Wai Tong Chung

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Education

Stanford University Stanford, CA
Ph.D. in Mechanical Engineering. *Advisor: Prof. Matthias Ihme*. Sept. 2018 - Exp. June 2024
Research Focus: *Machine Learning, AI for Science, High-Performance Computing, Energy.*
Thesis: *Overcoming Small Datasets in High-Dimensional ML Studies of Multi-physics Flows in Propulsion.*
Courses: *Deep Learning, Computer Vision, Mining Massive Datasets, Linear Algebra, Parallel Computing, Numerical Methods, The AI Awakening, Fluid Mechanics, Physical Gas Dynamics, etc*.

Imperial College London United Kingdom
B.Eng. M.Eng. in Mechanical Engineering *with First Class Honours*. Sept. 2013 - Aug. 2017
Thesis: *Two-dimensional Probability Density Function Model for HCCI Combustion*.

Experience

Stanford University Stanford, CA
Machine Learning Research Assistant Sept. 2018 - Exp. June 2024
Investigating ML for multi-physics flows in energy, propulsion, and wildfire modeling via high-performance computing.

ME 375: *Wildfire Science* Teaching Assistant Mar 2023 - June 2023
Developed/delivered a new graduate-level course on empirical/computational/ML-based wildfire modeling.

Lawrence Livermore National Laboratory Livermore, CA
Deep Learning Research Intern June 2022 - Sept. 2022
Explored deep learning methods for climate modeling and COVID-19 drug discovery.

JPMorgan Chase & Co. United Kingdom
Financial Messaging Software Engineer Sept. 2017 - Aug. 2018
Developed, deployed, and tested a Java-based global financial messaging application.

Imperial College London United Kingdom
Environmental Engineering Research Assistant June 2017 - Aug. 2017
Prototyped light and acoustic sensor networks for flood warning systems in Nepal.

JPMorgan Chase & Co. United Kingdom
Software Engineer Intern June 2016 - Aug 2016
Developed, deployed, and tested a Java-based global financial messaging application.

PTL Technology Malaysia
Mechanical Engineer Intern July 2014 - Sept. 2014
Contributed to hospital construction site work, and drafted medical gas pipeline floor plans.

Research Work

Refereed Journal Articles and Conference Proceedings on Machine Learning

W.T. Chung, B. Akoush, P. Sharma, A. Tamkin, K.S. Jung, J.H. Chen, J. Guo, D. Brouzet, M. Talei, B. Savard, A.Y. Poludnenko, M. Ihme. Turbulence in Focus: Benchmarking Scaling Behavior of 3D Volumetric Super-Resolution with BLASTNet 2.0 Data. *Adv. Neural Inf. Process. Syst. (NeurIPS)* 36, 2023. [.pdf]

P. Sharma[†], **W.T. Chung**[†], B. Akoush, M. Ihme. A Review of Physics-informed Machine Learning in Fluid Mechanics. *Energies* 16(5):2343, 2023. ([†]*Equal Contribution*)[.pdf]

W.T. Chung, K.S. Jung, J.H. Chen, M. Ihme. BLASTNet: A Call for Community-Involved Big Data in Combustion Machine Learning. *Appl. Energy Combust. Sci.* 12:100087, 2022. [.pdf]

M. Ihme[†], **W.T. Chung**[†], A.A. Mishra[†]. Combustion Machine Learning: Principles, Progress, and Prospects. *Prog. Energy Combust. Sci.* 91:101010, 2022. ([†]*Equal Contribution*)[.pdf]

W.T. Chung, A.A. Mishra, M. Ihme. Interpretable Data-driven Methods for Subgrid-scale Closure in LES for Transcritical LOX/GCH_4 Combustion. *Combust. Flame* 239:111758, 2022. [.pdf]

W.T. Chung, A.A. Mishra, N. Perakis, M. Ihme. Data-assisted Combustion Simulations with Dynamic Submodel Assignment using Random Forests, *Combust. Flame* 227:172-185, 2021. [.pdf]

Refereed Workshop Papers on Machine Learning

W.T. Chung, K.S. Jung, J. H. Chen, M. Ihme. The Bearable Lightness of Big Data: Towards Massive Public Datasets in Scientific Machine Learning. In: *ICML AI4Science Workshop*, 2022. [.pdf]

D.D. Wu, **W.T. Chung**, M. Ihme. ML for Safely Landing on Mars. In: *NeurIPS ML4PS Workshop*, 2022. [.pdf]

W.T. Chung, A.A. Mishra, N. Perakis, M. Ihme. Accelerating High-fidelity Combustion Simulations with Classification Algorithms. In: *AAAI MLPS Spring Symp.*, 2021. [.pdf, video]

W.T. Chung, A.A. Mishra, N. Perakis, M. Ihme. Random Forests for Accelerating Turbulent Combustion Simulations. In: *NeurIPS ML4PS Workshop*, 2020. [.pdf]

Refereed Journal Articles and Conference Proceedings on Computational Science and Engineering

W.T. Chung, N. Ly, M Ihme. LES of HCCI Combustion of Iso-octane/air in a Flat-piston Rapid Compression Machine. *Proc. Combust. Inst.* 39(4):5309-5317, 2023. [.pdf]

J. Guo, D. Brouzet, **W.T. Chung**, M. Ihme. Analysis of Ducted Fuel Injection at High-pressure Transcritical Conditions using Large-eddy Simulations. *Int. J. Engine Res (in press)*, 2023. [.pdf]

W.T. Chung, P.C. Ma, M. Ihme. Examination of Diesel Spray Combustion in Supercritical Ambient Fluid using Large-eddy Simulations. *Int. J. Engine Res.* 21(1):122-133, 2020. [.pdf]

Conference Presentations

W.T. Chung, B. Akoush, P. Sharma, M. Ihme. Fostering Open-source Resources and Practices within Deep Learning of Flow Physics. In: *Annu. Meet. Am. Phys. Soc., Div. Fluid Dyn.*, Washington D.C., 2023.

M. Ihme, **W.T. Chung**, B. Akoush, P. Sharma. Unlocking the Hidden Details: New Approaches for ML-Based Super-Resolution of Turbulent Flows. In: *Int. Conf. Flow Dyn.*, Sendai, Japan, 2023.

J.Z. Ho, M. Talei, **W.T. Chung**, D. Brouzet, P. Sharma, B. Akoush, M. Ihme. Advancing Flame Surface Density Modelling with Machine Learning. In: *Int. Conf. Flow Dyn.*, Sendai, Japan, 2023.

J. Kildare, **W.T. Chung**, M. Evans, Z. Tian, P. Medwell, M. Ihme. Instantaneous Temperature Field Prediction of JHC Flames using Machine Learning. In: *Aust. Combust. Symp.*, Darwin, Australia, 2023.

D.D. Wu, **W.T. Chung**, M. Ihme. Physics-guided Data-driven Methods for Modeling Multi-Nozzle Supersonic Retropropulsion. In: *Int. Planet. Probe Workshop*, Marseille, France, 2023.

M. Ihme, **W.T. Chung**, A.A. Mishra, P. Sharma. Guiding the Blind: Injecting Knowledge into Combustion Machine Learning. In: *KAUST Research Conference: AI for Energy*, Thuwal, Saudi Arabia, 2023. [video]

W.T. Chung, M. Ihme. Learning Combustion Closure Models using the Open-source BLASTNet Database. In: *U.S. Natl. Combust. Meet.*, College Station, TX, 2023.

W.T. Chung, M. Ihme. Data-assisted Combustion Modeling in LES of a Laser-ignited GCH_4/GOX Rocket. In: *Int. Conf. Numer. Combust.*, La Jolla, CA, 2022.

D.D. Wu, **W.T. Chung**, M. Ihme, K. Edquist. Physics-informed Modeling of Multi-nozzle Plume Physics with Quantifiable Uncertainties from Supersonic Retropropulsion Tests. In: *Int. Planet. Probe Workshop*, Santa Clara, CA, 2022.

D.D. Wu, **W.T. Chung**, M. Ihme, K. Edquist. Machine Learning with Supersonic Retropropulsion Wind Tunnel Test Data. In: *Annu. Meet. Am. Phys. Soc., Div. Fluid Dyn.*, Indianapolis, IN, 2021.

W.T. Chung, M. Ihme. Training on Lossy Compressed Data in Combustion Machine Learning. In: *Meet. West. States Combust. Inst.*, Stanford, CA, 2022.

W.T. Chung, A.A. Mishra, M. Ihme. Subgrid-scale Models with Interpretable Machine Learning in LES of Transcritical Reacting Flows. In: *Annu. Meet. Am. Phys. Soc., Div. Fluid Dyn.*, Phoenix, AZ, 2021.

W.T. Chung, A.A. Mishra, M. Ihme. Modeling Subgrid-scale Stresses in Transcritical Combustion with Interpretable Machine Learning. In: *U.S. Natl. Combust. Meet.*, Virtual, 2021.

W.T. Chung, A.A. Mishra, N. Perakis, M. Ihme. Deep Learning-based Assignment of Combustion Submodels for Large-eddy Simulation. In: *Annu. Meet. Am. Phys. Soc., Div. Fluid Dyn.*, Virtual, 2020.

Accepted Grants

Google Award for Inclusion Research Grant (Awarded $60,000). PI: M. Ihme, 2022. [info]

NERSC Award Grant (Awarded 11.2M core-hours). PI: M. Ihme, 2022. [info]
NASA Early Stage Innovations Grant (Awarded $650,000). PI: M. Ihme, 2021. [info]

Honors and Awards

Stanford CS323: *The AI Awakening* **Best Final Project Prize** (of 87 Students) 2023
Stanford Human-Centered AI **Affinity Group Award** [info, press] 2023
Stanford Human-Centered AI **Graduate Fellowship** [info, press] 2022-2023
WSSCI Student **Travel Award** for *Int. Symp. Combust.* 2022
Stanford School of Engineering **Graduate Fellowship** 2018-2019
Imperial College Mechanical Engineering **Most Outstanding Thesis Prize** (of 138 Students) 2017
Imperial College Mechanical Engineering **Dean's List** (Top 10% of 138 Students) 2017
Imperial College Engineering **Undergraduate Research Award** 2017

Professional Activities

Invited Lecturer. ML Fundamentals and Applications. In: Stanford ME375: *Wildfire Science*, 2023. [.pdf]
Invited Speaker. Addressing Gaps in Scientific Data within ML studies of Thermo-fluid Systems. In: *Stanford Thermal and Fluid Sciences Industrial Affiliates Conference*, 2023.
Invited Speaker. Potential and Challenges of ML in Industrial and Environmental Reacting Flows. In: *K1st World Symposium*, 2022. [video]
Invited Speaker. Towards Massive Public Datasets in Scientific ML. In: *Stanford HAI Grad Seminar*, 2022.
Invited Speaker. Data-assisted Simulations using a Classification Algorithm. In: *Stanford Thermal and Fluid Sciences Industrial Affiliates Conference*, 2020.

Reviewer for *ML and the Physical Sciences Workshop at NeurIPS*, 2021, 2022, 2023.
Reviewer for *Synergy of Scientific and Machine Learning Modeling Workshop at ICML*, 2023.
Reviewer for *ReScience C (ML Reproducibility Challenge)*, 2023.
Reviewer for *ASME Turbomachinery Technical Conference & Exposition*, 2023.
Reviewer for *Combustion and Flame*, 2023.
Reviewer for *International Journal of Engine Research*, 2023.
Reviewer for *AI for Science: Progress and Promises Workshop at NeurIPS*, 2022.

Session Chair for Physics-Informed ML and Dynamic Modeling at *Annu. Meet. Am. Phys. Soc., Div. Fluid Dyn.*, 2023.
Session Chair for Turbulent Combustion at *U.S. Natl. Combust. Meet.*, 2023.
Session Chair for Numerical/Computational Combustion at *Int. Symp. Combust.*, 2022.

AI/ML Technical Lead for *Stanford Fx Lab (PI: M. Ihme)*, 2022-Present.
Lead Organizer for *Future Learning Approaches for Modeling and Engineering (FLAME) AI Workshop*, 2023. [info]
Lead Organizer for *Stanford HAI Climate-Centered AI Seminar Series*, 2023. [press]
Student Affiliate for *Stanford Data Science Center for Open and REproducible Science*, 2023.
Co-organizer for *Stanford Mechanical Engineering Student Committee*, 2019-2022.
Co-organizer for *Imperial College London Mechanical Engineering Society*, 2016-2017.

Open-source Projects

Hosted 2023 FLAME AI Challenge. [kaggle.com/competitions/2023-flame-ai-challenge/]
Curated BLASTNet Simulation Dataset. [blastnet.github.io]
Developed Multi-GPU Deep Learning Tutorials for 3D Datasets. [github.com/blastnet/kaggle_tutorials]
Developed Intro. to ML Tutorials. [github.com/IhmeGroup/CombML_Tutorials]

Skills

Programming
Proficient: `Python, PyTorch (Lightning), TensorFlow, MATLAB.`
Familiar: `C++, C, Gym, PySpark, MPI, FORTRAN, Java, Arduino.`

Languages
Proficient: English, Malay.
Familiar: Mandarin, Cantonese.