# Miguel Xochicale

My research interests are in Real-time AI, Medical Imaging, MedTech, SurgTech, and Biomechanics.

Research Engineer, advancing AI-based Surgical Navigation tools
Advanced Research Computing Centre and WEISS
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## Education

**Ph.D. in Computer Engineering at The University of Birmingham** — Birmingham, UK

Thesis: Nonlinear Analysis to Quantify Movement Variability in Human-Humanoid Interaction. *Nov 2014 – Nov 2018*
Supervisors: Professor Chris Baber and Professor Martin Russell
Awarded PhD degree: 12/07/2019. Thesis: GitHub: Website:

**M.Sc. in Signal Processing at Institute of Astrophysics, Optics and Electronics (INAOE)** — Puebla, México

Thesis: Design of digital filters with fewer multipliers. *Sep 2004 – Sep 2006*
Supervisor: Dr. Gordana Jovanovic Dolecek
Awarded MSc degree: 01/11/2006. Thesis: GitHub:

## Research Experience

**Research Engineer at University College London, UK** — Oct 2022 – Present

- Collaborators: Stephen Thompson, Dr Thomas Dowrick and Prof Matt Clarkson
- I am advacing AI-based Surgical Navigation tools with Python and CUDA programming languages via GitHub. See more at ( ).

**Research Associate in Real-time AI-based Ultrasound Imaging at King's College London, UK** — Sep 2021 – Sep 2022

- PIs: Dr Andrew King and Dr. Alberto Gomez
- I scientifically contribed to automatic biometric recognition of electrocardiography ultrasound data using real-time deep learning techniques with Python, CUDA, C++ and Qt programming languages via GitHub. See more at ( ).

**Research Associate in Software and Hardware Engineering at King's College London, UK** — Apr 2019 – Aug 2021

- PIs: Dr. Wenfeng Xia and Prof. Tom Vercauteren
- I pushed forward the state-of-the-art of Ultrasound-Guidance Interventions, contributing to the development of a needle tip tracking system, real-time ultrasound image processing, quality management system (QMS) for clinical translation of medical devices, and public engagement activities. See more at ( ).

## Publications

1. **M. Xochicale**, L. Thwaites, S. Yacoub, L. Pisani, T. H. N. Phung, H. Kerdegari, A. King, and A. Gomez, *A machine learning case study for ai-empowered echocardiography of intensive care unit patients in low- and middle-income countries*, 2023, 4-page paper and 2-page appendix with code and data.
2. T. Bautista, J. Matthew, H. Kerdegari, L. Peralta, and **M. Xochicale**, "Empirical study of quality image assessment for synthesis of fetal head ultrasound imaging with dcgans," in *26th UK Conference on Medical Image Understanding and Analysis (**MIUA '22**)*, arXiv, Jun. 2022, 3-page abstract, code and data.
3. E. Puyol-Antón, B. Ruijsink, B. S. Sidhu, *et al.*, *Ai-enabled assessment of cardiac systolic and diastolic function from echocardiography*, Mar. 2022. arXiv: 2203.11726 [physics.med-ph; cs.CV; eess.IV], Full Manuscript.
4. A. Badillo-Perez, D. Badillo-Perez, D. Coyotzi-Molina, D. Cruz, R. Montenegro, L. Vazquez, and **M. Xochicale**, "Piloting diversity and inclusion workshops in artificial intelligence and robotics for children," in *17th Annual Conference on Human-Robot Interaction (**HRI '22**)*, Mar. 2022.
5. R. Beale, J. B. Rosendo, C. Bergeles, *et al.*, "Oxvent: Design and evaluation of a rapidly-manufactured covid-19 ventilator," *eBioMedicine*, vol. 76, p. 103 868, 2022.
6. **M. Xochicale** and C. Baber, "Nonlinear methods to quantify movement variability in human-humanoid interaction activities," Mar. 2021. arXiv: 1810.09249 [eess.SP], Full Manuscript.
7. 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].
8. C. Baker, **M. Xochicale**, F. Joubert, *et al.*, "Real-time ultrasonic tracking of an intraoperative needle tip with integrated fibre-optic hydrophone," in *2021 IEEE International Ultrasonics Symposium (IUS)*, 2021, pp. 1–4.
9. **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.
10. **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.
11. **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.
12. **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.

## Talks and Posters

1. **M. Xochicale**, "Fetal ultrasound imaging synthesis," Data Learning Seminar at Imperial College London, Sep. 2022, Presentation Abstract.
2. **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.
3. **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.
4. **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.
5. **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.

6. **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.
7. **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.

# Supervision and Teaching Experience

**University College London** Jan 2023 – Present

- Teaching Associate: AI in Healtchare Group projects. Lecturer: Prof. Paul Taylor *Jan 2023 – Present*
  I am leading two students group projects on *Fetal Brain Ultrasound Imaging synthesis with Diffusion Models*.

**King's College London** Jan 2020 – September 2022

- Supervision: Pablo Prieto Roca and Samuel Eyob. *KURF projects on 3DGANs for fetal US imaging*. *Jun 2022 – Aug 2022*
- Supervision: Tsz Yan (Goosie) Leung, MSc in Medical Engineering and Physics. *Project: Simple US guidance intervention.* *Feb 2021 – Aug 2022*
- Supervision: Thea Bautista, M. Eng. in Biomedical Engineering. *Project: DCGANs for fetal US imaging.* *Oct 2021 – May 2022*
- Supervision: Guilherme Gomes de Figueiredo and Amal Hussein. *KURF projects on DCGANs for US imaging.* *Jun 2021 – Aug 2021*
- Supervision: Alexander Mitton, M.Sc. in Medical Engineering and Physics. *Project: Vibro-tactile stimulator for dystonia.* *Jan 2020 – Sep 2020*
- Teaching Associate: Medical Robotics. Lecturer: Dr. Alejandro Granados *Jan 2022 – Apr 2022*
- Teaching Associate: Medical Robotics. Lecturer: Dr. Hongbin Liu *Jan 2021 – Apr 2021*
- Teaching Associate: Medical Robotics. Lecturer: Dr. Christos Bergeles *Jan 2020 – Apr 2020*

**The University of Birmingham** Jun 2018 – Dec 2018

- Supervision: Dinghuang Zhang, M.Sc. in Computer Engineering. *Project: Tools for human-humanoid collaboration* *Aug 2018 – Dec 2018*
- Teaching associate: Engineering Maths 2. Lecturers: Prof. Martin Russell, Dr Carl Anthony *Aug 2017 – Dec 2017; Jan 2018 – Apr2018*
- Teaching Associate: Matlab Laboratories. Lecturer: Dr Edward Tarte *Jan 2017 – Apr 2017*
- Teaching Associate Computing for Engineering. Lecturer: Dr Sridhar Pammu *Aug 2016 – Dec 2016; Aug 2017 – Dec 2017*
- Teaching Associate: Small Embedded Systems. Lecturer: Prof. Chris Baber *Aug 2016 – Dec 2016*

# Grants, Awards and Honours

- My M.Sc. student, Thea Bautista received the Maurice Wilkins Prize at KCL for the best MEng Individual Research Project in 2022 *(30/08/2022).*
- 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)*
- My M.Sc. student, Alexander Mitton, won the Outstanding Individual Project award *(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*
- I won a 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*

# 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], continuous integration and continuous delivery [2019-present], and CUDA Programming [2021-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], Graphic design (e.g. Inkscape, GIMP)[2014-present], CAD design (e.g. Autodesk inventor, blender, FreeCAD, and onshape)[2015-present], Artificial Neural Networks (e.g. PyTorch, and TensorFlow)[2017-present], 3D printing (e.g., flsun, cura)[2019-present], Video framegrabbers (e.g. PCI and usb from ephipan), and Medical imaging (e.g. 3D slicer, ITK-SNAP).

**QMS** Control documents with standard compliances for Good Machine Learning Practice by FDA, Health Canada, and MHRA; IEC 62304 Medical Device Software Standard; BS EN 82304-1:2017 Health Software; IEC 60601-1 Medical electrical equipment; BS EN 61391-2:2010 Ultrasonics;, and BSI 60825-14 Safety of laser products.

**Languages** Spanish[Native], English[Fluent] and interested in learning Chinese.

# Outreach activities and scientific engagement

- Organised activities for SciKit-Surgery tools for the CMICHACKS hackathon: . *10/11-11-2022.*
- Organised events on behalf of the Early Career Researcher Network at the BMEIS (monthly meetings & writing workshops). *01-01-2021 - 01-09-2022.*
- Participation in the Westminster Enterprise Week to engage students aged 14-18 to Biomedical Engineering. *10-11-2021*
- 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 BMEIS *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 that helps doctors to create 3D models of brain tumors using AI. *09-2019*
- Finalist at the Three Minute Thesis Competition 2018. Video: and GitHub: *05-2018*
- Research Poster Conference for (2015) , (2016) , and (2018) . GitHub: . *2016 to 2018*
- 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*
- Building Artificial Intelligence and Robotics for Children. Twitter: @air4children GitHub: @air4chidlren *2019–Present*