Dr. Mingming Liu

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Summary

1. **Ph.D. in control, optimisation and decision science from the Hamilton Institute at Maynooth University, three years' postdoctoral research experience at UCD, one year's data scientist & H2020 project lead experience at IBM Ireland Lab.**

2. **Strong academic and industrial background in machine/deep learning, data science, control and optimisation with applications to IoT, automotive and transportation, smart grid, smart cities, advanced logistics management system (physical internet).**

3. **IEEE member with over 20 papers published since 2012, including 9 top-tier journal papers [citations > 270, averaged journal article impact factor > 4.1].**

4. **Organization committee member, automotive and transportation track co-chair for the IEEE 5th World Forum on Internet of Things. Artificial Intelligence and Machine Learning track co-chair for the IEEE 6th World Forum on Internet of Things.**

5. **Experience with SFI project: Green Transportation Networks; EU H2020 funded projects: ENABLE-S3, Chariot, VI-DAS, ICONET and 5G-Solutions (work package lead). Acting as PI for three submitted H2020 proposals, one got funded in 2019.**

6. **Hands-on experience of applying machine/deep learning techniques and frameworks for solving practical large-scale learning & data science problems in the industry.**

7. **Familiar with common Python libraries including Numpy, Scipy, Matplotlib, Seaborn, CVXOPT, Sci-Kit Learn, Tensorflow, Keras, Theano, PyTorch & fastai.**

8. **Sophisticated programming skills: Python, Matlab, Simulink, Socket programming, C/C++, CPLEX, Android Studio for rapid prototyping and proof of concept.**

9. **Mentor and supervising experience to both M.Sc. and Ph.D. level students in school of electrical and electronic engineering at UCD and DCU.**

10. **Proficiency in written, spoken and presentational communication skills in English.**

Education

9/2011–9/2015   **Ph.D. in Distributed Control and Optimisation of Plug-in Hybrid Electric Vehicles**, *Hamilton Institute*, National University of Ireland Maynooth, Ireland.

Thesis title: ○ Topics in Electromobility and Related Applications.

Supervisors: ○ Prof. Robert Shorten (Imperial College London at present) and Prof. Seán McLoone (Queen's University Belfast at present).

9/2010–6/2011   **B.Eng. (1st Hons) in Electronic Engineering**, *School of Electronic Engineering*, National University of Ireland Maynooth, Ireland.

Thesis title: ○ Modelling and Control of a Twin Rotor Multiple Input Multiple Output Helicopter System.

Supervisor: ○ Dr. Seán Doherty (NUI Maynooth).

9/2007–6/2010   **B.Eng. (1st Hons) in Electronic Engineering**, *School of Electronic Engineering*, China Changzhou University, China.

Work and Research Experience

09/2019–Present **Assistant Professor in Electronic Engineering**, *Dublin City University*.

Main projects:
- **Smart DCU**: Currently collaborate with Insight Centre for Data Analytics at DCU and DCU Alpha for the improvement of micro-mobility services (E-scooters) with 5G capability in the context of smart DCU campus.
- ⇒ Module coordinator for EE458 and EE459.
- ⇒ Supervision of 5 master students, one PhD to commence late this year.

6/2018–9/2019 **Data Scientist, Applied Researcher, H2020 Project Lead**, *IBM Ireland Lab*.

Main projects:
- **Chariot**: Cognitive Heterogeneous Architecture for Industrial IoT, which aims to develop a cognitive computing platform that places devices and hardware at the root of trust, contributing to high security and integrity of industrial IoT system.
- **VI-DAS**: Vision Inspired Driver Assistance Systems, which leverages advanced sensors, data fusion, and machine learning techniques to better understand driver, vehicle and road context, facilitating a significant step along the road towards next generation ADAS.
- **ICONET**: New ICT infrastructure and reference architecture to support Operations in future PI logistics NETworks, which explores and creates innovative Physical Internet (PI) network services that optimise cargo flows against costs and environmental performance.
- **5G-Solutions**: Conducting advanced field-trials of innovative use cases, directly involving end-users across five significant industry vertical domains to prove and validate that 5G can provide prominent ubiquitous access to a wide range of forward-looking services with order of magnitude of improvement over 4G.
- ⇒ Involved in leading and contributing to various technical tasks by applying modelling, analysis, optimisation, (cloud-based) machine/deep learning techniques for solving challenging research problems in different use cases.
- ⇒ One patent from the work in Chariot has achieved the highest rank patent for IBM.
- ⇒ Acting as PI for three submitted EU H2020 proposals for IBM.

11/2017–6/2018 **Senior Postdoctoral Research Fellow**, *University College Dublin*.

Main projects:
- **ENABLE-S3**: European Inivitative to Enable Validation for Highly Automated Safe and Secure Systems. This project aims to develop an industrial verification and validation simulation testing platform to flexibly evaluate and improve performance of different automotive systems and applications.
- ⇒ Involved in two main work packages to develop use cases, including building drivers' travelling pattern and developing a route predictor using Bayesian clustering method.

9/2015–11/2017 **Postdoctoral Research Fellow**, *University College Dublin*.

Main projects:
- **SPONGE**: Smart Procurement of Naturally Generated Energy, which focuses on using free renewable energy in an optimal way to maximise the efficiency of the hybrid electric transportation fleet.
- **Cyclist Protection**: Developed an algorithm to control the emission level around the cyclist in a virtual geographic boundary.
- **Street Parking**: Developed a distributed control algorithm to minimise the overall routing cost of vehicles for parking.
- **Consensus based optimal feedback control theory**: A rigorous proof was presented for the non-uniform convergence and stability of a class of consensus system driven by a nonlinear input. (published in Automatica).

Key Achievements (Research and Impact)

1. **Pedestrian-Aware Engine Management Strategies for Plug-in Hybrid Electric Vehicles**, *This paper was nominated as the best paper by reviewers in IEEE Transaction on Intelligent Transportation Systems. The work itself has been received wide attentions by automotive industry in Ireland such as Nissan,Toyota and Renault*, This work proposes novel context-aware based engine management strategies for Plug-in Hybrid Electric Vehicles (PHEVs) to optimally switch the vehicles between different operation modes in order to maximise the environmental benefits to pedestrians outside of the vehicles. The idea of this work is simple but very effective in the sense that car manufacturer can easily adopt our ideas to further improve their products and services in current automotive market.

2. **A New Take on Protecting Cyclists in Smart Cities**, *Results are published in top transaction of intelligent transportation system research - IEEE Transactions on Intelligent Transportation Systems. The idea of this work has attracted attention by Dublin city council for improvement of next generation transportation system for cyclists in Dublin city*, This work extends the ideas from the pedestrian-aware engine management strategies for PHEVs by incorporating popular cyclist routing data to lower emissions on roads in the geofence which cyclists use often. A variety of simulations, including HIL emulations, have been implemented to show the efficacy of the proposed approach.

3. **A Distributed and Privacy-Aware Speed Advisory System for Optimising Conventional and Electric Vehicle Networks**, *Results are published in IEEE Transactions on Intelligent Transportation Systems*, One of the key ideas to make intelligent transportation systems work effectively is to deploy advanced communication and cooperative control technologies among vehicles and road infrastructures. In this spirit, we propose a consensus-based distributed speed advisory system that optimally determines a recommended common speed for a given area in order that the group emissions, or group battery consumptions, are minimised. Our algorithms achieve this in a privacy-aware manner; that is, individual vehicles do not reveal in-vehicle information to other vehicles or to infrastructure. A mobility simulator is used to illustrate the efficacy of the algorithm, and HIL tests are given to illustrate user acceptability and ease of deployment of our proposed system.

4. **Smart Procurement of Naturally Generated Energy (SPONGE) for Plug-in Hybrid Electric Buses**, *Results are published in leading journal of automation engineering - IEEE Transactions on Automation Science and Engineering. Results presented in this paper have also been included in a recent published book entitled "Electric and Plug-in Hybrid Vehicle Networks: Optimization and Control" by CRC press*, In this work, a new energy management paradigm has been introduced for bus operator by using the forecast of generation of energy from renewable resources on a day ahead basis. This forecast is to prioritise the manner in which individual buses dissipate electrical energy taking account of the fact that some drivers/routes are more energy efficient than others.

5. **On the Stability and Convergence of a Class of Consensus Systems with a Nonlinear Input**, *Results are published in top journal of system and control theory research*, The objective of this work is to determine conditions under which a certain partially distributed system converges to a Lur'e-like-like scalar system, and to provide a rigorous proof of its stability. A solid example is given of a speed advisory system of vehicles where such a system arises in real engineering practice. Note that the detailed design of this example has been published in the paper "A Distributed and Privacy-Aware Speed Advisory System for Optimizing Conventional and Electric Vehicle Networks" as presented in 3.

6. **A Privacy-Aware Transmission Frequency Management System for Optimizing IoT Edge Devices**, *Results have been indexed as "Search 1 (highest rank)" in IBM patent board*, In this work, we have devised a novel method to optimally manage transmission frequency of a group of IoT edge devices in a privacy preserving manner.

Awards

2014	**Scholarship for 6th Elgersburg school in system control theory**, *TU Ilemnau*, Germany.
2013	**Professional certificate in teaching & learning**, *Maynooth University*, Ireland.
2012	**Ph.D. scholarship (3 years fully funded)**, *SFI*, Ireland.
2011	**Doctoral teaching scholarship (4 years fully funded)**, *Maynooth University*, Ireland.
2011	**International student award**, *Maynooth University*, Ireland.
2011	**Agilent technologies award (for best final year project)**, *Maynooth University*, Ireland.
2011	**Best undergraduate student award (ranked 1st)**, *Maynooth University*, Ireland.
2010	**Exemplary role model (highest honour for undergraduate students in the college)**, *China ChangZhou University*, China.
2007–2010	**Outstanding student scholarship**, *China ChangZhou University*, China.

Certificates

2019	**Cognitive Practitioner**, IBM.
2019	**Machine Learning with Python**, IBM.
2018	**Deep Learning**, IBM.
2018	**Python for Data Science**, IBM.

Technical Skills

OS:	Linux, MS Windows
Programming:	Python, Matlab & Simulink, C/C++, Java, VHDL
ML&DL:	Numpy, Scipy, Sci-Kit Learn, Tensorflow, Keras, Theano, PyTorch & fastai
Control:	Classical PI/D control, state estimation (Kalman filtering), modern optimal control techniques
Optimisation:	Linear and quadratic programming, distributed constraint optimisation on networked agents, CPLEX and CVXOPT for optimisation
Scientific software:	Android studio, SUMO (traffic simulator), OpenDSS (power system simulator), Arduino, NS2 & NS3 (network simulator), Multisim (circuit simulator)
Other software:	LaTeX, HSQLDB, EndNote, MS office suite

Scientific Activities

Reviewer:	Energies
	IEEE Transactions on Intelligent Transportation Systems
	IEEE Transactions on Systems, Man, and Cybernetics: Systems
	Transactions of the Institute of Measurement and Control
	International Journal of Electrical Power and Energy System
	IEEE ICNP 2017 conference
Organisations:	IEEE Member
	IEEE Power & Energy Society Member
	IEEE ICNP 2017 Technical Programme Committee (TPC) Member
	IEEE 5th World Forum on Internet of Things (organising committee & track co-chair)

Google Scholar Page

https://scholar.google.com/citations?user=woHxot0AAAAJ&hl=en

Publications

Journals

1. **M. Liu**, J. N. Sawaya, F. Lecue and R. Shorten. "*A Distributed Markovian Parking Assist System*", in IEEE Transactions on Intelligent Transportation Systems, 2018 **(IF: 4.051)**

2. A. Herrmann, **M. Liu**, F. Pilla and R. Shorten. "*A New Take on Protecting Cyclists in Smart Cities*", in IEEE Transactions on Intelligent Transportation Systems, 2018 **(IF: 4.051)**

3. Y. Gu, **M. Liu***, J. Naoum-Sawaya, E. Crisostomi, G. Russo, R. Shorten. "*Pedestrians-Aware Engine Management Strategies for Plug-in Hybrid Electric Vehicles*", in IEEE Transactions on Intelligent Transportation Systems, 2017 **(IF: 4.051)**

4. **M. Liu***, F. Wirth, M. Corless and R. Shorten. "*On the Stability and Convergence of a Class of Consensus Systems with a Nonlinear Input*", in Automatica, 2017 **(IF: 6.126)**

5. J. Naoum-Sawaya, E. Crisostomi, **M. Liu***, Y. Gu, R. Shorten. "*Smart Procurement of Naturally Generated Energy (SPONGE) for Plug-in Hybrid Electric Buses*", in IEEE Transactions on Automation Science and Engineering, 2017 **(IF: 3.667)**

6. **M. Liu***, R. H. Ordóñez-Hurtado, F. Wirth, Y. Gu, E. Crisostomi, and R. Shorten. "*A Distributed and Privacy-Aware Speed Advisory System for Optimizing Conventional and Electric Vehicle Networks*", in IEEE Transactions on Intelligent Transportation Systems, 2016 **(IF: 4.051)**

7. **M. Liu***, P. McNamara, R. Shorten and S. McLoone. "*Residential Electrical Vehicle Charging Strategies - the Good, the Bad and the Ugly.*" in Journal of Modern Power Systems and Clean Energy, 2015. **(IF: 2.122)**

8. E. Crisostomi, **M. Liu**, M. Raugi and R. Shorten. "*Plug-and-Play Distributed Algorithms for Optimized Power Generation in a Microgrid.*" in IEEE Transactions on Smart Grid, 2014. **(IF: 7.364)**

9. **M. Liu*** and S. McLoone. "*Enhanced AIMD-based Decentralized Residential Charging of EVs.*" in Transactions of the Institute of Measurement and Control, 2013. **(IF: 1.579)**

Conferences

1. **M. Liu**, Y. Gu, E. Crisostomi and R. Shorten. "*Identification of new patterns in urban traffic flows*" in Proceedings of 2018 International Conference on Control Technology and Applications (CCTA), 2018.

2. **M. Liu**, Y. Gu, J. Monteil, J. Epperlein, S. Zhuk and R. Shorten. "*Route Prediction Through Bayesian Classification with Markov Chains*", in Proceedings of the 21st IEEE International Conference on Intelligent Transportation Systems, 2018.

3. **M. Liu***, R. H. Ordóñez-Hurtado, F. Wirth, Y. Gu, E. Crisostomi, and R. Shorten. "*An intelligent speed advisory system for electric vehicles*" Proceedings of 2015 International Conference on Connected Vehicles and Expo (ICCVE), pp. 84-88, 2015.

4. **M. Liu***, E. Crisostomi, Y. Gu and R. Shorten. "*Optimal Distributed Consensus Algorithm for Fair V2G Power Dispatch in a Microgrid*" Proceedings of 2014 IEEE International Electric Vehicle Conference (IEVC), pp. 1-7, 2014

5. Y. Gu, **M. Liu**, E. Crisostomi and R. Shorten. "*Optimised Consensus for Highway Speed Limits via Intelligent Speed Advisory Systems*" Proceedings of 2014 International Conference on Connected Vehicles and Expo (ICCVE), pp. 1052-1053, 2014.

6. **M. Liu***, P. McNamara, R. Shorten and S. McLoone. "*Distributed Consensus Charging for Current Unbalance Reduction*" Proceedings of 18th IFAC World Congress, vol. 47, no. 3, pp. 3146-3151, 2014.

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* indicates corresponding author.

7. **M. Liu**[*], S. Stüdli, R. Middleton, S. McLoone, R. Shorten and J. Braslavsky. "*On-Off based Charging Strategies for EVs Connected to a Low Voltage Distribution Network*" Proceedings of 2013 IEEE Asia-Pacific Power and Energy Engineering Conference (APPEEC), pp. 1-6, 2013.

8. **M. Liu**[*], W. Griggs, C. King, F. Wirth, P.Borrel and R. Shorten. "*Applying a QoS-based Fleet Dimension Method to Reduce Fleet Emissions*" Proceedings of 2013 International Conference on Connected Vehicles and Expo (ICCVE), pp. 732-733, 2013.

9. **M. Liu**[*], P. McNamara and S. McLoone. "*Fair Charging Strategies for EVs Connected to a Low-Voltage Distribution Network*" Proceedings of the 4th IEEE/PES Innovative Smart Grid Technologies Europe (ISGT EUROPE), pp. 1-5, 2013.

10. **M. Liu**[*], E. Crisostomi, M. Raugi and R. Shorten. "*Optimal Distributed Power Generation for Thermal and Electrical Scheduling in a Microgrid*" Proceedings of the 4th IEEE/PES Innovative Smart Grid Technologies Europe (ISGT EUROPE), pp. 1-5, 2013.

11. **M. Liu**[*] and S. McLoone. "*Investigation of AIMD based EV Charging Strategies for EVs Connected to a Low-Voltage Distribution Network*" Intelligent Computing for Sustainable Energy and Environment, pp. 433-441, 2012.

Acknowledged

1. Y. Gu. "*Collaborative and Context-Aware Applications for Intelligent and Green Transportation*", Ph.D. thesis, University College Dublin, 2018.

2. Y. Gu, F. Häusler, W. Griggs, E. Crisostomi and R. Shorten. "*Smart procurement of naturally generated energy (SPONGE) for PHEVs*", International Journal of Control, vol. 89, no. 7, pp. 1467-1480, 2016.

3. J. Epperlein, R. Shorten and S. Zhuk. "*Recovering Markov Models from Closed-Loop Data*", submitted to Automatia and arXiv, [online] `https://arxiv.org/abs/1706.06359`, 2017.

4. E. Crisostomi, R. Shorten, S. Stüdli and F. Wirth. "*Electric and Plug-in Hybrid Vehicle Networks: Optimization and Control*, published by CRC Press, 2017.

Reference

Available on request.