Amit Kumar

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Research Interest

Human and Face Analysis and Reconstruction, Generative models for human-like AI agents, Audio-Visual LLMs

Education

University of Maryland, College Park, Maryland *September 2014 - December 2019*

MS + PhD, Electrical and Computer Engineering. (GPA 3.7/4.0) **Advisor:** Rama Chellappa

Indian Institute of Technology, Kharagpur, India *July 2009 - May 2014*

B. Tech (Hons) and MTech, Electronics and Communication Engineering (GPA 8.7/10)
Minor: Computer Science and Engineering

Professional Experience

Research Scientist *Feb 2020 - Present*

Meta (previously Facebook Inc)

Developed Periocular Authentication for user verification via eye recognition. Mentored two interns and integrated presentation attack detection, achieving state-of-the-art performance. Filed a patent on Periocular authentication for head-mounted devices.
Co-authored CVPR 2022 paper EyePAD++ showcasing joint training efficiencies and trade-offs.

Led a 3D face reconstruction project from mono-ocular images, focusing on occlusion. The proposed method outperformed graphics-based approaches in computation, latency, and accuracy.
Filed a patent on holographic calling for artificial reality.
Mentored an intern and co-authored a CVPR 2023 paper titled "AV Face," which uses audio conditioning to recover occluded details.

Created a 3D training pipeline for portrait images, addressing overutilization and data scarcity via triplane denoising. Mentored an intern and extended ideas on generating talking humans from videos, co-authoring the ECCV 2024 paper "TalkingNerf".

Engineered an anti-alias generator for realistic visual AI agents, reducing finetuning time by 30x with a canonical volume approach. Developed algorithms to represent behavior with limited data while ensuring visually pleasing actor representation.

Co-authored Language-Based Approach For Style-Conditioned Synthesis of Indoor 3D Scenes (currently under submission) which aims at generating a realistic and visually possible and pleasing room layout given a rough room description

Research Intern *June 2018 – August 2018*

Snap Research Inc, NY

Worked on the application of multimodal data for enhancing the user experience. Project involved audio generation using RNNS and GANs for audio spectrograms.

Research Intern *June 2017 – August 2017*

IBM T.J. Watson Research Centre, Yorktown Heights, NY

Worked on low dimensional hashing schemes for fast retrieval of faces from large-scale dataset Developed SOTA face verification pipeline using limited data. Proposed two disclosure agreements

Reviewer IEEE Signal Processing Society and Computer Society *August 2018 - Present*

IEEE Transactions of Neural Networks and Learning Systems, IEEE Signal Processing Letters, IEEE Transactions on Information Forensics and Security, IEEE Transactions on Image Processing, Springer International Journal of Computer Vision, ICCV'19-23, CVPR'20-24, ECCV'20-24

Graduate Teaching Assistant *September 2014 - December 2014*

University of Maryland, College Park

Conducted lab sessions and graded exams for two sections under ENEE245 Digital Circuits course

Undergraduate Summer Internships

Johns Hopkins University *May 2013 – July 2013*

● Developed software to be used in hospitals for annotating the data for pre-processing and training in later stages. Implemented human detection algorithm using SVMs on the ICU dataset collected at Johns Hopkins Hospital

KTH Royal Institute of Technology, Sweden *May 2012 – July 2012*

● Selected for the EU-FP7 LISTA project under European Union Directorate General of Research and Innovation

● Proposed Noisy kernel for GP Regression to improvise mapping of human speech segments

Publications

Conferences

- DECORUM: A Language-Based Approach for Style-Conditioned Synthesis of Indoor 3D Scenes
  Kelly Marshall, Omid Poursaeed, Amit Kumar, Yilei Li, Rakesh Ranjan, Chinmay Hegde (Under submission)
- TalkinNeRF: Animatable Neural Fields for Full-Body Talking Humans
  Aggelina Chatziagapi, Bindita Chaudhuri, **Amit Kumar**, Rakesh Ranjan, Dimitris Samaras, Nikolaos Sarafianos (ECCVW 2024)
- AVFace: Towards Detailed Audio-Visual 4D Face Reconstruction
  C Aggelina, B Chaudhury, **A Kumar,** S Dimitris (CVPR 2023)
- HIME: Efficient Headshot Image Super-Resolution with Multiple Exemplars
  Xiaoyu Xiang, Jon Morton, Fitsum A Reda, Lucas Young, Federico Perazzi, Rakesh Ranjan, **Amit Kumar**, Andrea Colaco, Jan Allebach (WACV 2023)
- EyePAD++: A Distillation-based approach for joint Eye Authentication and Presentation Attack Detection using Periocular Images
  P Dhar, **A Kumar**, K Kaplan, K Gupta, R Ranjan, R Chellappa (CVPR 2022)
- EVRNet: Efficient Video Restoration on Edge Devices
  S Mehta, **A Kumar**, F Reda, V Nasery, V Mulukutla, R Ranjan, V Chandra (ACM Mulitmedia'20)
- Integrating Acting, Planning and Learning in Hierarchical Operational Models
  S Patra, J Mason, **A Kumar**, M Ghallab, P Traverso, D Nau (ICAPS'20)
- S2LD: Semi-Supervised Landmark Detection in Low-Resolution Images and Impact on Face Verification
  A Kumar, Rama Chellappa (CVPRW'20)
- A Dual Path Model with Adaptive Attention for Vehicle Re-Identification
  P Khorramshahi, **A Kumar**, N Peri, SS Rambhatla, JC Chen, R Chellappa (ICCV'19, Oral)
- Disentangling 3D Pose in A Dendritic CNN for Unconstrained 2D Face Alignment
  A Kumar, Rama Chellappa (CVPR'18)
- KEPLER: Keypoint and Pose Estimation of Unconstrained Faces by Learning Efficient H-CNN Regressors
  A Kumar, R Chellappa (FG'17)
- A Cascaded Convolutional Neural Network for Age Estimation of Unconstrained Face
  JC Chen, **A Kumar**, R Ranjan, V Patel, A Alavi, R Chellappa (BTAS'16)
- Attention Driven Vehicle Re-identification and Unsupervised Anomaly Detection for Traffic Understanding
  P Khorramshahi, N Peri, **A Kumar**, A Shah, R Chellappa (CVPRW'19)

- A semi-automatic 2D solution for vehicle speed estimation from monocular videos
  A Kumar, P Khorramshahi, WA Lin, P Dhar, JC Chen, R Chellappa (CVPRW'18)
- An end-to-end system for unconstrained face verification with deep convolutional neural Networks
  JC Chen, R Ranjan, **A Kumar**, CH Chen, VM Patel, R Chellappa (ICCVW'15)
- Unconstrained age estimation with deep convolutional neural networks
  R Ranjan, S Zhou, J Cheng Chen**, A Kumar**, A Alavi, VM Patel, R Chellappa (ICCVW'15)

Journals

- Semi-Supervised Landmark-Guided Restoration of Atmospheric Turbulent Images
  CP Lau, **A Kumar**, R Chellappa (IEEE Journal of Selected topics in Signal Processing' 20)
- KEPLER: Simultaneous Estimation of Keypoints and 3D Pose of Unconstrained Faces in a Unified Framework by Learning Efficient H-CNN Regressors
  A Kumar, A Alavi, R Chellappa (Image and Vision Computing, Sept 2018)
- Unconstrained Still/Video-Based Face Verification with Deep Convolutional Neural Networks
  JC Chen, R Ranjan, S Sankaranarayanan**, A Kumar**, CH Chen, VM Patel, R Chellappa (IJCV'2017)
- Towards the design of an end-to-end automated system for image and video-based Recognition
  R Chellappa, JC Chen, R Ranjan, S Sankaranarayanan, **A Kumar**, VM Patel, C Castillo (ITA'16)

Pre-Prints

- S2LD: Semi-Supervised Landmark Detection in Low Resolution Images and Impact on Face Verification
  A Kumar, P Khorramshahi, R Chellappa
- Face alignment by local deep descriptor regression
  A Kumar, R Ranjan, VM Patel, R Chellappa
- A Convolution Tree with Deconvolution Branches: Exploiting Geometric Relationships for Single Shot Keypoint Detection
  A Kumar, R Chellappa

Miscellaneous

Graduate Courses: Statistical Pattern Recognition, Image Understanding, Deep Learning, Convex Optimization, Advanced Numerical Optimization, Advanced Digital Signal Processing, Estimation and Detection Theory, Information Theory, Random processes for communication and control

Skills Software: Python, C/C++, MATLAB, OpenCV

Deep Learning: Caffe, PyTorch, TensorFlow

Achievements

- MCM Scholarship, IIT Kharagpur
- Merit Scholarship, CBSE, Govt. of India