

# CONG LIU

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## EDUCATION

### Tsinghua University, China

Sep. 2022 - June. 2025

- M.Eng in Electronic and Information Engineering, Supervisor: Xinghui Li
- GPA: 4.0/4.0 (**Top 1%**)
- University First-class Scholarship (2024) (**Top 3%**)

### Northeastern University, China

Sep. 2018 - June. 2022

- B.Eng in Measuring and Control Technology and Instrumentation
- GPA: 4.07/5.00 (**Top 5%**)
- University First-class Scholarship (2021) (**Top 3%**) & University Second-class Scholarship (2019 & 2020)
- Thesis: Research and design on calibration method of 3D laser scanning system (**Outstanding Graduation Thesis Award**)
- **Outstanding Graduate of Northeastern University**, 2022, Northeastern University

## PUBLICATIONS & PATENTS

1. **C. Liu**, C. Zhang, X. Liang, *et al.* Attention Mono-depth: attention-enhanced transformer for monocular depth estimation of volatile kiln burden surface. *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 35, no. 2, pp. 1686-1699, Feb. 2025. doi: 10.1109/TCSVT.2024.3479412. (**IF=8.3, JCR Q1**).
2. **C. Liu**, X. Li, *et al.* Deformable attention-guided network for multi-task learning. *Optoelectronic Imaging and Multimedia Technology XI*. SPIE, 2024, 13239: 226-232, doi: <https://doi.org/10.1117/12.3036091>.
3. **C. Liu**, *et al.* HSLLM: Hidden State-Augmented Prompt-Based LLM for Long-Term Time Series Forecasting in Industrial Process. (Under review)
4. Z. Li, W. Chen, **C. Liu**, *et al.* An efficient exposure fusion method for 3D measurement with high-reflective objects. *Optoelectronic Imaging and Multimedia Technology XI*. SPIE, 2024, 13239: 348-356, doi: <https://doi.org/10.1117/12.3036376>.
5. **C. Liu**, C. Zhang, *et al.* A monocular depth estimation method for materials in the kiln head area of rotary kilns. *China Invention Patent*. CN202410114473.8. Pending.
6. **C. Liu**, Q. Wang, *et al.* High sensitivity LRSPR fiber optic sensor based on  $\text{Ti}_3\text{C}_2$  and its fabrication method. *China Invention Patent*. CN112730339A. Authorized.
7. **C. Liu**, B. Li. A New Structure Fiber Optic SPR Sensor. *China Utility Model Patent*. CN213516873U. Authorized.

## RESEARCH EXPERIENCE

### Monocular depth estimation of volatile kiln burden surface

Feb. 2023 - Feb. 2024

Pengcheng Laboratory

- A novel encoder-decoder network integrated with an attention module is proposed for monocular depth estimation of volatile kiln burden surface for the first time, which achieves a depth prediction error of **RMSE = 11.008 mm** for the burden surface region, outperforming the SOTA networks.
- The **attention module**, incorporating both global and local attention mechanisms, is developed to learn the relationships between long-range and adjacent pixels, adaptively partition **depth intervals**, and predict probability distribution over depth intervals for each pixel more precisely.
- A scale-down prototype of an industrial on-site volatile kiln is built to simulate the actual operation of the kiln.
- Code is available at: <https://github.com/LLLcong/Attention-MonoDepth>

### Deformable attention-guided network for multi-task learning

Mar. 2024 - Aug. 2024

Tsinghua University

- A novel deformable attention-guided network is proposed for multi-task learning, which improves the accuracy of both **depth estimation** and **semantic segmentation** tasks, compared with single-task and multi-task baselines.
- The proposed model effectively fuses feature maps with different semantic information by using a **deformable attention mechanism**. Additionally, the proposed model balances the computational complexity and accuracy, achieving an **RMSE = 0.5183m** within a 10m-range and **IoU = 44.82%** on the NYU dataset.

## Large language model for long-term time series forecasting in industrial process

Jul. 2024 - Present

Pengcheng Laboratory

- A novel LLM-based framework is proposed for long-term time series forecasting using **hidden state-augmented prompts**. Instead of relying on fixed or manually crafted templates, hidden states are extracted through a GRU to capture historical patterns and latent trends. These states are integrated with GPT-2 word embeddings through multi-head attention to construct prompts, effectively enhancing the LLM's forecasting performance.
- A **patch-temporal representation module** is designed to capture both **original temporal dependencies** and **trend information**. Patch-wise features are extracted from segmented sequences to model raw temporal patterns, while 1D convolution captures deep and trend-related information. The fused representation encodes rich temporal and relational information for downstream forecasting.

## Research on image scratch removal method based on deep learning

Mar. 2022 - Jun. 2022

Northeastern University

- In this work, a cGAN model, named Pix2Pix, is applied to remove scratches from images. The generator G uses damaged images which contain scratch latent features as input to remove scratches from images, and the repaired images output by G are then fed into the discriminator D along with the real unimpaired images with the constraint of scratch features. G and D are trained together to eliminate discrepancy and discriminate between the repaired images and the real unimpaired images respectively.
- GAN loss and L1 loss are jointly applied in training the network for retaining both the high and low-frequency components of the images. The algorithm shows high accuracy of removing scratches, with the evaluation metric of **PSNR = 41.1dB**, **MSE = 0.000084**, and **LPIPS = 0.003976**.

## COMPETITIONS & AWARDS

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1. University Computer Games & National Computer Games Tournament, **National First Prize**.
2. Mathematical Contest In Modeling, **Honorable Mention**.
3. National University Student Social Practice and Science Contest on Energy Saving & Emission Reduction, **National Third Prize**.
4. China Undergraduate Mathematical Contest in Modeling, **Second Prize in Liaoning Province**.
5. 'Jianlong Iron and Steel' Electronic Design Competition of Northeastern University, **University Second Prize**.

## PROJECTS

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### Research on high sensitivity LRSPR optic fiber biosensors

- A China invention patent and a utility model patent are authorized.
- A highly sensitive long-range surface plasmon resonance (LRSPR) biosensor, based on  $\text{Ti}_3\text{C}_2$ -enhanced multi-single-multi cascaded optic fiber, is proposed for the detection of **human immunoglobulin G (IgG)**, with a sensitivity of **1.84 nm/(ug/mL)**. The biosensor exhibits the advantages of small size, ease of fabrication, high sensitivity, label-free and rapid response.

### Design of high-accuracy temperature measurement system for weak signals

- A high-accuracy multi-point temperature system is designed, featuring functions including temperature drift correction, filtering, overvoltage protection and channel isolation. The system operates in the range of **0 to 1300 degrees Celsius**, achieving **an error of less than 1 degree**.

## EXTRACURRICULAR ACTIVITIES

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### Rural Revitalization Social Practice Activity of Tsinghua University

Jan. 2023 - Feb. 2023

- Awarded as **Silver Prize of Tsinghua University Social Practice**
- Conduct in-depth field research on rural development and industrial development mode of local products.
- A live streaming plan was organized to support farmers, successfully attracting **420,000** viewers to the broadcast.

## SKILLS

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**Programming:** Python/Pytorch, C/C++, Matlab, etc.

**Tools:** VS Code, PyCharm, SolidWorks, Multisim, Altium Designer, Comsol, etc.

**Languages:** Mandarin (Native), English (IELTS 7.0).