Haowei Cao

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EDUCATION

Johns Hopkins University Baltimore, Maryland, USA
Graduate Student, Computer Science & Electrical and Computer Engineering *01/2024 - Present*

University of Houston Houston, Texas, USA
Ph.D. Student, Computer Science *08/2022 - 12/2023*

- Research Assistant, Teaching Assistant

University of Tennessee Knoxville, Tennessee, USA
Undergraduate, Computer Science, Minor in Mathematics *09/2016 - 05/2020*

- Dean's List 6 semesters, graduated cum laude

RESEARCH INTERESTS

- **Computer Vision** - Object Detection and Segmentation, Image Classification, Image Processing
- **Video Indexing and Retrieval** - Content Analysis, Scene Understanding, Machine Learning

SKILLS

- **Programming Languages** - C/C++, Python, Java, Kotlin, R
- **Database Technologies** - SQL, MongoDB, Redis
- **Embedded Systems** - Arduino, Raspberry Pi, ROS
- **Software and Toolkits** - TensorFlow, PyTorch, Scikit-Learn, Git, MATLAB, VTK, Qt5, OpenGL, Blender, LaTeX

INTERNSHIP EXPERIENCE

Shanghai Floauto Valve Co.Ltd Shanghai, China
ERP System, Enterprise Software Development, System Integration *10/2020 - 06/2021*

- Participated in the development of an openERP-based system project aimed at integrating three different systems from three departments into a unified ERP system. Significantly improved overall system efficiency, reducing cross-departmental order processing time from 2 days to a few hours.
- Developed a microservice architecture based on RESTful APIs, improving system modularity and scalability.
- Implemented full-text search functionality based on Elasticsearch, greatly enhancing user efficiency in finding information.

RESEARCH PROJECTS

Facial Expression Emotion Recognition Wabash College, Indiana, USA
Deep Learning, Computer Vision, Affective Computing *05/2024 - 07/2024*

- Engaged in a project aimed at er using existing datasets. Initiated research with a baseline accuracy of approximately 25%.
- Systematically explored and implemented various deep learning architectures, including U-Net, ResNet, Inception Network, and Transformer. Introduced innovative techniques such as Multilevel Triplet Loss to enhance model performance.
- Achieved incremental improvements in recognition accuracy through iterative experimentation and optimization. Ongoing research focuses on further advancing the efficiency and accuracy of complex emotion recognition systems.

Speech Sequence Recognition and Information Extraction Johns Hopkins University, Maryland, USA
Deep Learning, Speech Recognition, Natural Language Processing *01/2024 - 05/2024*

- Participated in a project aimed at improving the accuracy of isolated word speech recognition, dedicated to building an end-to-end speech recognition system based on the CTC (Connectionist Temporal Classification) objective function.

- Systematically explored and implemented various deep learning architectures, including LSTM, CNN-LSTM hybrid models, and Transformer, and introduced innovative techniques such as attention mechanisms and multi-task learning to enhance model performance.
- Implemented the transition from discrete features to continuous features (such as MFCC and Wav2Vec2.0 features), exploring the impact of different feature representations on recognition performance.

Image Classification and Adversarial Machine Learning Research Johns Hopkins University, Maryland, USA

Deep Learning, Computer Vision, Adversarial Machine Learning *01/2024 - 05/2024*

- Participated in an image classification and adversarial machine learning project based on the CIFAR-10 dataset, aimed at improving the performance and robustness of deep learning models.
- Designed and implemented a deep convolutional neural network (DCNN) architecture, trained on the CIFAR-10 training set, and evaluated performance on the test set.
- Systematically implemented and evaluated multiple adversarial attack models, including noise attacks, Fast Gradient Sign Method (FGSM), Projected Gradient Descent (PGD), and Carlini-Wagner (C-W) attacks, analyzing the impact of different attack intensities on model performance.

Hexahedron-Dominated Mesh Structure Extraction and Analysis University of Houston, Texas, USA

Geometric Modeling, Visualization, Computer Graphics *08/2023 - 12/2023*

- Developed advanced visualization techniques based on Blender to provide more insightful evaluation for hexahedral mesh structures, thereby improving mesh quality.

Topic-Based Video Content Indexing University of Houston, Texas, USA

Natural Language Processing, Image Processing, Machine Learning *08/2022 - 12/2023*

- Incorporated visual elements into existing text-based indexing systems, enabling the segmentation of lecture videos into different clips based on topics. Used the BERT model for text feature extraction, combined with ResNet50 for visual feature extraction, implementing multi-modal learning.

EcoCAR Mobility Challenge University of Tennessee, Tennessee, USA

ROS Software Developer, Full Stack Developer *09/2019 - 05/2020*

- As a member of the Connected and Automated Vehicles (CAVs) team, participated in the 12th Advanced Vehicle Technology Competition (AVTC) sponsored by the U.S. Department of Energy (DOE), collaborating with General Motors and Bosch to develop autonomous driving software based on the NVIDIA DRIVE AGX Xavier platform.
- Led the design and implementation of a visual remote diagnostic tool using Webviz, Ttyd, and ROS, enabling real-time data collection, visualization, and remote modification for key on-board sensors including radar, LiDAR, cameras, and ultrasonic sensors.

Productivity Tracking Software University of Tennessee, Tennessee, USA

Cross-platform Development, Desktop Application, UI Design *01/2019 - 04/2019*

- Developed a cross-platform productivity analysis application supporting Windows and macOS systems using C++, Electron, and JavaScript technology stack.

TEACHING ACTIVITIES

- **Database Systems** - Fall 2022 to Fall 2023, four semesters. Assisted professor in teaching relational database theory, SQL programming, and practical applications of database management systems.

ACADEMIC PUBLICATIONS

- Lei Si, **Cao, Haowei**, and Guoning Chen. Hybrid base complex: Extract and visualize structure of hex-dominant meshes. *IEEE Transactions on Visualization and Computer Graphics*, pages 1–12, 2024