

Weilong Chen

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EDUCATION

Chalmers University of Technology

M.Sc. in Engineering Mathematics and Computational Science; GPA: 4.5/5.0

National University of Defense Technology

B.Sc. in Aerospace Engineering; GPA: 85/100

Track: Flight Vehicle Propulsion Engineering; Supervisor: Mingbo Sun

Gothenburg, Sweden

Aug 2022 – Jun 2024

Changsha, China

Aug 2018 – Jun 2022

RESEARCH EXPERIENCE

Research of supersonic airflow mixing and combustion scale effects

NUDT, China

Graduation thesis

Oct 2021 – May 2022

- **Supervisor:** Guoyan Zhao
- Establish mathematical models for the key sub-processes of fuel mixing 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 and analytical models for supersonic mixing and combustion, in an attempt to guide the extension of existing research findings on scaled-down combustion chambers to large scale combustion chambers.
- **Conference Paper Published** : 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, which provides a tremendous amount of useful experimental data about 2-D laminar diffusion flame.
- Build a CNN-LSTM model to be trained and then predict the evolution of combustion flame.
- Compared with the experimental data, it turns out the data-driven method can be effective when predicting the flame evolution, which is a complex nonlinear dynamical system. Compared with traditional CFD methods, deep learning algorithm shows computational efficiency and reasonable accuracy.

WORK EXPERIENCE

Volvo Group

Gothenburg, Sweden

Deep Learning Engineer

Jun 2023 –

- Developed and implemented LLM applications and infrastructure for Volvo Group.
- Use Hugging Face pipeline to utilize PEFT techniques like LoRa and Adapter to finetune Llama-33B, Llama-65B, and Falcon-40B models for different language tasks.
- Constructed a comprehensive database incorporating various Volvo internal data sources, such as PowerPoint presentations, Git repositories, and documents.
- Implemented a vector database to enhance compatibility and facilitate collaboration among multiple users.
- Worked on parallel processing utilizing multiple nodes and GPUs, optimizing performance for deep learning tasks.

China Academy of Space Technology

Beijing, China

Summer Intern

Jul 2021 – Aug 2021

- Visit space station research center and satellite manufacturing base.
- Flight vehicle optimization algorithm development and test

AVIC Engine Design Institute

Shenyang, China

Summer Intern

Jul 2021 – Aug 2021

- Aeronautical engine test preparation and experiment.
- Experimental facility design and test. Master experimental safety principle.

Science and Technology on Scramjet Laboratory

Changsha, China

Experimental Aerodynamics R&D Intern

Jun 2019 – Sep 2019

- Scramjet propulsion experiments using PIV, PLIF, Schlieren systems.
- Process optical diagnostics experimental data.
- Deploy temperature and pressure sensors in a supersonic wind tunnel to get flow field information.
- Work on detonation engine, solid rocket engine and injection & atomization test stands. Liquid rocket engine turbine pump CAD design.

AWARDS & ACHIEVEMENTS

Social Practice and Science Contest on Energy Saving & Emission Reduction: National Third Award
Low-cost repeatable energy saving performance product based on combined water rocket devices

- Patent Application Number:
The invention relates to a teaching appliance based on water rockets with propelled glider.(202110666202.x)

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

University Third Scholarships: Awarded to undergraduate students who have been ranked in the top 30% at college of Aerospace Science and Engineering

Mathematical Contest Third Award: Awarded to undergraduate students who take part in mathematical competition and rank top 10%

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 addressing; Linux.
- Parallelism, Openmp, OpenCL, MPI, C11 Threads.

Advanced Probabilistic Machine Learning | [GitHub](#)

- Frequentist vs Bayesian approach; Bayesian inference; Supervised learning: Bayesian linear regression; Linear methods for classification
- Bayesian graphical models: Bayesian networks, Markov random fields, factor graphs; Belief propagation; Approximate inference and learning: Monte Carlo inference (importance sampling, Gibbs sampling, Markov chain Monte Carlo); Approximate inference: Variational inference and Expectation propagation
- Unsupervised learning: K-means clustering, the Gaussian mixture model, expectation maximization, principal component analysis

CUDA for Computational Fluid Dynamics | [GitHub](#)[Report](#)

- Supervisor:** [Lars Davidson](#)
- Implemented CFD algorithms using the Cupy library in Python. Results showed that using a GPU with Cupy was able to significantly improve the computation time for the CFD algorithms tested. In some cases, the use of a GPU resulted in a speedup of over 110x compared to using a CPU alone. Investigations also dive into different GPUs, matrix sizes and block sizes.
- Investigations also dive into different GPUs, matrix sizes and block sizes. Comparison between Numba and Cupy.

Image Analysis | [GitHub](#)

- Classifiers, Filtering, Gradients, Scale, SIFT, CNN, RANSAC, Camera geometry, Triangulation, Generative neural networks, NERFs

Sensor Fusion and Nonlinear Filtering | [Github](#)[Report](#)

- Bayes rule, Bayesian estimation, Optimal filtering, Optimal smoothing, Motion models, Sensor models, Sigma point methods, Kalman filters, Particle filters, Rauch-Tung-Striebel smoothers, MMSE estimators, Constant velocity model, EKF, UKF, CKF, Application on various problems.

Embedded Control Systems | [GitHub](#)[Report](#)

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

SKILLS

Programming: C, C++, Python, MATLAB, MySQL, Linux

Tools: Git, Simulink, Pytorch, OpenFoam, CUDA, MPI, OpenCL, Huggingface

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

OTHER COURSEWORK

Master-level coursework: Nonlinear Optimization, Abstract Algebra, Functional Analysis, Numerical Linear Algebra

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