

AAYUSH JUNG RANA

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SUMMARY

I am a research engineer with a strong track record in Computer Vision and Artificial Intelligence. I am particularly interested in fundamentals of video action detection, video generation and segmentation, sparse annotation training for large datasets, and efficient deep learning applications. My research involves understanding key issues for learning effectively from large video datasets with limited annotations and solving optimization problems for deploying deep learning models on real-time solutions. I have combined leading edge research with product focused application for segmentation and tracking in videos and images, with multiple system papers and patents as a result.

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 <i>Qualcomm Technologies Inc.</i>	05/2023 – Present San Diego, CA
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- 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 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.

Interim Engineering Intern <i>Qualcomm Technologies Inc.</i>	05/2022 – 08/2022 San Diego, CA
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- 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 <i>Stanford Research Institute (SRI) International</i>	05/2020 – 08/2020 Princeton, NJ
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- 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 Assistant <i>Center for Research in Computer Vision (CRCV), University of Central Florida</i>	08/2017 – 05/2023 Orlando, FL
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- Developed novel deep learning techniques to address fundamental research problems in video understanding and analysis. This includes video action generation, action detection, classification, temporal understanding of long untrimmed videos, and bridging gap between pseudo-labels, synthetic data and sparse annotations for large scale video dataset training.
- Published research papers in top AI/ML venues (CVPR, NeurIPS, AAAI) and was awarded best scientific paper in ICPR 2020. Our team also obtained one system patent and I have another system patent filed.
- Mentored multiple interns (on-site and remote) through research projects and successfully published two separate research papers with interns.
- Developed and drove roadmap of different funding projects as part of a cohesive large team. Ensured project results were above satisfactory to retain continued funding for research over 6 years, including consecutively placing in top-2 in open challenges.

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 (super-pixel 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, Udo), 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)**

RESEARCH 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.
- 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 for real and synthetic datasets.
- Evaluated in several large scale video action datasets (real and synthetic).
- Published research paper in BMVC 2021 with undergraduate intern.

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

- Developed multiple deep active learning approaches to annotate high utility samples for high precision video action detection.
- Addressed 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.
- 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.

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