Juan M. Parrilla

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Research interests

3D-printing, digital manufacturing and rapid prototyping; bio-inspired artificial life, intelligence and robotics, computer and robot vision; laboratory automation and robot integration with life sciences.

Professional experience

University of Glasgow **Glasgow, UK**
Lord Kelvin Adam Smith Research Fellow *2019–present*
Started my own research group. Our research focuses on: (1) Building modular robots inspired by how life emerged during the Origin of Life. (2) Combining digital manufacturing, robotics and artificial intelligence to create autonomous manufacturing machines. (3) Using Deep Learning to model scientific experiments.

University of Glasgow **Glasgow, UK**
Research associate *2016–2019*
Supervisor: Prof. Leroy Cronin. Developing autonomous robots for the characterisation of chemical experiments, such as real-time analysis of crystallization processes, tracking and manipulation of droplet experiments, and designing a chemical computer using oscillating reactions. Developing CAD software for the design of 3D-printable reaction vessels. Helping with the administration of the Robotics team: mentorship of students and publications, recruiting new members and defining new projects. Assisting with grant applications, their deliverables, and the collaboration with other universities and industry partners. The Chemical Computer project was awarded a £1m DARPA grant.

Syddanks Universitet **Odense, Denmark**
Project student *2012*
Supervisor: Danish Shaikh and Prof. John Hallam. Project title: Sound localization with Arduino based on the lizard peripherical auditory system.

Spain, Denmark and Scotland
Organized several DIY workshops *2012–present*
With Kliment Yanev (Future Bits OpenTech UG) I have organized several workshops that involved building 3D-printers based on the RepRap project, as well as building bespoke robotic platforms for laboratory automation

Syddansk Universitet **Odense, Denmark**
System Administrator *2009–2010*
At MMMI for Prof. John Hallam. Writing server applications in Perl and PHP.

Meristation **Spain**
Article writer *2008-2010*
Wrote videogame articles for the most popular videogame website in Spain.

UPC **Barcelona, Spain**
System Administrator *2008*
Set-up a Wikipedia using MediaWiki for the "Networks" course.

Education

University of Glasgow **Glasgow, UK**
PhD in Robotics and Chemistry *2012–2016*

Specialized in robot design integrated with chemistry, 3D-printing, Computer Vision, and AI.
Supervisor: Prof. Leroy Cronin. Thesis title: Investigating automated chemical evolution of oil-in-water droplets. During the PhD two different automated platforms were designed: a custom 3D-printed liquid handling robot, and a custom 3D-printed device with in-built mixer and droplet generator. Both projects required to interface with chemistry and produce platforms that could generate thousands of experiments to be analysed in real-time using computer vision and machine learning. *Other experiences:* Set-up a hardware workshop and managed the 3D-printing facilities. Worked on a daily basis with researchers from life sciences in multidisciplinary teams. Presented to several visitors and stakeholders, including a EPRSC committees. A follow-up of the PhD project was awarded a £1.5m EPSRC grant.

Syddansk Universitet   **Odense, Denmark**
MSc in Robot Systems Engineering   *2010–2012*
Specialized in AI and computer vision.
Thesis title: Automatic liquid handling for artificial life research. Supervisors: Dr. Martin Hanczyc and Dr. Kasper Stoy. A robot was built that generated droplets into an aqueous phase. The robot was also able to track the droplets, and add or remove content from them. The work developed during this project kickstarted the Evobliss EU project.

Syddanks Universitet   **Odense, Denmark**
Erasmus semester   *2009*
Followed courses on game design and bioinformatics.

Universitat Politècnica de Catalunya   **Barcelona, Spain**
Informatics Engineering (*five-year degree*)   *2003–2009*
Equivalent to BSc plus MSc in Computer Engineering. Specialized in Software Design and AI.
Thesis title: Using support vector machines and similarity functions to work with heterogeneous data and classifying documents. Supervisors: Dr Romero from UPC (Spain) and Prof. John Hallam from SDU(Denmark).

Teaching and supervision

- Achieved an "Associate Fellowship of Recognizing Excellence in Teaching" certificate on completion of the "Developing as teacher of Higher Education" course offered by the University of Glasgow.
- Presented tutorials within the Cronin group about 3D-printing, computer vision and robotics.
- Mentored PhD students, providing help with their publications; and mentored and designed projects for undergraduate project students.
- Organized an on-line Python course for beginners during Covid-19 lockdown. This course was offered to students and researchers from the School of Chemistry at the University of Glasgow.

Scientific collaborations

- Currently writing a European FET Open proposal with collaborators from Universidad del Pais Vasco (Spain). The consortium involves partners from CNRS (Lyon, France), Technical University Eindhoven, University of Amsterdam and MaxPlanck.
- Core member of the *Glasgow University* team in the EU "*Evobliss*" project where we collaborated with different european research teams with the objective of combining robotics, chemistry and microbiology. As a member of this project I have given regular research updates to the other members, and helped with the reports.
- Collaborated with Kliment Yanev from *Future Bits OpenTech UG* using 3D-printers to build robots that could automate laboratory actions.
- Collaborated with Unilever, as part of the Cronin group, testing how different formulations of detergent would clean stained cloths using one of our robots.

Public engagement and media coverage

- Published an opinion piece in the journal *Nature*: "Dear grant agencies: tell me where I went wrong" February 2021 (doi: 10.1038/d41586-021-00444-x).
- Participated in "Science Slam 2015" organized by the University of Glasgow (College of Science and Engineering). It was hosted in a pub and the audience was mostly composed of members the public.
- Participated in "7 Minutes of Science 2020", organized by the University of Glasgow (School of Physics and Astronomy). The audience was mostly composed of undergraduate students.
- Participated in RSC Twitter Poster Conference 2018 and 2020 (2020 Engineering winner).
- The first robot built during the PhD featured in the episode "Are we here for a reason?" of the TV program *Through the Wormhole*, presented by Morgan Freeman.
- The publication "Evolution of oil droplets in a chemorobotic" (*Nature Comm, 2014*) had feature articles in the *Daily Mail*, *Wired* and *Popular Science*.
- The publication "A Crystallization Robot for Generating True Random Numbers" (*Matter, 2020*) had feature articles in *Vice Magazine*, *Chemistry World* and *Phys.org*.

Technical skills

-Able to conceive, design and build autonomous robots, from start to end. This includes the use of 3D-printers, actuators and DIY electronics, in conjunction with embedded and "high-level" software, computer vision and artificial intelligence.
-Knowledge of general programming languages, such as C, C++, Python, Java Perl, PHP and HTML+JS. Production tools like Matlab, Labview, Eclipse, Tex or VIM. Version control system software like Git.
-Familiar with many libraries for scientific and robot related work such as: Tensorflow, NumPy, SciPy, Matplotlib, Scikit-learn, OpenCV. Familiar with Arduino and Raspberry Pi. Familiar with database management software such as MySQL or NoSQL.
-Knowledge of 3D design tools like OpenSCAD and Rhinoceros, and video editing like Blender.

Presentations

2021 Designing a chemical computer and modelling its behaviour using RNNs and Transformers. Invited talk at the "Machine Learning in Science" symposium organized by the University of Glasgow.
2020 Using AI to model chemistry. Invited talk at the "Computer-aided Chemistry" on-line symposium organized by the University of Nottingham.
2020 Building robots based on how life happened on Earth. 7 Minutes of Science. Glasgow, UK.
2015 Programming droplet behaviours. Invited talk at the *SynNatSys* workshop during the ECAL'15 conference. York, UK.
2015 Embodied evolution of artificial cells in a robotic platform. During the "In Vitro" main track of the ECAL'15 conference. York, UK.
2015 Oil droplets and the origin of life. Science Slam 15. Glasgow, UK.
2014 Assisted evolution of protocell droplets in a chemo-robotic platform. Invited talk at the Evobliss workshop during the ALife'14 conference. New York, USA.