

# Jayson Co SIA

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## Education

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- **Ph.D. in Electrical Engineering** **Los Angeles**  
○ *University of Southern California*  
Control Systems  
Advisers: Dr. Edmond Jonckheere, Dr. Paul Bogdan  
*2015-2024*
- **M.Sc. in Electrical Engineering** **Singapore**  
○ *National University of Singapore*  
Automation and Control Engineering  
*Jun 2015*
- **B.Eng. in Electrical Engineering** **Singapore**  
○ *National University of Singapore*  
Automation and Control Engineering, Second Class Honours (Upper Division)  
Advisers: Dr. Lum Kai-Yew, Dr. Mouhacine Benosman  
*Jun 2009*
- **B.A. in Economics** **Singapore**  
○ *National University of Singapore*  
Econometrics and Financial Economics  
*Jun 2009*

## Publications

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### Journals

- Mohamed Ridha Znaidi, Jayson Sia, et al., "A unified approach of detecting phase transition in time-varying complex networks," *Scientific reports* 13, 17948 (2023). <https://doi.org/10.1038/s41598-023-44791-3>
- Jayson Sia, Laith Shalalfe, Edmond Jonckheere, and Paul Bogdan, "Phasor measurement unit change-point detection of frequency hurst exponent anomaly with time-to- event," *IEEE Transactions on Dependable and Secure Computing*, (2023). <https://doi.org/10.1109/TDSC.2023.3262825>
- Jayson Sia, Wei Zhang, Edmond Jonckheere, David Cook, and Paul Bogdan. "Inferring functional communities from partially observed biological networks exploiting geometric topology and side information." *Scientific reports* 12, no. 1 (2022): 1-17. <https://doi.org/10.1038/S41598-022-14631-X>
- Jayson Sia, Edmond Jonckheere and Paul Bogdan, "Ollivier-Ricci Curvature-Based Method to Community Detection in Complex Networks," *Scientific Reports* 9 Article number: 9800 (2019). <https://doi.org/10.1038/s41598-019-46079-x>.

### Conference

- Valeriu Balaban, Jayson Sia, and Paul Bogdan, "Robust Learning under Label Noise by Optimizing the Tails of the Loss Distribution," to appear in the Proceedings of the 2023 IEEE International Conference on Machine Learning and Applications (ICMLA), Jacksonville, FL, USA, December

15-17, 2023.

- Jayson Sia, Edmond Jonckheere, Laith Shalalfeh, and Paul Bogdan, "PMU Change Point Detection of Imminent Voltage Collapse and Stealthy Attacks," in the Proceedings of the 2018 IEEE Conference on Decision and Control (CDC), Miami Beach, FL, USA, December (2018). <https://doi.org/10.1109/CDC.2018.8619847>.

## Workshops

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- *PMU Data Science for Blackout and Cyber-Attack Early Warning*.  
2018 IEEE SmartGridComm Conference on 29-31 October 2018 at Aalborg, Denmark.  
Presenters: Prof. Edmond Jonckheere and Jayson Sia.

## Research, Teaching and Projects

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### Research Assistant

- *University of Southern California* *Aug 2017–Present*

#### Smart Grid and Power Systems

- Change Point Detection of PMU Signals

Fractal geometry inspired analysis of PMU signals (via the Hurst exponent) reveals that an imminent voltage collapse is preceded by a significant increase in the Hurst exponent. A novel change point detection strategy that optimally anticipates the fractal geometry change point from the PMU signals subject to a pre-specified false alarm rate is developed.

#### Coarse Geometry Analysis of Complex Systems

- Ollivier-Ricci Curvature Based Method to Community Detection

Analysis of complex networks using topological concepts such as the Ollivier-Ricci curvature can reveal underlying structures of the network. As a preliminary investigation, we explored the application of the Ollivier-Ricci curvature to detecting communities in complex networks.

- Community detection in partially observed networks using a priori side information

We explore the community detection problem by incorporating a priori network side information to improve the overall community detection performance. We first investigate this with synthetic network data with varying levels of network observability as well as varying levels of a priori node side information. Finally, we apply this to real-world networks, particularly biological networks, to discover hidden relationships, essential pathways and communities in partially observed protein-protein interaction networks with scarce a priori gene annotation and functional information.

#### Machine learning general transcriptional predictors of plant disease

- A research collaboration project using a combination of machine learning and feature selection methods to identify sets of genes that could predict host disease development from early time-point transcriptome data. We investigate both established ML approaches as well as classical and geometric network science nodal metrics as feature selection criteria. To identify if any of the gene sets represented general predictors of disease development, we cross-validated our trained machine learning models using data from a different fungal and bacterial pathogen.

## Protein Engineering

- An ongoing research collaboration project in protein engineering using large language models and network analysis

## Teaching Assistant

- *USC Ming Hsieh Department of Electrical Engineering*  
EE-526 (Spring 2018): Renewable Energy in Power Systems  
EE-444 (Fall 2019, 2021): Power Systems Technology  
EE-503 (Spring 2022): Probability for Electrical and Computer Engineers

## Course Mentor

- *USC Ming Hsieh Department of Electrical Engineering*  
EE-527 (Spring 2018): Net-Centric Power-System Control

## Department Activities

- *Race On - Student Self Driving Car Competition* *Aug 2019–Present*  
Organizing committee

- **Final Year Undergraduate Research Project '2 DOF Helicopter Modeling and Control'**

The final year undergraduate dissertation project exploring the system identification and control of a 2 DOF helicopter test-bed. A nonlinear model of the system is derived using system identification. Three controllers, Linear-Quadratic Regulator, Fault-Tolerant Control and Input-Output Linearization with Static-State Feedback, were designed and developed in simulations and validated in the actual test-bed.

## Professional Experience

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### Project Engineer R&D

**Singapore**

- *Cargotec CHS Asia-Pacific Pte. Ltd.*

*Jan 2012–Jun 2015*

*Project: Automated Guided Vehicles (AGV) Navigation Systems (NS) for PSA Container Terminals*

- Developed obstacle detection device driver in C++ for the NS
- Performed NS systems integration, calibration, control performance testing, and endurance trials
- Troubleshoot vehicle hardware and software issues (PLC and NS software) through data log analysis
- Conducted NS software trainings for PSA engineers

### Associate Scientist

**Singapore**

- *Temasek Laboratories (TL@NUS), Control Science Group*

*Sep 2009–Dec 2011*

*Project: Nonlinear guidance and control of unmanned marine surface vessels (USV)*

- Completed a research collaboration project with TL and DSO National Laboratories
- Developed the simulation platform in Simulink and implemented the actual controller in C/C++
- Conducted vehicle sea trials for system parameter identification and controller performance testing
- Performed large data analysis from sea trials results using MATLAB and Excel
- Conducted a guidance and control workshop for knowledge transfer to DSO engineers
- Prepared presentations and reports for project milestones

## Relevant coursework

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### USC - Ph.D.

- EE 482 - Linear Control Systems (A)

- EE 503 - Probability for Electrical and Computer Engineers (A)
- EE 527 - Net-Centric Power-System Control (A)
- EE 562 - Random Processes in Engineering (B-)
- EE 585 - Linear System Theory (A-)
- EE 553 - Computational Solution of Optimization Problems (A)
- EE 587 Nonlinear and Adaptive Control (A-)
- EE 563 Estimation Theory (A-)

#### NUS - M.Sc.....

- EE5103R - Computer control systems (A-)
- MCH5206 - Instrumentation and Sensors (B+)
- EE5102 - Multivariate Control Systems (A-)
- EE5106R - Advanced Robotics (B+)
- EE5104 - Adaptive Control Systems (A)
- EE5107 - Optimal Control Systems (A-)
- EE5711R - Modelling and Control of Power Electronic Converters (B-)
- EE5904R - Neural Networks (A)

## Technical and Personal skills

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- **Certification:**  
IEC61131-3 (PLC) Application Development Course (Leaptron, Singapore, Mar 2013)
- **Programming Languages:**  
Proficient (7+ years experience) in: C, C++, Python,  $\LaTeX$ , UNIX bash scripting  
Basic (3+ years experience) in: CoDeSys (PLC Programming), Web Technologies (HTML/CSS, Javascript, Node.js, Swift)
- **Softwares:**  
MATLAB, Simulink, LabView, MS Office Suite
- **Languages:**  
Mother tongue: Filipino (Tagalog)  
Fluent: English  
Intermediate: Mandarin Chinese  
Basic: French, Spanish

## Honors and Awards

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- **Viterbi Undergraduate Research Mentorship Award**  
*Viterbi CURVE research mentees:* Hannah Rose (Won best undergraduate poster), Eszter Morvay *May 2021*
- **USC Annenberg Ph.D. Fellowship**  
*Full Ph.D. funding for four years.* *2015–2019*
- **NUS Undergraduate Dean's Lister** *2007–2008*
- **Ministry of Foreign Affairs Singapore Scholarship**  
*Full undergraduate scholarship.* *2004–2009*