Weilong Chen

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Education

Chalmers University of Technology — Gothenburg, Sweden
M.Sc. in Engineering Mathematics and Computational Science; ***GPA: 4.5/5.0*** — *Aug 2022 – Jun 2024*

National University of Defense Technology — Changsha, China
B.Sc. in Aerospace Engineering; ***GPA: 85/100*** — *Aug 2018 – Jun 2022*
Track: Flight Vehicle Propulsion Engineering; ***Supervisor:*** *Mingbo Sun*

Research Experience

Generative models for accelerating Molecular Simulations — Chalmers, Sweden
Project Course & Master thesis — *Sep 2023 – Ongoing*

- **Supervisor:** Simon Olsson
- Extended Implicit Transfer Operator framework by integrating recent generative models such as Stochastic Interpolants and Flow Matching.
- Introduced the Thermodynamic Interpolant concept to tackle the limitation of ITO framework, enabling transformation across different kinetic states, such as temperature variations.

Research of supersonic airflow mixing and combustion scale effects — NUDT, China
Graduation thesis — *Oct 2021 – May 2022*

- **Supervisor:** Guoyan Zhao
- Established models for the key sub-processes of fuel mixture and flame combustion in supersonic airflow, clarify the spatial scale effects of fuel injection and mixing, and the time scale effects of supersonic combustion and flame stabilization.
- Establish the scale similarity laws for supersonic mixing and combustion, in an attempt to guide the extension of existing research findings on surrogate combustion chambers to large scale combustion chambers.
- Conference Paper : China National Symposium on Combustion: 224378 (Co-first author)

Pre-mixed combustion flame prediction based on CNN-LSTM — NUDT, China
Research Assistant — *Oct 2019 – Aug 2020*

- Generate a trustworthy dataset through PIV system about 2-D laminar diffusion flame.
- Build a CNN-LSTM model to be trained and then predict the evolution of combustion flame.
- Compared with CFD methods, deep learning model shows computational efficiency and reasonable accuracy.

Work Experience

Volvo Group — Gothenburg, Sweden
Deep Learning Engineer — *Jun 2023 – Jan 2024*

- LLM applications for Volvo Trucks.
- Huggingface Transformers, PEFT, Finetune, Llama 2, Falcon, Mixtral.
- Implemented Milvus Vector Database with Langchain to build RAG systems.
- Deepspeed, Multi node & Multi cluster training
- Agents for NLP, Multimodal models using Llava framework
- Pretained BERT for time series analysis (Volvo trucks electrical signals)

China Academy of Space Technology — Beijing, China
Summer Intern — *Jul 2021 – Aug 2021*

- Flight dynamics optimization algorithm for satellites.

AVIC Engine Design Institute — Shenyang, China
Summer Intern — *Jul 2021 – Aug 2021*

- Aeronautical Engine R&D, Experimental Aerodynamics.

Science and Technology on Scramjet Laboratory — Changsha, China
Experimental Aerodynamics R&D Intern — *Jun 2019 – Sep 2019*

- Scramjet propulsion experiments, PIV, PLIF, Schlieren systems.
- Optical diagnostic & data analytics.
- Detonation engine, Liquid rocket engine, Turbine pump CAD design.

Awards & Achievements

Social Practice and Science Contest on Energy Saving & Emission Reduction: National Thrid Award
Low-cost repeatable energy saving performance product based on combined water rocket devices
Patent: The invention relates to a teaching appliance based on water rockets with propelled glider.(202110666202.x)

College Best Athelete: 400m, 800m and 4*400m champions.

IELTS: Overall: 7.0 Minimal: 6.5 (Year: 2021)

Projects

High Performance Computing in C Language | *GitHub*

- Stack and heap allocation; Memory fragmentation; Benchmark; Valgrind and GDB; Assembler; Inlining; Locality; Data dependency; Indirect adressing; Parallelism, Openmp, OpenCL, MPI, C11 Threads; Linux.

Advanced Probabilistic Machine Learning | *GitHub*

- Frequentist vs Bayesian approach; Bayesian inference; Supervised learning
- Bayesian graphical models; Belief propagation; Approximate inference and learning: Monte Carlo inference, Variational inference and Expectation propagation
- Unsupervised learning: K-means clustering, the Gaussian mixture model, expectation maximization, PCA

CUDA for Computaional Fluid Dynamics | *GitHub&Report*

- **Supervisor:** Lars Davidson
- GPU-accelerated computational methods using Python and CUDA.

Image Analysis | *GitHub*

- Classifiers, Filtering, SIFT, CNN, RANSAC, Camera geometry, Generative Neural Networks, NERFs

Sensor Fusion and Nonlinear Filtering | *Github*

- Bayesian principles, Optimal filtering and smoothing, Motion models, Sensor models, Sigma point methods, Kalman filters (EKF, UKF, CKF), Particle filters, Rauch-Tung-Striebel smoothers, MMSE estimators.

Embedded Control Systems | *GitHub&Report*

- Cyber Physical System, Quadrotor control, LQR, Simscape, Model-based simulation, Flight Dynamics

Project course in mathematical and statistical modelling | *Report*

- Pre-training time series models of truck behavior using BERT architecture.

Research-oriented course in Data Science and AI | *Course Page*

- Geometric Deep Learning, Graph Neural Networks, Large molecules, Proteins and representations, Gauges, Geodesics and manifolds, Dimensions and Units.

Project in Computer Science | *Report*

- Utilizing the Stochastic Interpolants framework, we adeptly transform samples across various thermodynamic states governed by the Boltzmann distribution, highlighting the efficacy of generative models in augmenting sampling via neural network surrogate models. I am continuing my master's thesis research on this subject.

Skills

Programming: Python, C, C++, MATLAB

Tools: Git, Pytorch, Linux, OpenFoam, CUDA, MPI, Transformers, Huggingface, Docker

Others: ANSYS Fluent, AutoCAD, Solidworks, Pointwise, Tecplot, Simulink

Other Coursework

Master-level coursework: Nonlinear Optimization, Abstract Algebra, Financial Time Series

Bachelor-level main coursework: Fluid Mechanics, CFD, Automation and Control, Combustion, Heat Tranfer, Aerodynamics, Object-Oriented Programming, Thermodynamics, Flight Mechanics, Electrics and Electronics, Principle of Propulsion, Numerical Analysis, PDE, Complex Analysis, Statistical Inference