

Miguel Xochicale

My research interests focus on advancing real-time AI tools for MedTech, SurgTech, Biomechanics, and clinical translation.

Senior Research Engineer
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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

Senior Research Software Engineer at University College London, UK

Oct 2022 – Present

- I lead software development for AI tools, models, and APIs, ensuring smooth deployment to scalable, clinically effective medical devices [🔗](#). I support and accelerate innovation by helping UCL researchers turn ideas into production, ensuring high code quality throughout (CDI-HUB [🔗](#), SENSE-BASE [🔗](#) & SciKit-Surgery [🔗](#)).

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 contributed 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 for clinical translation of medical devices, and public engagement activities. See more at ([🔗](#)).

Publications

1. A. Das et al., "Automated surgical skill assessment in endoscopic pituitary surgery using real-time instrument tracking on a high-fidelity bench-top phantom," *Healthcare Technology Letters*, vol. 11, no. 6, pp. 336–344, 2024. eprint: <https://ietresearch.onlinelibrary.wiley.com/doi/pdf/10.1049/htl2.12101>.
2. P. T. H. Nhat et al., "Clinical benefit of ai-assisted lung ultrasound in a resource-limited intensive care unit," *Critical Care*, vol. 27, no. 1, p. 257, Jul. 2023.
3. S. Thompson, M. Xochicale, T. Dowrick, and M. Clarkson, "Using scikit-surgery for augmented reality in surgery research," *Hamlyn Symposium of Medical Robotics*, Jun. 2023.
4. M. Iskandar, H. Mannering, Z. Sun, J. Matthew, H. Kerdegari, L. Peralta, and M. Xochicale, "Towards realistic ultrasound fetal brain imaging synthesis," in *Medical Imaging with Deep Learning (MIDL '23)*, arXiv, Apr. 2023, 3 pages, 1 figure with code and data.
5. L. Tsz Yan and M. Xochicale, "Towards a simple framework of skill transfer learning for robotic ultrasound-guidance procedures," in *Robot-Assisted Medical Imaging (RAMI) ICRA workshop 2023 (RAMI '23)*, arXiv, Apr. 2023, 2 pages, 2 figure with code and data.
6. A. Badillo-Perez, D. Badillo-Perez, A. Barco, R. Montenegro, and M. Xochicale, "Teaching ai and robotics to children in a mexican town," in *18th HRI conference at the 2nd Inclusive HRI workshop (HRI '23)*, arXiv, Mar. 2023, 4-page paper and 2-page appendix with code and data.
7. 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*, Jan. 2023, 4-page pre-print, 2-page appendix, code, data and slides.
8. 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.
9. 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.
10. R. Beale et al., "Oxvent: Design and evaluation of a rapidly-manufactured covid-19 ventilator," *eBioMedicine*, vol. 76, p. 103 868, 2022.
11. C. Baker et al., "Intraoperative needle tip tracking with an integrated fibre-optic ultrasound sensor," *Sensors*, vol. 22, no. 23, 2022.
12. 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.
13. 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.R0].
14. C. Baker 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.

See more full list of publications and associated links ([🔗](#)).

Talks, Posters and Workshops

1. M. Xochicale, "How open-source software is shaping the future of healthcare," Free and Open source Software Developers' European Meeting (FOSDEM), Feb. 2025, Presentation, Abstract.
2. S. Hekim, S. Thompson, and M. Xochicale, "Towards lightweight transformer-based models with multimodal data for low-latency surgical applications," Fast Machine Learning for Science at Imperial College London, Sep. 2023, Presentation, Abstract.
3. S. Thompson, M. Xochicale, T. Couch, I. Idil Ozdemir, T. Dowrick, and M. Clarkson, "How to use and contribute to a software sustainability dashboard," Swansea University, Sep. 2023, Workshop.
4. I. Idil Ozdemir, M. Xochicale, and S. Thompson, "Towards sustainable dashboards for open-source software projects," RSLondonSouthEast 2023 at Imperial College London, Jul. 2023, Presentation, Abstract.
5. M. Xochicale, "Innovating in medical device development," OxfordXML Seminar, Jun. 2023, Presentation, Abstract.
6. M. Xochicale, "Fetal ultrasound imaging synthesis," Data Learning Seminar at Imperial College London, Sep. 2022, Presentation Abstract.
7. 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.
8. 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.
9. 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.

10. **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.

See more full list of references and associated links (🔗).

Supervision and Teaching Experience

University College London

- Co-supervision of PhD student Elvira Cortese from the UCL Queen Square Institute of Neurology
- Supervision: Sujon Hekim, in2reserach summer placement *Project: AI-based surgical skill assessment using transformer model.*
- Supervision: Xiaoning Zhu, M.Sc in Health Data Science *Project: Automatic Medical Image Reporting with transformer-based models.*
- Supervision: Qingyu Yang, M.Sc. in Health Data Science *Project: Fetal Brain Ultrasound Imaging synthesis with diffusion models.*
- Technical Lead: CHME0039: Artificial Intelligence in Healthcare Group Project. Lecturers: Prof. Paul Taylor and Dr Kevin Tsang
- I led two group projects on *Fetal Brain Ultrasound Imaging Synthesis with Diffusion Models.*
- I led two group projects on *End-to-End AI Workflow for Automated Multimodal Medical Image Reporting (AMMIR).*

Jan 2023 – Present

Oct 24’ – Sep 27’
June 23’ – Sep 23’
Jan 23’ – Aug 23’
May 23’ – Aug 23’

Jan 23’ – March 23’
Jan 25’ – March 25’

King’s College London

- Supervision: Pablo Prieto Roca and Samuel Eyob. *KURF projects on 3DGANs for fetal US imaging.*
- Supervision: Tsz Yan (Goosie) Leung, MSc in Medical Engineering and Physics. *Project: Simple US guidance intervention.*
- Supervision: Thea Bautista, M. Eng. in Biomedical Engineering. *Project: DCGANs for fetal US imaging.*
- Supervision: Guilherme Gomes de Figueiredo and Amal Hussein. *KURF projects on DCGANs for US imaging.*
- Supervision: Alexander Mitton, M.Sc. in Medical Engineering and Physics. *Project: Vibro-tactile stimulator for dystonia.*
- Teaching Associate: Medical Robotics. Lecturers: Dr. Christos Bergeles (Jan2020-Apr2022), Dr Hongbin Liu (Jan2021-Apr2021), Dr. Alejandro Granados (Jan2022-April2022)

Jan 2020 – September 2022

Jun 2022 – Aug 2022
Feb 2021 – Aug 2022
Oct 2021 – May 2022
Jun 2021 – Aug 2021
Jan 2020 – Sep 2020
Alejandro Granados
Jan 2020 – Apr 2022

The University of Birmingham

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

Jun 2018 – Dec 2018

Aug 2018 – Dec 2018
Aug 2017 – Dec 2017; Jan 2018 – Apr2018
Jan 2017 – Apr 2017
Aug 2016 – Dec 2016; Aug 2017 – Dec 2017
Aug 2016 – Dec 2016

Grants, Awards and Honours

- UCL Open Science award 2023 for organising "Open-Source Software for SurgTech" workshop (🔗, 📺) (26/10/2023).
- 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)
- “Towards Healthy Ageing with Humanoid Robots” was selected for a talk at the 2nd forum of Mexican Talent 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 1st international public entrepreneurship program in Mexico (MECATE 2015). (🔗 📺) 20-24/07/2015
- I was awarded with a Ph.D. scholarship by the Mexican National Council on Science and Technology and the University of Birmingham. 11/2014-11/2018
- Markovito’s team was awarded the first place of HOME category at the Mexican Tournament of Robotics 2013, presenting a Human-Robot Interaction Dance Demo (📺) 25-27/05/2013

Skills

Programming and software Python[2014-present], GNU/Linux Operating System user (OpenSuse, Debian & Ubuntu)[2005-present], R[2013-present], Robot Operating System (ROS)[2016-present], ROS2[2025-present], GNU-Octave (as well as MatLab)[2009-present], L^AT_EX[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 & continuous delivery [2019-present], CUDA Programming [2021-present], Docker [2024-present], python-based linting [2022-present], aws-cli (📺 [Oct2024-present]).

Tools and hardware Single-board computers and microcontrollers (NVIDIA Jetson Nano, RaspberryPi, BeagleBone, Arduino & PIC)[2010-present], Inertial Measurement Units (calibration, collection & data analysis)[2013-present], Web design (Github pages, Jekyll)[2015-present], Graphic design (Inkscape, GIMP)[2014-present], CAD design (Autodesk inventor, blender, FreeCAD, & onshape)[2015-present], Artificial Neural Networks (PyTorch, & TensorFlow)[2017-present], 3D printing (flsun, cura) [2019-present], Video framegrabbers (PCI & usb from ehipan), Clinical Ultrasound Devices (Voluson E10, Philips EPIC, convex & linear probes), Medical imaging (3D slicer, ITK-SNAP), NVIDIA Clara AGX with holoscan-sdk [2023-present], gtec EEG and g.USBamp [2025-present].

QMS Control documents with standard compliances using: Good Machine Learning Practice by FDA, Health Canada, & 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, & BSI 60825-14 Safety of laser products.

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

Outreach activities and scientific engagement

- Lead organiser of "Open-Source Software for Surg, BioMed and AI Tech 3" at the Hamlym Symp. on Medical Robotics 2025. (🔗) Jan 25’ – Oct 25’.
- Lead organiser of HAWKESHACKS3 hackathon "Redefining Eye Tracking with Open-Source Real-Time AI Solutions": Site: (🔗), & GitHub: (📺). 6-8th Nov 24’.
- Lead organiser of "Open-Source Software for SurgTech 2" at the Hamlym Symp. on Medical Robotics 2024. (🔗) Jan 24’ – Oct 24’.
- Lead organiser of "Open-Source Software for SurgTech" at the Hamlym Symp. on Medical Robotics 2023. GitHub: (📺) & Video Playlist (📺). Jan 23’ – Oct 23’.
- Lead organiser of CMICHACKS hackathon 2023 "Real-time AI for surgery": Site: (🔗), & GitHub repository: (📺). 9-10 Nov 23’.
- Co-organised of journal club for computer vision and deep learning at Advanced Research Computing Centre 01-01-2023 – 01-06-2023.
- Co-organised of events at the BMEIS Early Career Researcher Network (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