Anil Kumar Vadathya

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Research engineer with >5 years experience in machine learning, interested in solving challenging problems to create a measurable impact.

RESEARCH EXPERTISE

Machine learning	- generative models (GANs, diffusion), neural networks, regression, classification
Computational imaging	- solving inverse problems, depth estimation, 3D imaging, and implicit models
Computer vision	- CNNs, face detection, recognition, gaze estimation, and adversarial learning
Medical imaging	- segmentation and classification of MRI, 3D reconstruction
Behavioral health	- AI applications for prediction, risk estimation, and causal analysis

EDUCATION

Indian Institute of Technology (IIT) Madras
June 2018

MS in Electrical Engineering   *Chennai, India*

- Masters thesis on "generative models for image restoration" won Qualcomm Innovation Fellowship-India

Rajiv Gandhi University of Knowledge Technologies   **May 2015**

B. Tech in Electronics and Communications Engineering   *Basar, India*

SKILLS

Training, testing, and deploying neural networks; Python, PyTorch, Tensorflow, MXNet, C, BASH, SQL, Matlab; GitHub, Docker, Linux; Database management, High dimensional data labeling;

PROFESSIONAL EXPERIENCE

Rice University   **Nov 2018 – Present**

Research Engineer, [Digital Health Initiative](), ECE   *Houston, TX*
Visting Researcher, CNRC, Baylor College of Medicine

- Led machine learning and computer vision efforts in developing, FLASH-TV, technology for objectively measuring screentime (TV, mobile use) for NIH grant (*#R01DK113269*)
    - addresses **pressing** needs of pediatricians to study **screentime** effects on early **childhood obesity**
    - provides **objective** measurements, more **accurate** over parents' self-report
    - **>85% accuracy** using **state-of-the-art** face detection, recognition, and gaze estimation methods.
    - runs **real-time** on edge devices, deleting images after analysis, **preserving privacy**
- Collaborated across a diverse team of pediatricians, behavioral researchers, and engineers
    - Led iterative, alpha, beta, and validation test studies to refine FLASH-TV
        - performed classification, regression and reliability evaluations (*Kappa, ICC*)
    - Managed large-scale video databases and labeling tools
        - quality checks (*reliability Kappa*) and controls for human-coding of gold standard from video data
        - analysis, storage and processing of high dimensional video and image data for downstream tasks
- Our RO1 efforts led to an ongoing NIH PO1 grant (*#P01HD109876*)
    - **First robust data** for the influence of technology and digital media (TDM) use on preschool children's health (weight gain, sleep status, and executive function) to inform future guidelines
    - Led two sub-awards of PO1 grant - TECH study and Digital Assessment Core (DAC)
    - Press releases:
        - Houston Chronicle (www.houstonchronicle.com/news/houston-texas/health/article/How-does-screen-time-affect-child-development-17574295.php)

Indian Institute of Technology Hyderabad   **May 2014 – Aug 2014**
Research Internship, LFOVIA Lab   *Hyderabad, India*
▪ Applied deep Boltzmann machines for facial image quality assessment

GRANTS & FELLOWSHIPS

Leveraging Passive Objective Assessment Methods of Preschooler's Media Use to Examine Multiple Paths of Influence on Sleep, Executive Function and Weight Status *(NIH Grant #P01HD109876)*   **Oct 2022 - Mar 2022**
PIs: Dr. Teresia O'Connor, CNRC, BCM; Dr. Ashok Veeraraghavan, ECE, Rice University
reporter.nih.gov/project-details/10532289

Development and Validation of an Automated Measurement of Child Screen Media Use: FLASH *(NIH Grant #R01DK113269)*   **Nov 2018 - Mar 2022**
PIs: Dr. Teresia O'Connor, CNRC, BCM; Dr. Ashok Veeraraghavan, ECE, Rice University
reporter.nih.gov/search/vQDL3LGxi0uQMkV-k1gyJg/project-details/9288252

Qualcomm Innovation Fellowship India (super winner)   **July 2017 - June 2018**
PI: Dr. Kaushik Mitra, Computational imaging lab, IIT Madras, India
▪ Capturing lightfield (3D) data from a regular DSLR camera

Qualcomm Innovation Fellowship India   **July 2016 - June 2017**
PI: Dr. Kaushik Mitra, Computational Imaging lab, IIT Madras, India
www.qualcomm.com/research/university-relations/innovation-fellowship/winners
▪ Generative image models for solving inverse problems in computational imaging

PROFESSIONAL SERVICES

▪ Reviewer for journals - IEEE TPAMI, IEEE TCI, Optics Express, IJCV
▪ Reviewer for conferences
  ○ ECCV 24, CVPR 24, WACV 24, CVMI 24, ICIP 24, Face & Gesture 24, ICHI 24, IEEE BHI 24
  ○ ICHI 23, ICIP 23, CVPR 22, ICIP 22, WACV 2022, CVPR 21, FG 2021, CVPR 19
  ○ ICVGIP 2018, SPCOM 2016

RESEARCH PROJECTS

Technology and digital media's influence on children's sleep and weight status   **Oct 2023 – Present**
with Dr. Teresia O'Connor, Dr. Ashok Veeraraghavan Young and Uzair Alam

▪ Led TECH study for sub-award of an NIH PO1 grant (https://www.bcm.edu/healthcare/clinical-trials/h-52282) (reporter.nih.gov/project-details/10532290)
▪ Adresses crtical gaps in screenmedia research with objective data using FLASH-TV and FLASH-Mobile
  ○ mediators for association of screenmedia use and increased risk ofoverweight and obesity
  ○ role of screenmedia use in effecting children's sleep and circadianrhythms
▪ **Specific aim - 1**: Examine preschool children's <u>screenmedia exposure</u> using real-time, passive objective assessment in the home setting and how screenmedia exposure <u>interacts with preschooler's family and environmental factors</u> to influence their sleep, EF and weight status.
▪ **Specific aim - 2:** <u>Inform guidelines</u>**,** to provide actionable, practical recommendations that parents canuse to help mitigate adverse effects of screenmedia use on children's healthand development.

Digital Assessment Core   **Oct 2023 – Present**
with Dr. Jennnette Moreno, Dr. Joseph Young, Uzair Alam, and Rohitaa Ravikumar
- Sub-award of NIH PO1 grant (reporter.nih.gov/project-details/10532294)
- Managed software pipeline and hardware components (embedded devices) for data collection
    o developed a Linux application (systemd) for standalone execution of software once initialized
    o completed 25% of data collection in year-1 with **zero failure rates**
- Managed a team of engineers for data collection, ensuring quality control and checks
    o database management, query, and conflict resolution
    o driving insights, developing prediction models and behavioral patterns from the screen use data

Family Level Assessment of Screen use in the Home (FLASH-TV)   **Nov 2018 – Oct 2023**
with Dr. Teresia O'Connor and Dr. Ashok Veeraraghavan
- Built an integrated system using state-of-the-art computer vision methods - face detection (RetinaFace), recognition (ArcFace), and gaze estimation (Gaze360) to measure screen-time (TV) among children.
- Addressed the domain gaps using adversarial domain adaptation, data augmentation, and regularization methods.
- Extensive evaluation of the system through iterative alpha tests under challenging conditions. Performs **with 85% accuracy,** overcoming the recall errors associated with self-report.
- Built an easily portable embedded system that runs our deep learning-based algorithms in real-time. Runs on edge devices, deleting images after analysis, ensuring user privacy.
- FLASH-TV paved way for an ongoing 5-year NIH PO1 grant (2022-2027) to study impact of screentime on children's health (childhood obesity, weight gain, sleep status - circadian rhythm, and executive function).

Family Level Assessment of Screen use in the Home (FLASH-Mobile)   **Nov 2018 – Oct 2023**
with Dr. Teresia O'Connor, Matt Barnett, and Dr. Ashok Veeraraghavan
- Helped develop an app to identify meaningful device usage for Android phones and tablets
- Proposed and validated methods to separate a specific child's use from others who share the device

Bias-for-action: implicit neural networks for video modeling   **Oct 2023 – Jan 2024**
with Dr. Guha Balakrishnan and Dr. Vishwanath Saragadam, Rice University
- Bias variables in implicit representations tend to act similarly to motion fields; controlling them enables video editing and compression capabilities.

Reconstructing CT Volume from a few Chest X-ray images   **Oct 2022 – Dec 2024**
with Yiran Sun and Dr. Guha Balakrishnan, Rice University
- Extended PixelNeRF architecture to reconstruct 3D CT volume from a few X-ray projections. This application significantly reduces the time and cost-effective alternative to obtaining CT volume with expensive hardware.

Perceptual loss functions for medical imaging restoration   **June 2022 – Oct 2022**
with Dr. Guha Balakrishnan, Rice University
- Pretrained unsupervised CNN models for medical imaging restoration perceptual loss. Popular imagenet pretrained models are not perfect for medical imaging applications.

Lightfield Reconstruction from Focus-Defocus Pairs using CNNs   **Oct 2017 – Apr 2018**
with Dr. Kaushik Mitra, IIT Madras
- We learn to estimate disparity from focus-defocus pair via view-supervision using deep neural networks. The disparity map is used to synthesize light field.

Recurrent Generative Priors for Computational Photography   **June 2016 – Aug 2017**
with Akshat Dave and Dr. Kaushik Mitra, IIT Madras
- Data-driven priors for compressive imaging reconstruction, we achieved a 3dB improvement on avg. over traditional methods like TVAL3 and D-AMP.

Face Quality Assessment for Face Recognition in The Surveillance Scenario   June 2014 – Aug 2014
with Dr. Sumohana Channapayya, IIT Hyderabad
- Here, we used Gaussian Binary Restricted Boltzmann Machine (RBM) for modeling the distribution of facial features. We then used this model to perceptually assess the face image for face recognition i.e. whether a face is recognizable in the given image.

Butterfly Communication strategies: A prospect for soft-computing   Jan 2014 – Mar 2015
with Chakravarthi Jada, RGUKT Basar
- In this work, we have developed a multi-modal optimization algorithm inspired by the communication strategies deployed by butterflies. We evaluated it on benchmark functions and practical applications like unsupervised clustering of satellite images.

RoboG: Robo Guide based on simple learning strategy   Aug 2013 – Feb 2014
with Chakravarthi Jada, RGUKT Basar
- We developed a navigation guiding robot for our university (RGUKT). We formulated the navigation as a regression problem and solved it with neural networks.

JOURNAL PUBLICATIONS

- **Anil Vadathya et al.** "FLASH-TV a machine learning pipeline to passively measure children's TV viewing: validation studies of the system," in print at *Nature Scientific Reports*, 2024
- **Anil Vadathya et al.** "Development of family level assessment of screen use in the home for television
- (FLASH-TV)," *Multimedia Tools and Applications* (2024): 1-19
- Perez, Oriana, Tatyana Garza, Olivia Hindera, Alicia Beltran, Salma M. Musaad, Tracey Dibbs, Anu Singh et al. "Validated assessment tools for screen media use: A systematic review." *Plos one* 18, no. 4 (2023): e0283714.
- Oriana Perez and **Anil Vadathya** et al. "The Family Level Assessment of Screen Use–Mobile Approach: Development of an Approach to Measure Children's Mobile Device Use." *JMIR Formative Research* 6, no. 10 (2022): e40452.
- **Anil Vadathya et al.** "An Objective System for Quantitative Assessment of Television Viewing Among Children (Family Level Assessment of Screen Use in the Home-Television): System Development Study," *JMIR Pediatric and Parenting*, 2022
- Moukaddam, Nidal, Vishwanath Saragadam, Mahsan Abbasi, Matt Barnett, **Anil Vadathya**, Ashok Veeraraghavan, and Ashutosh Sabharwal. "Evolution of Mood Symptomatology Through the COVID-19 Pandemic: Findings From the CovidSense Longitudinal Study." *Cureus 14*, no. 10 (2022)
- **Anil Vadathya**, Sharath Girish, Kaushik Mitra, "A unified learning-based framework for light field reconstruction from coded projections," *IEEE Transactions on Computational Imaging*, 2019
- Akshat Dave, **Anil Vadathya**., Ramana Subramanyam, Rahul Baburajan, Kaushik Mitra, "Solving Inverse Computational Imaging Problems using Deep Pixel-level Prior," *IEEE Transactions on Computational Imaging*, 2018

CONFERENCE PUBLICATIONS

- **Anil Kumar Vadathya**, Sai Kiran Cholleti, Gautham Ramajayam, Vijalakshmi K, and Kaushik Mitra. "Learning Light Field Reconstruction from a Single Coded Image."*Asian Conference on Pattern Recognition*, 2017.
- Akshat Dave, **Anil Kumar Vadathya**, and Kaushik Mitra. "Compressive Image Recovery Using Recurrent Generative Model." IEEE *International Conference on Image Processing*, 2017.
- Sowmya C, Anjumara Shaik, Chakravarthi Jada, **Anil Kumar Vadathya**. "Butterfly Communication Strategies: A Prospect for Soft-Computing Techniques." Proc. of IEEE *International Joint Conference on Neural Networks* (IJCNN), 2014.
- Harish Y, Kranthi Kumar R, Irfan Feroz G MD, Chakravarthi Jada, **Anil Kumar Vadathya**, Mounika Mesa. "ROBOG: Robo-Guide with simple learning strategy." Proc. of IEEE Student's Technology Symposium, India, 2014.
- Chakravarthi Jada, **Anil Kumar Vadathya**, Anjumara Shaik, Sowmya Charugundla, Parabhaker Reddy Ravula, and Kranthi Kumar Rachavarapu. "Butterfly Mating Optimization." In *Intelligent Systems Technologies and*

Applications, Springer International Publishing, 2015.
- Kranthi Kumar R, Irfan Feroz G MD, Chakravarthi Jada, Harish Y, **Anil Kumar Vadathya**. "ROBOG An Autonomously Navigating Outdoor Robo-Guide." In Swarm, Evolutionary, and Memetic Computing, Springer International Publishing, 2014.

ABSTRACTS

- Teresia M. O'Connor, **Anil Kumar Vadathya**, Tatyana Garza, Uzair Alam, Alicia Beltran, Alex Ho, Salma Musaad, Sheryl O. Hughes, Jason Mendoza, Jennette P. Moreno, Tom Baranowski, Ashok Veeraraghavan, "FLASH-TV 3.0: Validation of FLASH-TV methods for estimating TV-viewing among children", *ISBNPA abstracts 2024*.
- Teresia M. O'Connor, **Anil Kumar Vadathya**, Alicia Beltran, Salma Musaad, Sheryl O. Hughes, Jason Mendoza, Tom Baranowski, Ashok Veeraraghavan, "Development of an automated, objective assessment of children's mobile device use: FLASH-Mobile," *ISBNPA abstracts 2022*.
- Teresia M. O'Connor, **Anil Kumar Vadathya**, Alicia Beltran, Salma Musaad, Sheryl O. Hughes, Jason Mendoza, Tom Baranowski, Ashok Veeraraghavan, "FLASH-TV 2.0: Refining and assessing the FLASH-TV methods for TV viewing estimation," *ISBNPA abstracts 2022*.

TALKS & PRESENTATIONS

- Live demo of FLASH-TV at *Children and Screens Congress 2023*, Oct 2023, Washington DC.
- Talk on "Solving inverse problems using Deep Generative Image models" at LFOVIA Lab, IIT Hyderabad, Aug 2018.
- Poster on "A Deep Learning Framework for Light Field Reconstruction from Minimal Measurements" at *ICCP 2018*, CMU, Pittsburgh.
- Talk on "Compressive Lightfield Reconstruction using Deep Neural Nets" at Qualcomm, Banglore, May 2017.
- Poster on "Compressive Image Recovery using Recurrent Generative Model" at ICCP 2017, Stanford.
- Talk on "Single Pixel Camera(SPC) Reconstruction using Recurrent Generative Model", at Qualcomm Banglore, Feb 2016.
- Presented "Deep Generative Networks For Image Processing" at a workshop by the Interdisciplinary Lab on Data Sciences (ILDS), IIT Madras, 2016.

TEACHING & MENTORING EXPERIENCE

- Mentorship
  - Anurag Kumar, an intern for summer of 2023, *currently an undergrad at CMU*
  - Alex Ho, a research assistant from Aug 2021 to July 2022, *currently a research engineer at BCM*
- Teaching assistance for Deep Learning for Image Processing (Fall 2017)
- Teaching assistance for Machine Learning for Computer Vision (Spring 2017)
- Teaching assistance for Computational Photography (Fall 2017)
- Teaching assistance for Machine Learning for Computer Vision (Spring 2016)

SCHOLASTIC ACHIEVEMENTS

- M.S. thesis was awarded Qualcomm Innovation Fellowship (India) 2016
- Received IEEE SPS Travel Grant award for ICIP 2017
- Granted MHRD, India scholarship for masters at IITM (Jul 2015 to Feb 2018)
- Selected for Summer Fellowship 2014 of Indian Academy of Sciences