AAYUSH JUNG RANA

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SUMMARY

I am a research engineer with a strong track record in deep learning and computer vision. My focus lies in the fundamentals of efficient deep learning applications, including large scale training, image/video generation and segmentation, and sparse annotation training for large datasets. My research involves understanding key issues for learning effectively from large datasets with limited annotations and solving optimization problems to deploy deep learning models on real-time solutions, combining leading edge research with product focused applications.

EDUCATION

PhD in Computer Science University of Central Florida   08/2017 – 08/2023

MSc in Computer Science University of Central Florida   08/2017 – 05/2023

BSE in Information and Communication Technology Asian Institute of Technology   09/2011 – 05/2015

EXPERIENCE

Senior Engineer   05/2023 – Present
Qualcomm Technologies Inc.   *San Diego, CA*

- Building end-to-end ML system pipeline including dataset cleanup and analysis, ML model training and finetuning, optimizing inference module, and evaluation of system accuracy and power.
- Optimizing algorithms for consistent real-time video effects using low power computer vision techniques and multiple sensors input.
- Analysis on deep learning model performance, integration approach, and processing algorithms for depth prediction, 3D reprojection and texture prediction to reduce system runtime and improve result quality. Used ONNX runtime for efficient hardware deployment of existing ML models.
- Integrate modules from multiple teams and different programming languages for quick end-to-end system prototype, used for system testing and evaluation.
- Innovating new solutions to support features and solve issues related to active depth sensing, deep learning, camera system, and temporal refinement.

Research Assistant   08/2017 – 05/2023
Center for Research in Computer Vision (CRCV), University of Central Florida   *Orlando, FL*

Developed novel deep learning techniques to address fundamental research problems in video understanding and analysis including GANs, action detection, temporal analysis, and semi/weakly-supervised learning for videos. Drove roadmap of projects as part of a cohesive large team and ensured satisfactory completion of following projects:

Generation networks: Video action synthesis | *GANs, action synthesis, multi-modal learning*

- Developed a GAN based generative approach to synthesize temporally cohesive human action videos with consistent appearance and motion dynamics for real and synthetic datasets.
- Combined text embedding-based with motion generator to generate motion features based on action text. Integrated it with content embedding to make realistic action videos. Mentored and published research paper in BMVC 2021.

Video action detection: low cost annotation | *Active learning, large scale annotation, pseudo-labels*

- Developed deep active learning approaches to annotate high utility samples for high precision video action detection, addressing issues with sparse annotation based deep learning (cold start, pseudo-label accuracy) and large dataset annotation (data redundancy) for training on videos.
- Published **three** research papers in top venues (NeurIPS, CVPR, AAAI) and filed for system patent.

Untrimmed video understanding: Activity localization and classification | *Real-time, system, efficient*

- Developed deep learning based efficient real-time end-to-end action localization and classification method which surpassed prior methods in runtime and performance.
- Developed under IARPA funded program with 1st place in ActEV SDL 2020 and 2019 TRECVID ActEV challenge and 2nd place in 2020 TRECVID ActEV challenge. Was awarded best scientific paper in ICPR 2020.

Interim Engineering Intern 05/2022 – 08/2022
Qualcomm Technologies Inc. *San Diego, CA*
- Improved video semantic segmentation using deep learning model with temporally consistent predictions. Increased training dataset size using optical-flow warping in videos to improve training loss.
- Used deep learning techniques (temporal attention, CGRU) to provide multiple solutions based on runtime and prediction quality.

Research Intern 05/2020 – 08/2020
Stanford Research Institute (SRI) International *Princeton, NJ*
- Integrated deep learning models to finetune and evaluate on novel 3D LiDAR data from high altitude and perform 3D object detection over large areas.

Research Associate 06/2015 – 07/2017
Vision and Graphics Lab, Asian Institute of Technology *Thailand*
- Developed and deployed systems for multiple client projects based on image and video processing algorithms (superpixel segmentation, ORB SLAM, Kalman tracking), machine learning (SVM, kNN, Naive Bayes), and server interaction methods. Provided solutions using image based detection, tracking, segmentation and classification for projects (vehicle tracking, lane departure system, farm insect detection, tree measurements).
- Developed and integrated algorithms using computer vision in C++ and Python in Linux ecosystem for embedded systems and servers. Worked with multiple system and client teams to ensure successful product delivery and support.

TECHNICAL SKILLS

Programming: Python, C++, C, Matlab
Libraries: PyTorch, TensorFlow, Keras, OpenCV, NumPy
Miscellaneous: Embedded systems (ARM Cortex, Raspberry Pi, Udoo), Linux (Ubuntu)

PUBLICATIONS

(**AAAI 2024**) Ayush Singh, **Aayush Jung Rana**, Akash Kumar, Shruti Vyas, Yogesh Singh Rawat. "Semi-supervised Active Learning for Video Action Detection".

(**CVPR 2023**) **Aayush Jung Rana**, Yogesh Singh Rawat. "Hybrid Active Learning via Deep Clustering for Video Action Detection".

(**NeurIPS 2022**) **Aayush Jung Rana**, Yogesh Singh Rawat. "Are all Frames Equal? Active Sparse Learning for Video Action Detection".

(**BMVC 2021**) Naman Biyani, **Aayush Jung Rana**, Shruti Vyas, Yogesh Singh Rawat. "LARNet: Latent Action Representation for Human Action Synthesis".

(**WACV 2021**) **Aayush Jung Rana**, Yogesh Singh Rawat. "We don't Need Thousand Proposals: Single Shot Actor-Action Detection in Videos".

(**ICPR 2020**) Mamshad Rizve, Ugur Demir, Praveen Tirupattur, **Aayush Jung Rana**, Kevin Duarte, Ishan Dave, Yogesh Singh Rawat, and Mubarak Shah. "Gabriella: An Online System for Real-Time Activity Detection".

(**AAAI 2021 student abstract**) **Aayush Jung Rana**, Yogesh Singh Rawat. "SSA2D: Single Shot Actor-Action Detection in Videos".

(**CVPR 2023 workshop**) Rajat Modi, **Aayush Jung Rana**, Akash Kumar, Praveen Tirupattur, Shruti Vyas, Yogesh Singh Rawat, Mubarak Shah. "Video Action Detection: Analysing Limitations and Challenges".

PATENTS

Yogesh Singh Rawat, Mubarak Shah, **Aayush Jung Bahadur Rana**, Praveen Tirupattur, Mamshad Nayeem Rizve. "Methods of Real-Time Spatio-Temporal Activity Detection and Categorization from Untrimmed Video Segments". **United States Patent No. 11468676 B2**

Yogesh Singh Rawat, **Aayush Jung Bahadur Rana**. "Active Sparse Labeling System and Method". **United States Patent Application No. 63/514,482 (Filed)**

PROFESSIONAL SERVICES

Reviewer: CVPR, ECCV, AAAI, WACV, Machine Vision and Applications (Journal), IEEE Transactions on Circuits and Systems for Video Technology (Journal)

Organizer: 2021-2022 TinyAction Challenge (CVPR workshop), 2021 Multi-modal Video Understanding in a Noisy Environment (ACM MM Challenge)

PC: 2021 Trustworthy AI for Multimedia Computing (ACM MM workshop), 2022 Robustness in Sequential Data (CVPR workshop), 2023 Fine Grained Activity Detection (WACV workshop)

Mentor: NSF Research Experience for Undergrad (REU) students, Summer intern students

HONORS AND AWARDS

Achievements

- 2020 ICPR Best Scientific Paper Award
- 1st place in 2020 CVPR ActEV Sequestered Data Leaderboard (SDL) (P_{miss} TFA)
- 2nd place in 2020 TRECVID ActEV: Activities in Extended Video (P_{miss} RFA and AUDC)
- 1st place in 2019 TRECVID ActEV: Activities in Extended Video (P_{miss} TFA)

Honors and Scholarships

- 2022 NeurIPS Scholar Award
- University of Central Florida ORCGS Doctoral Fellowship
- Asian Institute of Technology Fellowship
- Asian Institute of Technology Dean's List