SANDESH BHARADWAJ

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SKILLS

Languages & Datastores: Python, C/C++, Java, Bash, MySQL, Logstash, ChromaDB, ElasticSearch.
DevOps & Simulators: AWS, GCP, Docker, Git, Perforce, CARLA, OpenAI Gym.
Frameworks: PyTorch, LangChain, TensorFlow, FastAPI, Firebase, Intel OpenVINO, Apache Spark, Apache AirFlow.
Libraries: OpenCV, Huggingface Transformers, Lightning, Scikit-Learn, Pandas, Selenium, Soundfile.

PUBLICATIONS

- *Unified Local-Cloud Decision-Making via Residual Reinforcement Learning.* ***ECCV 2024***
  K. Sengupta, Z. Shangguan, ***S. Bharadwaj****, S. Arora, E. Ohn-Bar, R. Mancuso*
- *Person Re-Identification by Analyzing Dynamic Variations in Gait Sequences.* ***ETCCS 2020***
  S. Bharadwaj*, K. Chanda*

RESEARCH EXPERIENCE

Human-to-Everything (H2X) Lab, Boston University | *Boston, MA* March 2023 – Present
Visiting Researcher / Graduate Research Assistant - Prof. Eshed Ohn-Bar [Full-Time]

- Enhanced vision-language model performance for autonomous driving by 80% through creation of novel dataset and application of fine-tuning, RAG, and RAFT techniques.
- Collaborated with Red Hat to optimize cloud-edge collaboration algorithms, developing a conditional routing module for dynamic offloading that reduced energy consumption.
- Achieved state-of-the-art performance in CARLA-based navigation metrics, outperforming existing solutions by 35% while enhancing energy efficiency.
- Designed a novel crowd navigation environment and introduced the Ecological Navigation Score metric to prioritize energy-efficient navigation in reinforcement learning tasks.
- Developed visual servoing for multi-robot simulations using RGB and depth sensors, integrated human feedback, and evaluated reinforcement learning algorithms for person-following, significantly improving performance.

Teaching Assistant: ENG EC 444 - Smart and Connected Systems [Part-Time] Jan 2024 – May 2024

- Assisted with an introductory course on cyber-physical and IoT systems covering microcontroller architecture, real-time OS programming, WPANs, IP gateways, cloud computing, reliability, security, and privacy.
- Supported course logistics, conducted classes, graded assignments, managed lab sessions independently and contributed to developing new assignments.

Robert Bosch GmbH | *Bangalore, India* Jan 2020 – June 2020
Research Intern - Corporate Research [Full-Time Co-Op]

- Adapted open-set classification to identify rare objects in vehicular datasets by merging classification models with meta-learning and few-shot algorithms, achieving 56% accuracy on the Open Images subset.
- Developed novel algorithm to predict automobile part degradation and recommend preemptive actions.

Note: Received a full-time offer, which was deferred due to a hiring freeze during the COVID-19 pandemic.

Center for Development of Advanced Computing | *Kolkata, India* May 2019 – Oct 2019
Research Intern [Full-Time]

- Led and implemented modified approach to person re-identification based on dynamic gait.
- Achieved best accuracy of 91.13% on CASIA-B Gait Dataset (Python, Pandas, Numpy, Scikit-learn).
- Presented research paper at ETCCS 2020, indexed in Springer LNEE Series.

Industry Experience

Ottometric Inc. | *Waltham, MA* June 2023 – Aug 2023
Software Engineering Intern [Full-Time]

- Developed data summarization algorithms for the Ottoviz platform by creating a custom fork of the *submodlib* library and applying submodular optimization techniques.
- Enabled efficient training of deep learning models by developing custom features for selecting important 1% subset of images, achieving significant dataset reduction.

Ignitarium Technology Solutions | *Bangalore, India* Jan 2022 – July 2022
AI Engineer [Full-Time]

- Improved inference performance on Untether AI's accelerator chips by developing high-performance low-level INT8 kernels in C++.
- Implemented generalized padding for transformation kernels, replacing the non-generalized version, and optimized quantization, performance metrics, and execution cycles, achieving 30% performance gain.
- Led team to streamline workflows, create detailed documentation, and reduce codebase size by 40%.

Synopsys India | *Bangalore, India* Jan 2021 – Jan 2022
Data Engineer [Full-Time]

- Optimized existing data extraction and processing pipelines with Apache Spark, improving processing time by 25%.
- Developed BERT-based anomaly detection tool to identify, track, and alert users to critical events requiring intervention, achieving average accuracy of 92% in runtime issue detection.
- Redesigned several existing applications for log analysis into a single unified system in production, improving performance by 30% while enhancing user experience, reliability, and accessibility.

Note: Chose to pursue graduate studies after successfully completing a 1-year fixed-term role at Synopsys, where a full-time offer was extended.

Thermo Fisher Scientific India Pvt. Ltd. | *Hyderabad, India* May 2018 – July 2018
Summer Intern [Full-Time]

- Developed proof-of-concept for upgrading existing product on ARM hardware using embedded C++, delivering nearly 2x processing power while reducing manufacturing and development costs by 70%.
- Designed user interface with Qt5 and implemented on Linux Yocto, enabling custom Linux-based systems independent of hardware architecture for seamless user interaction.

Projects

BetterSearch - github.com/tensorsofthewall/BetterSearch July 2024 – Present

- Developed desktop application integrating LLMs, advanced RAG techniques, and native OS functionality for efficient file search and content indexing, with customizable configurations for optimized CPU and GPU performance.
- Integrated osquery to enable text-to-SQL functionality, providing device management capabilities for users.
- Leverages custom fine-tuned LLM for text-to-SQL generation in local deployments, with support for cloud providers such as OpenAI and Google Gemini for scalability.

VidTune - github.com/tensorsofthewall/VidTune May 2024 – Aug 2024

- Created generative AI web-app that generates tailored music for videos.
- Designed an intuitive interface and advanced customization tools for genre-specific music integration, tempo adjustment, keyword alignment, and dynamic mixing.

Person Following Robot April 2023 – June 2023

- Developed and trained imitation learning and reinforcement learning algorithms in simulation for effective person tracking and following.
- Created multi-robot Gazebo simulation with leader, follower, and obstacles, achieving 72% accuracy in precise person detection, tracking, and following (Python, PyTorch, OpenCV, ROS, Gazebo).

Evaluating complex ML streaming pipelines Feb 2023 – April 2023

- Designed benchmarks for complex ML pipelines to evaluate external and embedded serving frameworks.
- External serving models (TorchServe, TF-Serving, OpenVINO Model Server) outperform embedding serving pipelines (TFSaved and ONNX) by 200%.

Robot Learning and Vision Jan 2023 – April 2023

- Designed a modular self-driving pipeline in CARLA consisting of Homography Transformation, Lane Detection, Waypoint Prediction, Lateral and Longitudinal Control modules, improving driving score to 53%.
- Designed and trained a custom CNN through imitation learning in CARLA, achieving a driving score of 32.5% and 54% route completion.

Dynamic Gesture Recognition Oct 2022 – March 2023

- Developed application for dynamic gesture detection using cameras; one of top 25 teams in OpenCV AI Competition 2022 - Spatial AI Track.
- Trained and evaluated vision models (ResNeXT-101, MViT, 3D-MobileNetV2) on Qualcomm Jester dataset, achieving 17% performance improvement with custom Bi-LSTM architecture.

Autonomous Underwater Vehicle - https://auviiitdm.github.io/ Sep 2018 – April 2020

- Led a team to the Singapore AUV Challenge finals in 2019 and 2020.
- Contributed to navigation, vision software, and electronics, guiding the team across all aspects of vehicle development.
- Enhanced object detection and tracking by integrating modified Sea-Thru water-removal algorithm into AUV inference pipeline.

EDUCATION

Boston University Graduation: 05/24

Master of Science in Computer Science *GPA: 3.26*

Coursework: Image & Video Computing, Streaming and Event-driven Systems, Robot Learning & Vision for Navigation, Deep Learning, Designing Computing Systems for Robotics.

Indian Institute of Information Technology Design and Manufacturing, Kancheepuram, Chennai, India Graduation: 06/20

Dual Degree: Bachelor of Technology in Electronics and Communication. Master of Technology in Signal Processing and Communication Systems Design.

Coursework: Machine Learning, Digital Signal Processing, Computer Vision, Data Structures and Algorithms.

Positions of Responsibility: Music Club Secretary. Autonomous Underwater Vehicle Team Lead.

REFERENCES

Eshed Ohn-Bar | Boston University
Assistant Professor
Department of Electrical and Computer Engineering
eohnbar@bu.edu

Sahana Prabhu | Robert Bosch Engineering and Business Solutions Private Limited
Research Scientist and Technical Architect
Sahana.MuraleedharaPrabhu@in.bosch.com

Kunal Chanda | Center for Development of Advanced Computing, Kolkata
Scientist-E
kunalchanda@cdac.in