Christian Cabrera

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I am a research associate in the ML@CL group at the Department of Computer Science and Technology of the University of Cambridge. I received a Ph.D. degree in Computer Science from Trinity College Dublin in 2020. My current research addresses the problems and challenges arising from deploying Artificial Intelligence systems in the real world. I am investigating the intersection between AI, systems, and software engineering to develop novel approaches for designing, building, monitoring, and adapting real-world AI-based systems. I am the author of more than 20 scientific papers published in top conferences and journals in the domains of Service-Oriented Computing, Pervasive Computing, and the Internet of Things.

Education

June 2020 — **Ph.D. in Computer Science**, Trinity College Dublin, Dublin, Ireland.
Dissertation: *uDiscovery: An Urban-Centric Model for Service Discovery in Smart Cities.*
Supervisor: Prof. Siobhán Clarke
Research focus on the IoT service discovery and composition problems in large, dynamic, and distributed networks.

September 2014 — **M.Sc. in Systems and Computer Engineering**, Los Andes University, Bogotá, Colombia.
Master's Dissertation: *MOWL: A Domain Specific Language for Handling Modular Ontologies.*
Research focus on knowledge management to integrate multiple knowledge models.
GPA: 4.37/5.0

September 2011 — **B.Sc. in Systems Engineering**, Universidad de Nariño, Pasto, Colombia.
GPA: 4.06/5.0

Experience

March 2021 – Current — **Research Associate**, Department of Computer Science and Technology, University of Cambridge, United Kingdom.
Current research on the problem of deploying AI-based systems in the real world as part of the AutoAI project. Particularly, I am exploring and developing the *Data-Oriented Architectures* concept to enable the design and monitoring of AI-based systems The ultimate goal of this research is to ensure AI-based systems perform robustly, safely, and accurately in their deployed environment.

October 2021 – Current — **Teaching Assistant**, Department of Computer Science and Technology, University of Cambridge, United Kingdom.
Advanced Data Science, Bachelors course: Designing the course material around the challenges data scientists face in reality. Supporting students' progress in laboratory sessions.

May 2019 – February 2021 — **Research Assistant (May 2019 - Jun 2020) - Research Fellow (Jun 2020 - Feb 2021)**, School of Computer Science and Statistics, Trinity College Dublin, Dublin, Ireland.
Research on the provision of context-aware, pervasive and resilient applications in large and dynamic urban environments. Particularly, exploring the *self-adaptive organisation of services information* based on RL algorithms in smart cities, and the dynamic and proactive *service placement problem* at the edge based on meta-heuristic and prediction models.

March 2015 – February 2021 — **Teaching Assistant**, School of Computer Science and Statistics, Trinity College Dublin, Dublin, Ireland.
Advanced Software Engineering, Master's course, *What is the Internet doing to to me?*, TCD elective course, *Scalable Computing*, Master's course, *Systems Programming I*, 2nd year Bachelors course, and *Programming Project*, 1st year Bachelors course.

August 2014 – December 2014 **Software Project Lead**, Conecta-TE, Los Andes University, Bogotá, Colombia.
Work on analysis, design and development of software to support educational processes.

February 2012 – July 2014 **Research Graduate Assistant**, Systems Engineering Department, Los Andes University, Bogotá, Colombia.
Research on the semantic web, learning objects, and mobile learning.
Master's thesis. Design and implementation of a domain-specific language to handle modular ontologies.

February 2011 – December 2011 **Software Developer**, CJT&T Software Engineering, Pasto, Colombia.
Work on analysis, design and development of software.

Awards, and Scholarships

Awards

November 2018 **Ph.D. Final Year Trinity Employability Award**, in partnership with Intel. Dublin, Ireland.

November 2011 **Best B.Sc. Research Final Project**, Universidad de Nariño, Pasto, Colombia.

Scholarships

March 2015 **Ph.D. research studentship in Dynamic Service Adaptation, Science Foundation Ireland**, Dublin, Ireland.

Supervision

Undergrad Students

June 2019 – December 2019 **Elizabeth Rojas**, Universidad de Nariño, Colombia.
Thesis topic: *Decision-making support tools for urban planners and authorities*.

Service to the Scientific Community

Roles in Academic Journals

Current **Reviewer for international peer-reviewed journals**, *IEEE Transactions on Services Computing (TSC), and IEEE Internet of Things Journal*.

2022 **Co-organiser**, Challenges in Deploying and Monitoring Machine Learning Systems, NeurIPS Virtual Workshop.

2022 **Co-organiser**, NeurIPS at Cambridge Meetup, NeurIPS Satellite Event.

2022 **Co-organiser**, *ATI AI Fellows day at Cambridge*.

2020-2021 **PC Member**, *International Joint Conference on Autonomous Agents and Multi-agent Systems (AAMAS)*.

Publications

Peer-Reviewed Journals

J5 **Cabrera C.**, Svorobej S., Palade A., Kazmi A., Clarke S., MAACO: A Dynamic Service Placement Model for Smart Cities. *IEEE Transactions on Services Computing (TSC)*, IEEE, Early Access 2022.

J4 **Cabrera C.**, Clarke S., A self-adaptive service discovery model for smart cities. *IEEE Transactions on Services Computing (TSC)*, Vol. 15, No. 1, pp. 386-399, IEEE 2022.

J3 Tabatabaee H., Rasool S., Kazmi A., Palade A., **Cabrera C.**, White G., Clarke S., Dynamic Service Placement in Multi-access Edge Computing: a Systematic Literature Review. *IEEE Access*, Vol. 10, pp. 32639-32688, IEEE 2022.

J2 Rojas E., Bastidas V., **Cabrera C.**, Cities-Board: A Framework to Automate the Development of Smart Cities Dashboards. *IEEE Internet of Things Journal*, Vol. 7, pp. 10128-10136, IEEE 2020.

J1 Palade A., **Cabrera C.**, Li F., White G., Razzaque MA., Clarke S., Middleware for internet of things: an evaluation in a small-scale IoT environment. *Journal of Reliable Intelligent Environments*, Vol. 4, pp. 3-23, SpringerLink 2018.

Peer-Reviewed Conference Proceedings

C16 Paleyes A., **Cabrera C.**, Lawrence N., An Empirical Evaluation of Flow Based Programming in the Machine Learning Deployment Context. *Proceedings of the 1st International Conference on AI Engineering: Software Engineering for AI*, 2022.

C15 Paleyes A., **Cabrera C.**, Lawrence N., Towards Better Data Discovery and Collection with Flow-Based Programming. *Neurips Data-Centric AI Workshop (DCAI)*, 2021.

C14 **Cabrera C.**, Clarke S., A Reinforcement Learning-Based Service Model for the Internet of Things. *International Conference on Service-Oriented Computing (ICSOC)*, pp. 790-799, SpringerLink 2021.

C13 Palade A., Mukhopadhyay A., Kazmi A., **Cabrera C.**, Nomayo E., Iosifidis G., Ruffini M., Clarke S., A Swarm-based Approach for Function Placement in Federated Edges. *IEEE International Conference on Services Computing (SCC)*, IEEE 2020.

C12 **Cabrera C.**, Palade A., White G., Clarke S., An Urban-driven Service Request Management Model. *IEEE International Conference on Pervasive Computing and Communications (PerCom)*, IEEE (2020).

C11 Li F., **Cabrera C.**, Clarke S., A WS-Agreement Based SLA Ontology for IoT Services. *International Conference on Internet of Things*, pp. 58-72, SpringerLink 2019.

C10 White G., Palade A., **Cabrera C.**, Clarke S., Autoencoders for QoS Prediction at the Edge. *IEEE International Conference on Pervasive Computing and Communications (PerCom)*, IEEE 2019.

C9 **Cabrera C.**, Palade A., White G., Clarke S., Services in IoT: A Service Planning Model based on Consumer Feedback. *International Conference on Service-Oriented Computing (ICSOC)*, pp. 304-313, SpringerLink 2018.

C8 Palade A., **Cabrera C.**, White G., Clarke S., Stigmergic Service Composition and Adaptation in Mobile Environments. *International Conference on Service-Oriented Computing (ICSOC)*, pp. 618-633 SpringerLink 2018.

C7 White G., **Cabrera C.**, Palade A., Clarke S., Augmented Reality in IoT. *Workshop on Context-Aware and IoT Services (CIoTS) in the International Conference on Service-Oriented Computing (ICSOC)*, pp. 149-160, SpringerLink 2018.

C6 **Cabrera C.**, Palade A., White G., Clarke S., The Right Service at the Right Place: A Service Model for Smart Cities. *IEEE International Conference on Pervasive Computing and Communications (PerCom)*, IEEE 2018.

C5 White G., Palade A., **Cabrera C.**, Clarke S., IoTPredict: Collaborative QoS Prediction in IoT. *IEEE International Conference on Pervasive Computing and Communications (PerCom)*, IEEE 2018.

C4 White G., Palade A., **Cabrera C.**, Clarke S., Quantitative Evaluation of QoS Prediction in IoT. *47th Annual IEEE/IFIP International Conference on Dependable Systems and Networks Workshops (DSN-W 2017)*, IEEE 2017.

C3 **Cabrera C.**, Li F., Nallur V., Palade A., White G., Razzaque MA., Clarke S., Implementing heterogeneous, autonomous, and resilient services in IoT: an experience report. *IEEE 18th International Symposium on A World of Wireless, Mobile and Multimedia Networks (WoWMoM)*, IEEE 2017.

C2 Palade A., **Cabrera C.**, White G., Razzaque MA., Clarke S., Middleware for Internet of Things: A quantitative evaluation in small scale. *IEEE 18th International Symposium on A World of Wireless, Mobile and Multimedia Networks (WoWMoM)*, IEEE 2017.

C1 **Cabrera C.**, Palade A., Clarke S., An evaluation of service discovery protocols in the internet of things. *17th Proceedings of the Symposium on Applied Computing (SAC)*, pp. 469-476, ACM 2017.

References

Current supervisor — **Prof. Neil Lawrence**, *DeepMind Professor of Machine Learning at University of Cambridge*, Department of Computer Science and Technology, University of Cambridge, William Gates Building, 15 JJ Thomson Avenue, Cambridge.
Email: ndl21@cam.ac.uk

Current supervisor — **Dr. Carl Henrik Ek**, *Associate Professor at University of Cambridge*, Department of Computer Science and Technology, University of Cambridge, William Gates Building, 15 JJ Thomson Avenue, Cambridge.
Email: che29@cam.ac.uk

Ph.D. Thesis supervisor — **Prof. Siobhán Clarke**, *Professor at Trinity College Dublin*, School of Computer Science and Statistics, College Green, Dublin 2, Ireland.
Email: Siobhan.Clarke@scss.tcd.ie