Yunkang CAO

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EDUCATION

Huazhong University of Science & Technology (HUST)	**GPA**: 88.26/100	*Hubei, China*
Ph.D. Candidate in Mechanical Engineering	Supervisor: Prof. Weiming Shen	2020.09- present

Huazhong University of Science & Technology (HUST)	**GPA**: 91.55/100	*Hubei, China*
B.E. in Mechanical Design, Manufacture & Automation	**Rank**: 14/309	2016.09- 2020.06

RESEARCH INTEREST

Multimodal Anomaly Detection: introduce multimodal information, e.g., 2D (RGB), 3D (depth), language for better anomaly detection performance.

PUBLICATIONS & MANUSCRIPTS

Journal Articles

[1] **Y. Cao**, Q. Wan, W. Shen, L. Gao. Informative Knowledge Distillation for image anomaly detection. *Knowledge-Based Systems (**KBS**)*. **(SCI, Q1)**. [Paper] [Code]

[2] **Y. Cao**, X. Xu, Z. Liu, W. Shen. Collaborative Discrepancy Optimization for Reliable Image Anomaly Localization. *IEEE Transactions on Industrial Informatics (**IEEE TII**)*, **(SCI, Q1)**. [Paper] [Code]

[3] C. Liu, J. Wang, **Y. Cao**, M. Liu, W. Shen. GON: End-to-end Optimization Framework for Constraint Graph Optimization Problems. *Knowledge-Based Systems (**KBS**)*. **(SCI, Q1)**. [Paper]

Conference Papers

[4] **Y. Cao**, Y. Song, X. Xu, S. Li, Y. Yu, Y. Zhang, W. Shen. Semi-supervised Knowledge Distillation for Tiny Defect Detection. *2022 IEEE 25th International Conference on Computer Supported Cooperative Work in Design (**CSCWD**)*. [Paper]

[5] **Y. Cao**, Y. Zhang, W. Shen. High-Resolution Image Anomaly Detection via Spatiotemporal Consistency Incorporated Knowledge Distillation. *2023 IEEE 19th International Conference on Automation Science and Engineering (**CASE**)*.

[6] Q. Wan, **Y. Cao**, L. Gao, W. Shen, X. Li. Position Encoding Enhanced Feature Mapping for Image Anomaly Detection. *2022 IEEE 18th International Conference on Automation Science and Engineering (**CASE**)*. [Paper] [Code]

[7] C. Liu, **Y. Cao**, C. Sun, W. Shen, X. Li, L. Gao. An Outlier-Aware Method for UWB Indoor Positioning in Non-line-of-sight Situations. *2022 IEEE 25th International Conference on Computer Supported Cooperative Work in Design (**CSCWD**)*. [Paper]

Ongoing Papers

[8] **Y. Cao**, X. Xu, W. Shen. Complementary Pseudo Multimodal Feature for Point Cloud Anomaly Detection. *Pattern Recognition (**PR**)*, Under Review. [Paper]

[9] **Y. Cao**, X. Xu, C. Sun, L. Gao, W. Shen. BiaS: Incorporating Biased Knowledge to Boost Unsupervised Image Anomaly Localization. *IEEE Transactions on Systems, Man, and Cybernetics: Systems (**IEEE TSMC**)*, Under Review.

[10] **Y. Cao**, X. Xu, C. Sun, Y. Chen, Z. Du, L. Gao, W. Shen. Segment Any Anomaly without Training via Hybrid Prompt Regularization. *Arxiv*. [Paper]

[11] Y. Jiang, **Y. Cao**, W. Shen. A Masked Reverse Knowledge Distillation Method Incorporating Global-Local Information for Image Anomaly Detection. *Knowledge-Based Systems (**KBS**)*, Under Review.

RESEARCH PROJECT

2D Anomaly Detection   2021.03- 2022.07

- ➤ [1] IKD: Proposed Informative Knowledge Distillation (IKD) to mitigate the overfitting problem, which contains a novel context similarity loss and a novel adaptive hard sample mining method, both help to distill informative knowledge and offer a strong supervision signal.

- ➤ [2] CDO: Proposed Collaborative Discrepancy Optimization (CDO) to mitigate the overgeneralization problem, which comprises a margin optimization module and an overlap optimization module, thereby optimizing normal and abnormal feature distributions with the assistance of synthetic anomalies.

- ➤ [5] STCIKD: Proposed Spatiotemporal Consistency Incorporated Knowledge Distillation (STCIKD) method, which translates high-resolution images into video sequences and exploits spatial and temporal consistency between them to capture both local spatial and long-term dependencies.

- ➤ [9] BiaS: Proposed Biased Students (BiaS) to enhances the effectiveness of unsupervised methods and adapts them to the open-set setting through biased knowledge generation, transfer, and fusion.

3D Anomaly Detection   2022.07- 2023.02

- ➤ [8] CPMF: Proposed Complementary Pseudo Multimodal Feature (CPMF) that incorporates local geometrical information in 3D modality using handcrafted PCD descriptors and global semantic information in the generated pseudo 2D modality using pre-trained 2D neural networks.

Text-guided Anomaly Detection   2023.02- present

- ➤ [10] SAA: Presented a novel framework, i.e., Segment Any Anomaly + (SAA+), for zeroshot anomaly segmentation with hybrid prompt regularization to improve the adaptability of modern foundation models..

SELECTED HONORS

- 2nd Place for CVPR VAND Zero-shot Anomaly Detection Challenge   2023.06
- First-class Scholarship for Postgraduates of HUST (<10%)   2020.09 & 2021.09 & 2022.09
- **Mathematical Modeling Stars Nomination (Top2)** of China Mathematical Modeling Contest   2022.05
- Student Award for Research and Innovation (<5%)   2022.01
- Merit Postgraduate student of HUST (<5%)   2021.09
- Excellent Graduates of HUST (<10%)   2019.06
- **National Scholarship (the highest scholarship for B.E)**   2017.09 & 2019.09

ACADEMIC SERVICE

- **Reviewer: TII, CASE2022/2023, CSCWD2023**

REFERENCES

Prof. Weiming Shen, Ph.D., CAE Fellow, IEEE Fellow, Fellow of the Engineering Institute of Canada (EIC)

- Professor at the Huazhong University of Science and Technology, Wuhan, China
- Adjunct Professor at the University of Science and Technology, ON, Canada
- Email: wshen@ieee.org — Tel: (86) 027-8754-3129
- Relationship: Advisor (since Sep. 2020 to present)