with Fang-Yu Lin and Shu Wang *(07/01/2021 - 07/01/2022)*
- Alexander Mitton won the Outstanding Individual Project award for his M.Sc. project, which I was the main supervisor, on designing a wearable, vibrotactile stimulation device for patients with dystonia *(15/10/2020)*
- King's Health Partners grant for the project "Sensory system abnormalities in childhood dystonia" lead by Verity McClelland and in collaboration with Carlos Seneci *(14/04/2020 - 9/06/2020)*
- My work "Towards Healthy Ageing with Humanoid Robots" was selected for a talk at the second forum of Mexican Talent, Innovation Match MX 2017, *11/01/2017*
- I won the best poster award at the XIV Symposium of Mexican Students in the UK at University of Edinburgh *16-18/06/2016*
- My project of a low-cost robot was selected among 125 applications received from 35 countries and presented at the first international public entrepreneurship program in Mexico (MECATE 2015). *20-24/07/2015*
- Ph.D. scholarship by the Mexican National Council on Science and Technology. *11/2014-11/2018*
- Markovito's team won the first place at the Mexican Tournament of Robotics 2013 in the category at HOME where I presented a Human-Robot Interaction Dance Demo. *25-27/05/2013*
- M.Sc. scholarship by the Mexican National Council on Science and Technology. *09/2004-09/2006*

Extra Activities

King's College London London, UK
Outreach activities and scientific engagement *Sep 2019 – Present*

- Participant in the STEAM WEEK organised by the City Westminster Council to engage students aged 14-18 to STEAM *23-03-2021*
- Alexandra Lautarescu and I organised the Reproducible, Interpretable, Open, & Transparent Science Club at St Thomas' Hospital *02-2020 – 06-2020*
- For the event In2ScienceUK, I shared my scientific journey to young scientist on how they can become better scientist. *20-08-2019*
- For the New Scientist Live, I showcased software segmentation that helps doctors to create 3D models of brain tumors using AI. *09-2019*

University of Birmingham Birmingham, UK
Outreach activities and scientific engagement *Aug 2014 – Jun 2018*

- Finalist at the Three Minute Thesis Competition 2018. Video: and GitHub: *05-2018*
- Research Poster Conference for (2015) , (2016) , and (2018) . GitHub: .
- Demoing Human-Robot Activities at the Undergraduate Open Days. GitHub: . *2014–2018*
- Coordinator of the Science Seminars for the Mexican Society. GitHub: , Website: . *2017–2018*

FREE AIR4Children México & UK

- Building Artificial Intelligence and Robotics for Children (air4children) with the purpose of teaching AIR to children for free. Twitter: @air4children GitHub: @air4chidlren *2019–Present*
- Creation Libre Robotics, a non-profit organization aiming to freely transfer knowledge in Robotics to Mexican children. Website: *2013 – 2017*

Developer of the Website "Machine Learning for México" México & UK

- GitHub: , Website: *2013 – 2018*