

Sathyanarayanan N. Aakur

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RESEARCH INTERESTS	Application of Cognitive Models in Computer Vision Predictive Learning for Active Event Perception in Videos; Commonsense Reasoning for Visual Understanding; Contextual Models of Memory for Event Perception
TEACHING INTERESTS	Machine Learning, Computer Vision, Introduction to Programming, Artificial Intelligence, Pattern Recognition
EDUCATION	University of South Florida , Tampa, FL Summer 2019 <i>Ph.D.</i> , Computer Science and Engineering Advisor: Dr. Sudeep Sarkar University of South Florida , Tampa, FL Fall 2015 <i>Master of Science</i> , Management Information Systems Anna University , Chennai, India Spring 2013 <i>Bachelor of Engineering</i> , Electronics & Communications Engineering Advisor: Prof. Leena Jasmine
PROFESSIONAL EXPERIENCE	Assistant Professor Auburn University Aug 2023 - Present Auburn, AL Assistant Professor Oklahoma State University Aug 2019 - Aug 2023 Stillwater, OK Applied Scientist Intern Amazon Go May 2018 - Aug 2018 Boston, MA Programmer Analyst CTSI-Global Oct 2012 - November 2015 Chennai, India Programmer Analyst Intern CTSI-Global Apr 2012 - Oct 2012 Chennai, India
ACADEMIC HONORS AND AWARDS	NSF CAREER Award 2022 Sigma Xi Full Member 2021 Outstanding Reviewer at CVPR 2020 (Top 3.9% of reviewers) 2020 Senior Fellow, USF NSF I-Corps 2019 Outstanding Contribution to the Company, CTSI-Global 2015 Best Student Project Award, Velammal Engineering College 2010 Best Student in Foreign Language - French, Leo Matriculation School 2009
MY STUDENT'S HONORS AND AWARDS	Carson Bulgin - <i>Auburn University Undergraduate Research Fellowship</i> 2024 Shubham Trehan and Udhav Ramachandran - <i>Winner, OSU App Competition.</i> 2023 Sai Narayanan - <i>J. Lindsay Oaks Best Student Molecular Biology Presentation</i> 2022 Sai Narayanan - <i>J. Lindsay Oaks Best Student Molecular Biology Presentation</i> 2021 Sanjoy Kundu - <i>Robberson Summer Dissertation Award, OK State</i> 2021
PEER REVIEWED PUBLICATIONS	<i>Note: In Computer Science, conferences are the primary publication venue over journal publications. They use double-blind reviewing and are equally or more selective than journals. CVPR, ECCV, MICCAI, ICPR, PAKDD, ICDM, WACV, VLSID, and ISVLSI are the top conferences in machine learning, computer vision, data mining, and Internet of Things research. Advised/mentored student authors are <u>underlined</u>. Works published after Auburn are marked with **.</i>

Book Chapters

- B1 Ramy Mounir, **Sathyanarayanan N. Aakur**, Sudeep Sarkar. Self-supervised Event Segmentation. Book Chapter in *Advanced Methods and Deep Learning in Computer Vision*. Elsevier Series on Computer Vision and Pattern Recognition.
- B2 **Sathyanarayanan N. Aakur**, Fillipe DM de Souza, Sudeep Sarkar. On the Inherent Explainability of Pattern Theory-based Video Event Interpretations. Book Chapter, *Explainable and Interpretable Models in Computer Vision and Machine Learning in the Springer Series on Challenges in Machine Learning*.

Journal Papers

- J1 **Sathyanarayanan N. Aakur**, Vishalini R. Laguduva, Priyadhsrini Ramamurthy, Akhilesh Ramachandran. TEPI: Taxonomy-aware Embedding and Pseudo-Imaging for Scarcely-labeled Zero-shot Genome Classification. *IEEE Journal of Biomedical and Health Informatics (J-BHI)*, 2024. (**Impact Factor**: 7.7) **
- J2 **Sathyanarayanan N. Aakur**, Sudeep Sarkar. Leveraging Symbolic Knowledge Bases for Commonsense Natural Language Inference using Pattern Theory. *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, 2023. (**Impact Factor**: 24.3)
- J3 M Suchetha, Snehith Sankineni, Aanchal Saraswat, **Sathyanarayanan N Aakur**, S Sehastrajit, D Edwin Dhas. An Insight on Recent Advancements and Future Perspectives in Detection Techniques of Parkinsons Disease. *Evolutionary Intelligence*, 2023. (**Impact Factor**: 2.9)
- J4 **Sathyanarayanan N. Aakur**, Sanjoy Kundu, Nikhil Gunti. Knowledge Guided Learning: Towards Open Domain Egocentric Action Recognition with Zero Supervision. *Pattern Recognition Letters*, 2022. (**Impact Factor**: 5.1)
- J5 **Sathyanarayanan N. Aakur**, Fillipe DM de Souza, Sudeep Sarkar. Generating Open World Descriptions of Video using Commonsense Knowledge in a Pattern Theory Framework. *Quarterly of Applied Mathematics*.

Peer-reviewed Conference and Archival Workshop Papers

- C1 Shenyuan Liang, Mauricio Pamplona Segundo, **Sathyanarayanan N. Aakur**, Sudeep Sarkar, Anuj Srivastava. Shape-Graph Matching Network (SGM-net): Registration of Shape Graphs Using Deep Networks. *IEEE International Symposium on Biomedical Imaging (ISBI)* 2024. **
- C2 Shubham Trehan, Udhav Ramachandran, Ruth Scimeca, **Sathyanarayanan N. Aakur**. ProtoKD: Learning from Extremely Scarce Data for Parasite Ova Recognition. *IEEE International Conference on Machine Learning and Applications (ICMLA)*, 2023 (**Oral**) **
- C3 Sanjoy Kundu, **Sathyanarayanan N. Aakur**. Iterative Scene Graph Generation with Generative Transformers. *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2023.
- C4 Shengfang Ma, Yuting Zhou, K. Colton Flynn, **Sathyanarayanan N. Aakur**. Peanut Seed Germination Detection from Aerial Images. *IEEE Workshop on Applied Imagery and Pattern Recognition*, 2022.
- C5 **Sathyanarayanan N. Aakur**, Sudeep Sarkar. Learning Actor-centered Representations for Action Localization in Streaming Videos using Predictive Learning. *European Conference on Computer Vision (ECCV)* 2022.
- C6 Aditi Bal Basu, Ramy Mounir, **Sathyanarayanan N. Aakur**, Sudeep Sarkar, Anuj Srivastava. Time-Series Analysis of Video Graphs Using Joint Kalman Smoothing and Registration. *European Conference on Computer Vision (ECCV)* 2022. (**Oral**)

- C7 Priyadharsini Ramamurthy, **Sathyanarayanan N. Aakur**. ISD-QA: Iterative Distillation of Commonsense Knowledge from General Language Models for Unsupervised Question Answering. *International Conference on Pattern Recognition (ICPR 2022)* (*Oral*)
- C8 Vishal Pallagani, Priyadharsini Ramamurthy, Vedant Khandelwal, Revathy Venkataramanan, Kausik Lakkaraju, **Sathyanarayanan N. Aakur**, Biplav Srivastava. A Rich Recipe Representation as Plan to Support Expressive Multi-Modal Queries on Recipe Content and Preparation Process. ICAPS 2022 Workshop on Knowledge Engineering for Planning and Scheduling (KEPS), 2022
- C9 Shubham Trehan, **Sathyanarayanan N. Aakur**. Towards Active Vision for Action Localization with Reactive Control and Predictive Learning. *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, 2022.
- C10 **Sathyanarayanan N. Aakur**, Sai Narayanan, Vineela Indla, Vennela Indla, Arunkumar Bagavathi, Akhilesh Ramachandran, and Vishalini Laguduva Ramnath. Metagenome2Vec: Building Contextualized Representations for Scalable Metagenome Analysis *International Conference on Data Mining (ICDM) Workshops*, 2021. (*Oral*)
- C11 **Sathyanarayanan N. Aakur**, Arunkumar Bagavathi, Sai Narayanan, Vineela Indla, Akhilesh Ramachandran, Vishalini Laguduva Ramnath. MG-NET: Leveraging Pseudo-Imaging for Multi-Modal Metagenome Analysis. *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2021.
- C12 Thanh Thieu, Ha Do, Thanh Duong, Shi Pu, **Sathyanarayanan N. Aakur**, Saad Khan. LexDivPara: A measure of paraphrase quality with integrated sentential lexical complexity. *Intelligent Systems Conference (IntelliSys)* 2021.
- C13 Vineela Indla, Vennela Indla, Sai Narayanan, Akhilesh Ramachandran, Arunkumar Bagavathi, Vishalini Laguduva Ramnath, **Sathyanarayanan N. Aakur**. Sim2Real for Metagenomes: Accelerating Animal Diagnostics with Adversarial Co-Training. *Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD-2021)* (*Oral*)
- C14 **Sathyanarayanan N. Aakur**, Arunkumar Bagavathi. Unsupervised Gaze Prediction in Egocentric Videos by Energy-based Surprise Modeling. *International Conference on Computer Vision Theory and Applications (VISAPP)*, 2021
- C15 Sai Narayanan, Akhilesh Ramachandran, **Sathyanarayanan N. Aakur**, Arunkumar Bagavathi. GRaDL: A Framework for Animal Genome Sequence Classification with Graph Representations and Deep Learning. *International Conference on Machine Learning Applications (ICMLA'20)*, 2020 (*Oral*)
- C16 Sanjoy Kundu, Nikhil Gunti, Bailey Hendrickson, Sunil More, **Sathyanarayanan N. Aakur**. Benchmark and Evaluation of Low Resource Object Detection in Biomedical Images. *IEEE Workshop on Applied Imagery and Pattern Recognition*, 2020
- C17 **Sathyanarayanan N. Aakur**, Sudeep Sarkar. Action Localization through Continual Predictive Learning. *European Conference on Computer Vision (ECCV)* 2020.
- C18 Vishalini R. Laguduva, Shakil Mahmud, **Sathyanarayanan N. Aakur**, Robert Karam, Srinivas Katkoori. Dissecting Convolutional Neural Networks for Efficient Implementation on Constrained Platforms. *IEEE International Conference on VLSI Design (VLSID)*, 2020. (*Oral*)
- C19 Vishalini R. Laguduva, **Sathyanarayanan N. Aakur**, Srinivas Katkoori. Latent Space Modeling for Cloning Encrypted PUF-based Authentication. *IFIP International Internet of Things (IoT) Conference*, 2019. (*Oral*)
- C20 Vishalini R. Laguduva, Sheikh Ariful Islam, **Sathyanarayanan N. Aakur**, Srinivas Katkoori and Robert Karam. Machine Learning based IoT Edge Node

Security Attack and Countermeasures *IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*, 2019. (**Oral**).

- C21 **Sathyanarayanan N. Aakur**, Sudeep Sarkar. A Perceptual Prediction Framework for Self Supervised Event Segmentation. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2019.
- C22 **Sathyanarayanan N. Aakur**, Fillipe DM de Souza, Sudeep Sarkar. Going Deeper with Semantics: Exploiting Semantic Contextualization for Interpretation of Human Activity in Videos. *Winter Conference on Applications of Computer Vision (WACV)*, 2019.
- C23 **Sathyanarayanan Aakur***, Daniel Sawyer*, Sudeep Sarkar. Fine-grained Action Detection in Untrimmed Surveillance Videos *Winter Conference on Applications of Computer Vision (WACV) Workshops*, 2019.
- C24 **Sathyanarayanan N. Aakur**, Fillipe DM de Souza, Sudeep Sarkar. Inherently Explainable Model for Video Activity Recognition *AAAI Workshop On Reasoning and Learning for Human-Machine Dialogues*, 2018 (**Oral**).
- C25 Gilbert Rotich*, **Sathyanarayanan Aakur***, Rodrigo Minetto, Mauricio Segundo, Sudeep Sarkar. Using semantic relationships among objects for geospatial land use classification. *IEEE Applied Imagery Pattern Recognition Workshop*, 2018.
- C26 **Sathyanarayanan N. Aakur**, Fillipe DM de Souza, Sudeep Sarkar. Towards a Knowledge-based Approach to Video Comprehension. In *Conference on Computer and Robot Vision (CRV)*, 2017 (**Oral**).

MENTORING

Current

1. Sanjoy Kundu (Ph.D., Spring 2020 - Present)
2. Shubham Trehan (Ph.D., Fall 2020 - Present)
3. Shanmukha Vellamchetti (Ph.D., Spring 2024 - Present)
4. Disharee Bhowmick (Ph.D., Spring 2024 - Present)
5. Zhou Chen (M.S., Fall 2023 - Present)
6. Shengfang Ma (OSU, M.S. Summer 2021 - Present)
7. Chi-Jui Wu (M.S. Spring 2024 - Present)
8. Udhav Ramachandran (OSU, B.S. Fall 2022 - Present)
9. Carson Bulgin (B.Eng. Fall 2023 - Present)
10. Elijah Parker (B.Eng. Fall 2022 - Present)

Alumni

At Auburn University

1. Saathvika Ajith (High School Research Intern, Summer 2023)

At Oklahoma State University

1. Venkata Ragavendra Vavilthota (M.S. Fall 2023) [Next: Data Engineer at Wayfair]
2. Priyadarshini Ramamurthy (Ph.D., Fall 2020 - Summer 2023)[*Ph.D. at OK State*]
3. Devyn Hubbard (B.S. Spring 2022 - Spring 2023; [*B.S. at OK State.*])
4. Udhav Ramachandran (High School Intern Summer 2022; [Next: *B.S. at OK State.*])
5. Deepthi Mikkilineni (M.S. Fall 2022)
6. Sriram Madepalli (M.S. Summer 2022; [*First Job: SDE, Amazon*])
7. Swapna Darsi (M.S. Summer 2022; [*First Job: Quality Assurance Analyst, Atlantic Casualty Insurance Co.*])

8. Ramya Mikkilineni (M.S. Summer 2022; [*First Job: SDE, Samsung*])
9. Vineela Indla (M.S. Fall 2021; [*First Job: SDE, Amazon*])
10. Yashwanth Peddaboina (M.S. Summer 2022; [*First Job: SDE, Amazon*])
11. Trae Primm (B.S. REU Summer 2021)
12. Madison Rushing (B.S. REU Summer 2021)
13. Nikhil Gunti (M.S., 2019 - 2021; [*First Job: Data Scientist, Concat Systems*])
14. Makenzie Terrell (B.S., Fall 2020 - Fall 2021)

Before Oklahoma State University

1. Gilbert Rotich (Ph.D. (USF), 2017-2019) [*Next: Ph.D. at USF, Tampa*]
2. Daniel Sawyer (B.S. (USF), 2016 - 2018) [*Next: Ph.D. at USF, Tampa*]
3. Subramanian Viswanathan (M.S. (USF), 2016 - 2017)[*First Job: Goldman Sachs*]

TEACHING EXPERIENCE

Instructor Auburn University
Apr 2012 - Oct 2012 Auburn, AL
Fall 2023: COMP 5600/6600 Artificial Intelligence
Spring 2024: COMP 5630/6630 Machine Learning

Instructor Oklahoma State University
Apr 2012 - Oct 2012 Stillwater, OK
Spring 2020-2023: CS 5323 Design and Implementation of Operating Systems II
Fall 2020-2022: CS 4783/5783 Machine Learning

Instructor University of South Florida
Summer 2017, Summer 2019 Tampa, FL
Undergraduate Course: IT Programming Fundamentals

Graduate Teaching Assistant University of South Florida
Summer 2017, Summer 2019 Tampa, FL
Spring 2019: Computer Vision (Graduate)
Spring 2017 - Summer 2019: USF I-Corps Sessions (NSF Lean Business Canvas Course)
Spring 2017: Biometrics (Graduate), IT Data Structures/Algorithms (Undergraduate)
Fall 2016: IT Data Structures (Undergraduate), Computational Geometry (Undergraduate)
Spring 2016: Automata Theory/Formal Languages (Undergraduate)

PROFESSIONAL SERVICE

Demo Chair. IEEE/CVF CVPR 2024.
Associate Editor: IEEE Robotics and Automation Letters (RA-L, 2021-Present)
Area Chair/Senior Program Committee: ACM Multimedia 2021, IEEE/CVF CVPR 2022-2024, NeurIPS 2023, CODS-COMAD 2024, IEEE/CVF WACV 2024
NSF Panels: IIS CHS (2020), IIS RI (2023)
Track Chair: DEEP-DIAL (AAAI-2021), Machine Learning for Graphs (ICMLA 2020), ICMLA 2020 (Computer Vision), Vision for Robotics (VISAPP 2021)
Organizer: DEEP-DIAL Workshop (AAAI-2021), Special Session on Machine Learning for Graphs (ICMLA 2020-2023), CS Colloquium (OK State, 2019-2023), AI Seminar (University of South Florida. Fall 2016 - Spring 2019)
Program Committee: AAAI 2020, AAAI 2021, AAAI 2022
Reviewer: IET Computer Vision, IEEE Access, Springer KAIS, WACV 2020, ICCV 2019, CVPR 2019, CVPR 2020, CRV 2020, ECCV 2020, WACV 2021, NeurIPS 2020, ACCV 2020, ICLR2021, CVPR2021, ICML 2021, NeurIPS 2021, ICCV 2021, WACV 2022, ICLR 2022, WACV 2023, WACV 2024, ICLR 2024, IEEE TIP, Pattern Recognition Letters, ICPR 2024
External Reviewer: PLOS ONE, IROS 2017, CAIP 2017

TALKS

Invited Talk. *Towards Multimodal Open World Event Understanding with Neuro Symbolic Reasoning.* WADLA 3.0, IIT-Sri City. Fall 2023.

Invited Talk. *Towards Multimodal Open World Event Understanding with Neuro Symbolic Reasoning.* 7th Summer School on AI, IIT-Hyderabad. Summer 2023.

Invited Talk. *Representation Learning for Metagenomics: An Explorative Study.* INTERACT Symposium on One Health and One Medicine. Summer 2023.

Invited Talk. *Towards Open World Event Understanding with Neuro Symbolic Reasoning.* The University of Iowa. Spring 2023

Invited Talk. *Towards Multimodal Open World Event Understanding with Neuro Symbolic Reasoning.* Auburn University. Spring 2023

Invited Talk. *Towards Open World Event Understanding with Neuro Symbolic Reasoning.* The Washington University at St. Louis. Fall 2022

Invited Talk *Towards Open World Visual Understanding with Neuro Symbolic Reasoning.* Mega AI series, Pacific Northwest National Lab (PNNL). Fall 2022

Invited Talk *Towards Intelligent Agents with Open World Visual Understanding .* Collaborative Assistants for the Society (CASY 2020). Fall 2020

Invited Talk *The Role of Commonsense Knowledge in Visual Understanding.* Oklahoma State University. Fall 2018

Invited Talk with Dr. Sudeep Sarkar. *Going Deeper with Semantics: Exploiting Semantic Contextualization for Interpretation of Human Activity in Videos.* Technical Seminar Series, Statistical Shape Analysis & Modeling Group, Florida State University. Fall 2018

Invited Talk with Dr. Sudeep Sarkar. *Video Event Understanding with Pattern Theory.* Robotics Technical Seminar Series, Department of Mechanical Engineering, University of South Florida. Spring 2018

Invited Talk *Leveraging ConceptNet to Reduce Training Requirements for Video Descriptions,* Seminar in AI, University of South Florida, Spring 2017.

FUNDING

Total Funding: \$3,034,577 (**External**), \$187,000 (**Internal**). **Aakur share:** \$1,084,402, **As PI:** \$844,232

Current

1. *Collaborative Research: RI: Medium: Understanding Events from Streaming Video - Joint Deep and Graph Representations, Commonsense Priors, and Predictive Learning,* NSF CISE Core Program, \$285,126, **PI**.
2. *CAREER: Towards Causal Multi-Modal Understanding with Event Partonomy and Active Perception,* National Science Foundation (NSF), \$514,186, **PI**
3. *AI-based approach to understand stress in low and high growth rate cattle.* US Department of Agriculture, \$999,078, **Co-PI**.

Past

1. *Identification of pile-up jets in the ATLAS experiment on an event-by-event basis.* US Department of Energy (DOE), \$224,547, **Co-PI**. Transferred to other co-PI.
2. *Deep Learning Computational Algorithms for Disease Diagnosis by Genome Sequence,* USDA National Animal Health Laboratory Network, \$158,136, **Co-PI**.
3. *REU Supplement: Collaborative Research: RI: Medium: Understanding Events from Streaming Video - Joint Deep and Graph Representations, Commonsense Priors, and Predictive Learning,* NSF CISE Core Program, \$7,920, **PI**
4. *GPU Server for Improving AI and Data Science Education,* OSU College of Arts and Sciences (CAS) Student Technology Fee Request, \$25,000, **PI**
5. OSU College of Arts and Sciences Research (ASR) Program, \$12,000, **PI**
6. *Next Generation User Interfaces for Gateway Autonomous Operations,* NASA X-Hab Project, \$30,000, **Co-PI**
7. *Accelerating Research Discoveries with GPU-enabled Computing,* Oklahoma State University Core Facility Support Program, \$150,000, **Co-PI**.

PROFESSIONAL Available upon request.
REFERENCES