

# Weilong Chen

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## EDUCATION

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### 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

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### 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

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### Volvo Group

Gothenburg, Sweden

*Deep Learning Engineer*

*Jun 2023 – Dec 2023*

- LLM applications and infrastructure for Volvo Group.
- Huggingface Transformers, PEFT, Finetune, Llama2, Falcon, Volvo Database.
- Implemented Milvus VectorDB with Langchain to achieve Information Retrieval tasks.
- Using Deepspeed to utilize multiple nodes and multi GPUs, optimizing performance for deep learning tasks.
- Agents for NLP, multimodal LLM
- FNO for time series data (Volvo vehicles electrical signals)

### 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

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**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

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### 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, PCA

### 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

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

**Tools:** Git, Simulink, Pytorch, OpenFoam, CUDA, MPI, Transformers, Kubernetes, Docker

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

## OTHER COURSEWORK

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**Master-level coursework:** Nonlinear Optimization, Abstract Algebra, Statistics and machine learning in high dimensions, [Structured Machine Learning](#)

**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