Chinmaya DEVARAJ

Ph.D. Graduate | Computer Vision | University of Maryland College Park

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I am a **Ph.D. candidate** in Electrical and Computer Engineering at the University of Maryland College Park, advised by **Prof. Yiannis Aloimonos and Dr. Cornelia Fermuller**. My broad field of research is **Computer vision and Generative AI with a focus on video understanding**. I have contributed to pioneering projects in **hand-object segmentation and tracking, action anticipation, zero-shot action recognition, knowledge graphs, text-image generation, Multimodal(text, images, video, audio) embeddings, and multimodal large language models** holding a patent and multiple publications. My recent research topics include **video-text models, video representation learning, LLMs, and action recognition**.

🎓 EDUCATION

Present	Ph.D.	Electrical and Computer Engineering, University of Maryland, College Park
2022	MS	Electrical and Computer Engineering, University of Maryland, College Park
2015	B.Tech.	Electrical Engineering, National Institute of Technology, Karnataka, Surathkal India

🖥 AWARDS

> Winner of EPIC-kitchens action anticipation challenge CVPR 2020.

> Selected among 10 teams globally at Amazon Simbot Challenge 2022 with an award amount of $250000.

> Received NSF Neuropac Fellowship for academic year 2023-2024 with award amount of $21000.

🖥 PUBLICATIONS

1. **Chinmaya Devaraj**, Cornelia Fermuller, Yiannis Aloimonos. Diving DeepWith Video-Text Models in Representing Motion . Accepted **ACL Findings 2024**. Link

2. **Chinmaya Devaraj**, Cornelia Fermuller, Yiannis Aloimonos. Incorporating Visual Grounding In GCN For Zero-shot Learning Of Human Object Interaction Actions. **CVPRW 2023** Link

3. Eadom Dessalene*,**Chinmaya Devaraj***, Michael Maynord*, Cornelia Fermuller, and Yiannis Aloimonos. Forecasting action through contact representations from first person video. **TPAMI 2021** (* Indicates equal contribution) Link

4. **Chinmaya Devaraj**, Cornelia Fermuller, Yiannis Aloimonos. Introducing Meta-Verbs into Graph Convolutional Networks for Zero-shot Action Recognition. **CVPRW** 2021

5. Eadom Dessalene, Michael Maynord, **Chinmaya Devaraj**, Cornelia Fermuller, and Yiannis Aloimonos. Egocentric object manipulation graphs. arXiv preprint. Link

6. **Chinmaya Devaraj**, Aritra Chowdhury, Arpit Jain, James R. Kubricht, Peter Tu, and Alberto Santamaria-Pang. From Symbols to Signals: Symbolic Variational Autoencoders.**ICASSP 2020**. Link

7. James Kubricht, Alberto Santamaria-Pang, **Chinmaya Devaraj**, Aritra Chowdhury, and Peter Tu. Emergent Languages from Pretrained Embeddings Characterize Latent Concepts in Dynamic Imagery. International Journal of Semantic Computing . (2020) Link

8. Alberto Santamaria-Pang, James R. Kubricht, **Chinmaya Devaraj**, Aritra Chowdhury, and Peter Tu. Towards semantic action analysis via emergent language. IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR) 2019. Link

9. Chengxi Ye, **Chinmaya Devaraj**, Michael Maynord, Cornelia Fermüller, Yiannis Aloimonos. "Evenly Cascaded Convolutional Networks." The 1st International Workshop on Big Visual Dataset Construction, Management and Applications, IEEE BigData 2018. **Best Student Paper Award.** Link

💼 PROFESSIONAL EXPERIENCE

Research intern June-Aug 2019	**GE Research , Computer Vision and Machine learning team, NISKAYUNA, NY** > Designed and evaluated **novel symbols-to-image generation using VAEs** to understand emergent languages in videos and images, resulting in a **patent and three publications during the internship.** > Developed a symbolic variational autoencoder, a novel model that reconstructs images from symbols, enhancing AI explainability by mapping symbols to distinct semantic concepts within the generated images. > Developed domain adaption methods using symbolic variational autoencoder for anomaly detection. `Emergent language` `Variational Autoencoders` `Text-Image Generation` `AI generated Images` `Explainable AI`

Research intern	Honda Research Institute , Mountain View, CA
June-Aug 2017	› Designed and evaluated deep neural network to model driver's visual attention and driver's behavior information from driving data by modeling the region of attention in videos.
	› **Enhanced computation speed by 10x** through designing efficient deep learning models to process driver video data.

object detection   object segmentation   self driving   Visual attention   Efficient deep learning

⌨ PATENTS

1. Alberto Santamaria-Pang, Peter Henry Tu, James KUBRICHT, Aritra Chowdhury, Arpit Jain, Chinmaya Devaraj. *System and methods for artificial intelligence explainability via symbolic generative modeling. US Patent 2021*

☰ SKILLS

Deep Learning frameworks:	Pytorch, TensorFlow, TFLearn, Keras
Languages:	Python, C, MATLAB
Deep Learning Architectures:	CNNs, RNNs, LSTMs, Transformers, VAE, GANs
Domain Skills:	Computer Vision, Machine Learning, Data collection, Multi-model Learning, Generative AI, Vision+Language Models, Natural Language Processing, Generative Pre-trained Transformers (GPT), Graph Neural Networks, Video Understanding, Video-text models, Motion understanding, Zero-shot recognition, Action Recognition, Action anticipation

⌨ SELECTED PH.D. PROJECTS

Segmenting Next Active Object and Anticipating Actions in First Person Video . (Jan 2020 - May 2020) Link

> Created a Novel Dataset: Introduced a training signal that captures the time-to-contact between hands and objects, as well as segmentations of hands and objects.
> Predicted Contact Anticipation Maps: pixel-wise anticipated time-to-contact involving either the left or right hand.
> Achieved new state-of-the-art results in the next active object segmentation by predicting the next active object and producing its segmentations in video sequences.
> Introduced EGO-OMG, a cutting-edge method for action anticipation using graphs to represent state changes in actions based on cognitive principles.
> Secured 1st place on the unseen test set of the EPIC Kitchens Action Anticipation Challenge at CVPR 2020.

Diving deep in video-language models. (Jan 2023- Present) Link

> Created a dataset of detailed captions outlining sub-actions and characteristic motions in action datasets using GPT-4.
> Conducted a user study to qualitatively and quantitatively evaluate the generated captions.
> Proposed methods to improve motion representation in video-langauge models and to perform zero-shot action recognition of fine-grained activities using video-text models.
> Validated the method on two action datasets, achieving a 25% performance improvement over existing video-language models.

Visual Grounding In GCN For Zero-shot Learning Of Human Object Interaction Actions. (May 2021- Nov 2021) Link

> Identified limitations in zero-shot learning of human object actions by using only the language graph, and proposed two methods to visually ground the language graph, enhancing semantic understanding.
> Achieved a 40% improvement over baseline GCN by integrating the proposed methods with existing GCN message-passing techniques, demonstrating simplicity and ease of integration.

Leveraging Motoric Information for Recognizing Manipulation Actions. (Sept 2016- March 2017) Link

> Developed an approach for visual recognition and temporal segmentation of fine-grained manipulation actions using a recurrent neural network architecture.
> During training, a hallucination structure is learned from video and IMU(time-series) data, and this mirroring structure helps recognition during the testing phase when only visual data is present.
> We validated our method on two multimodal fine-grained action datasets, and showed that the network outperforms vision-only approaches by over 4% on average.

⌨ SERVICE AND LEADERSHIP

> Serving as reviewer for major computer vision conferences CVPR[20,21,23], ICCV[21], NLP conferences NAACL[2024], and journals (CVIU, RA-L).
> Founder of SKY at UMD club at UMD dedicated to promoting mental and physical well-being in UMD community. Impacted over 2000 students and faculty through breathwork and meditation programs.