Miguel Xochicale

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Research Interests

I am currently pushing forward the state-of-the-art of ultrasound-guided procedures by making scientific contributions to new algorithms, software, hardware and to the design and development of medical devices. I have 21 years' experience in human-robot interaction, electronics, mechatronics and signal processing, along with 13 years' experience as a teaching assistant in computer and robotics engineering. I have passion for Robotics, Chaos, AI, Brains and Open Science.

Education

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 — 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*

- PIs: Prof. Tom Vercauteren and Dr. Wenfeng Xia
- In the context of Ultrasound Needle Tracking, I am developing validation experiments with linear stages under Windows and GNU/Linux OS, designing electronic PCBs and 3D printing holders, characterising ultrasonic transducers, and contributing to real-time tracking software based on Python language via GitHub. As well as contributing to verification and validation of design and development for medical device. 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.

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 Demo 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 students' 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.

Publications

1. **M. Xochicale** and C. Baber, "Nonlinear methods to quantify movement variability in human-humanoid interaction activities," in *preprint in arXiv*, Dec. 2020, Full Paper.
2. **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.
3. **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.
4. **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.
5. **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.
6. **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 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.

Teaching and Supervision Experience

King's College London London UK
Supervision *Jan 2020 – Sep 2020*

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

Teaching Associate *Jan 2020 – Apr 2020*

- Medical Robotics. Lecturer: Christos Bergeles

University of Birmingham Birmingham, UK
Supervision *Jun 2018 – Dec 2018*

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

Teaching Associate *Aug 2014 – Apr 2018*

- (01/2018–04/2018) Engineering Maths 2. Lecturers: Professor Martin Russell, Dr Carl Anthony
- (08/2017–12/2017) Engineering Maths 2. Lecturer: Professor Martin Russell
- (08/2017–12/2017) Computing for Engineering. Lecturer: Dr Sridhar Pammu
- (01/2017–04/2017) Matlab Laboratories. Lecturer: Dr Edward Tarte
- (08/2016–12/2016) Computing for Engineering. Lecturer: Dr Sridhar Pammu
- (08/2014–12/2014) Small Embedded Systems. Lecturer: Professor 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

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 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 *Feb 2020 – Jun 2020*

- Alexandra Lautarescu and I are organising the Reproducible, Interpretable, Open, & Transparent Science Club at St Thomas' Hospital *02-2020 – 06-2020*
- In2ScienceUK: sharing my scientific journey to young scientist on how they can become better scientist. *20-08-2019*
- New Scientist Live: showcasing software segmentation that helps doctors to create 3D models of brain tumors using AI. *09-2019*

LibrE Robotics México & UK

- Creation Libre Robotics, a non-profit organization aiming to freely transfer knowledge in Robotics to Mexican children. GitHub:, Website: *2013 – present*
- Creation of Artificial Intelligence and Robotics for Children (air4children) a project to teach air to children for free. GitHub: Slides: *2019–present*

Developer of the Webiste Machine Learning for Mexico México & UK

- GitHub:, Website: *2013 – 2018*

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:.

- Presenting Demos of Human-Robot Interaction at the Undergraduate Open Days. GitHub:. *2014–2018*
- Coordinator of the Science Seminars for the Mexican Society. GitHub:, Website:. *2017–2018*