TAO LV

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SUMMARY

My research interests focus on the compact design of high-dimensional signal acquisition systems with computational imaging theory at its core, as well as image processing tasks related to high-dimensional vision.

In high-dimensional signal acquisition, I introduced a novel snapshot imaging spectrometer with aperture diffraction (ICCV 2023) and investigated its parallel architecture (submitted to CVPR 2024). I am committed to researching affordable snapshot acquisition of spectral data on mobile devices. Expanding on this work, I am currently delving into the development of a snapshot spectral and depth imaging system with aperture diffraction, a passive and compact ultrafast spectral video imaging system with helical encoding, as well as a compact light field spectral imaging system based on chromatic polarization.

In the field of high-dimensional vision, I created a dataset and benchmark for detecting gas targets in the mid-wave and long-wave infrared band, showcased at CVPR 2022. I played a key role in developing a spectral video gas monitoring and early warning system, leading to top honors in three national competitions, where I served as the project lead for two. Furthermore, my research extends to applying artificial intelligence for improved chemical industry safety, earning me the Best Demo Award at the CAAI International Conference on AI.

EXPERIENCE

Medical Robotics Group, Shenyang Institute of Automation, CAS   Jun '19 – Oct '19
Hardware Development Engineer   *Shenyang, China*

· Contributed to the "**Portable Extracorporeal Life Support System**" project (national level), focusing on designing and developing emergency extracorporeal circulation equipment suitable for battlefield, natural disasters, and other crises.
· Device selection, experimentation and tuning, MFC development for sensor and DC motor control and tuning.

Department of Intelligent Detection and Control, NEU   Oct '19 - Jun '21
research of optics, circuits and algorithms   *Shenyang, China*

· Research and study of various infrared spectroscopic gas systems. Declare relevant undergraduate programmes.
· Build a multispectral gas imaging and trace system and try to integrate related image processing algorithms.

SpecNet, Lightgene   Jun '22 - Sep '23
Algorithm engineer (Internship)   *Nanjing, China*

· The first phase is dedicated to building a large-scale multi-industry spectral dataset and open-source platform (**SpecNet**).
· the later phase mainly focuses on developing a spectral vision smart camera and searching for landing applications.
· Enhance proficiency in Python and C++ development; master **edge deployment and optimization of models**.

Lab for Computational Imaging Technology & Engineering   Jan '21 - Present
Development and research of optics, circuits and algorithms   *Nanjing, China*

· Delve into optics, mechanics, electronics, and algorithms to build a solid understanding in computational imaging and computer photography. Focus research on **acquiring and processing high-dimensional information**.
· Construct a novel snapshot spectral imaging system with **aperture diffraction** and investigated its parallel architecture.
· Preparing to further extend amplitude-based aperture diffraction coding to combined depth-spectral imaging.
· Ongoing research related to **compact light field spectral imaging**, **spectral meta-imaging**.

HONORS & AWARDS

National Scholarships	Dec '19
National First Prize of China Graduate Electronic Design Contest	Aug '21
Principal Special Scholarship of Nanjing University	Dec '21
National First Prize of China Graduate AI Innovation Competition (**Leader**)	Dec '21
CAAI International Conference on AI - Best Demo Award	Nov '22
China Optics Valley Scholarship	Nov '22
Gold Medal of China International College Students'Innovation Competition (**Leader**)	Dec '23

EDUCATION

Northeastern University *Shengyang, China*

Materials Science & Engineering *2017-2018*

Overall GPA: 3.93 / 5 (rank: 13/390)

Northeastern University *Shengyang, China*

Bachelor degree of Engineering in Electrical Engineering & Automation *2018-2021*

Overall GPA: 4.06 / 5 (rank: 2/76)

Nanjing University *Jiangsu, China*

Towards a PhD in Information & Communication Engineering *2021-present*

PUBLICATIONS

Lv T, Ye H, Yuan Q, Shi Z, Wang Y, Wang S, Cao X. "Aperture Diffraction for Compact Snapshot Spectral Imaging." IEEE International Conference on Computer Vision (ICCV), 2023

Orthogonal mask, band-by-band transformed PSFs, compact snapshot spectral imaging system design.

Zhou K, Wang Y, **Lv T**, Li, Y, Chen, L, Shen, Q, Cao, X. Explore spatio-temporal aggregation for insubstantial object detection: benchmark dataset and baseline[C]//Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2022: 3104-3115.

Defines invisible gaseous target detection tasks and benchmarks.

Shi Z, Ye H, **Lv T**, Wang, Y, Cao, X. Compact Self-adaptive Coding for Spectral Compressive Sensing[C]//2023 IEEE International Conference on Computational Photography (ICCP). IEEE, 2023: 1-12.

Optimized snapshot spectral imaging based on temporal information and single-channel adaptive dynamic mask.

Huang E, Chen L, **Lv T**, Cao X. GLRNet: Gas Leak Recognition via Temporal Difference in Infrared Video[C]//CAAI International Conference on Artificial Intelligence. Cham: Springer Nature Switzerland, 2022: 515-520.

Highly accurate gas leakage identification algorithm based on temporal difference.

In addition, the **first-authored** paper "Parallel-structured Snapshot Spectral Imaging via Under-aligned Aperture Diffraction Fusion" has been submitted to **CVPR 2024**; the third-authored paper "Gaseous Object Detection" has been submitted to **TPAMI**.

TECHNICAL STRENGTHS

Working with the team to design algorithms and algorithm deployment, I enjoy python/matlab/C, and have gained a certain level of understanding of both deep learning and signal processing related technologies; adept at building various of computational imaging systems, including optical optimisation and related electro-mechanical controls.

INTERESTS

Computational Photography Compact Snapshot Spectral Imaging, Compact Light Field Spectral Imaging, Compact ultrafast Spectral Imaging. **High-dimensional visual processing tasks** Spectral video object detection and segmentation, multimodal image fusion, high-dimensional visual reconstruction.

Passionate about constructing imaging systems, I find joy in the exhilarating moments of inspiration that arise.