

## Bharatesh Chakravarthi, Ph.D.,

Postdoc Research Associate, ASU Active Perception Group, School of Computing and Augmented Intelligence, Arizona State University, Tempe, Arizona, USA

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### Summary

- 🚦 Postdoctoral research associate at Arizona State University's (ASU) Active Perception Group (APG), specializing in Intelligent Transportation Systems (ITS), Neuromorphic Vision-based Technology, and Artificial Intelligence. Currently involved in research and teaching graduate-level courses at ASU, with expertise in ITS, multi-modality sensing, human motion capture systems for motion generation, reconstruction, and 3D hand gesture interactions in Virtual Reality. Highly committed to advancing research, and academic excellence, and actively engaging students in transformative research pursuits.

### Appointments

- 🚦 **Postdoctoral Research Associate** at Active Perception Group, School of Computing and Augmented Intelligence, Ira. A Fulton Schools of Engineering, Arizona State University, Arizona. September 2022 – Till date.
- 🚦 **Guest Faculty** (Remote) at Work Integrated Learning Programmes (WILPS) Division, Birla Institute of Technology and Science (BITS), India. December 2021 – Till date.
- 🚦 **Research Associate** (Ph.D. Candidate) at Virtual Environments Lab, The Graduate School of Advanced Imaging Science, Multimedia and Film (GSAIM), Chung Ang University, Seoul, South Korea. August 2018 – August 2022.
- 🚦 **Assistant Professor** at Department of Information Science and Engineering, Jyothy Institute of Technology (JIT), Visvesvaraya Technological University (VTU), Bengaluru, Karnataka, India. July 2013 – August 2015.
- 🚦 **Assistant Professor** at Department of Information Science and Engineering, APS College of Engineering, Visvesvaraya Technological University (VTU), Bengaluru, Karnataka, India. June 2013 – June 2015.

### Education

- 🚦 **Ph.D. in Computer Graphics and Virtual Reality** from Virtual Environments Lab, The Graduate School of Advanced Imaging Science, Multimedia and Film (GSAIM), Chung Ang University, Seoul, South Korea. August 2018 – August 2022.
- 🚦 **Master of Technology (MTech) in Computer Networks Engineering** from The Oxford College of Engineering (TOCE), Visvesvaraya Technological University (VTU), Bengaluru, Karnataka, India. August 2011 – June 2013.
- 🚦 **Bachelor of Engineering (B.E) in Information Science Engineering** from APS College of Engineering, Visvesvaraya Technological University (VTU), Bengaluru, Karnataka, India. September 2007 – June 2011.

## Research Experience

- ✚ **Neuromorphic vision for intelligent transportation systems** (Ongoing)
  - ✚ Currently leading a project (1 Ph.D. student) to explore new avenues to utilize event-based vision systems to enhance traffic monitoring with the power of AI.
  - ✚ Fully event-based road traffic data curation, design, development of multimodal sensor fusion algorithms, and deep learning models for traffic participants (Vehicles, Vulnerable Road users, micro-mobility) detection, tracking, and prediction tasks in real-time scenarios during low-light conditions.
  - ✚ The development environment involves an IMX636 (Prophesee EVK 4 HD) sensor, frame-based camera, python programming, PyTorch framework, and CARLA simulator.
- ✚ **Monocular vision for real-time traffic monitoring on edge devices with AI** (Ongoing)
  - ✚ In association with Argos Vision (a tech start-up), currently leading a project (1 Ph.D., and 1 master's thesis student) to enhance pedestrian safety at traffic intersections.
  - ✚ High-quality synthetic pedestrian dataset curation, and development of novel methods to improve 3D pedestrian detection, tracking, and intention prediction with multi-view (multi-camera vision) perception to tackle occlusion challenges.
  - ✚ The development environment involves a CARLA simulator, python programming, and PyTorch framework.
- ✚ **Hand gesture generation using generative AI to enhance human-machine interaction in VR environments** (Ongoing)
  - ✚ Currently leading a project (4-5 graduate-level student volunteers) exploring generative AI architectures like GANs and VAEs for synthesizing natural and contextually relevant hand gestures in VR.
  - ✚ Curated diverse domain-specific static and dynamic hand gestures using an RGB camera, and an optical hand-tracking sensor. Working on developing algorithms and deep learning models for gesture generation, recognition, and translation into meaningful interactions within virtual space.
  - ✚ The development environment involves Ultraleap's Leap Motion Controller sensor, HD RGB camera, python and C++ programming, PyTorch framework, Unity, and Meta Spark Studio.
- ✚ **IMU-based MoCap systems for human motion data curation, real-time reconstruction, 3D model-based visualization, and movement analysis.**
  - ✚ Developed state-of-the-art full-body human movement analysis framework based on IMU MoCap systems. Curated realistic human motion datasets, real-time human action reconstruction, intuitive visualization, and activity recognition system.
  - ✚ Developed a novel human motion visualization tool (Motion-Sphere), designed and developed a sensor fusion (IMU + Lidar) algorithm for accurate orientation and position estimation, and modeled forward and inverse Kinematics (full-body) to ensure naturalness, developed a wearable jacket (a sensor suite) for real-time activity sensing.
  - ✚ Developed an Open-source tool "Modular Motion Authoring Platform" for human motion synthesis, editing, reconstruction, and visualization. (Registered with Korea Copyright Commission). Utilized machine learning models for activity.
  - ✚ The development environment involved Movella's MTw Awinda (motion-tracker) sensors, Movella's DOT (wearable sensor), Ouster OS-0 Lidar, C++ programming, machine learning models, Visualization Toolkit (VTK), Qt, Blender, Autodesk 3ds Max.

## Academic/Teaching Experience

### ✚ Teaching at Arizona State University

- ✚ Currently teaching graduate-level courses at the School of Computing and Augmented Intelligence at ASU.

✚ **Fall 2023** – Taught CSE512, Distributed Database Systems (145 Students)

✚ **Instructor/Course evaluation rating: 4.55**

✚ **Spring 2023** – Taught SER594, Human-Computer Interactions (78 Students)

✚ **Instructor/Course evaluation rating: 4.74**

✚ **Received Professor of Impact Award**

### ✚ Teaching at Birla Institute of Technology and Science – WILPS division (Online Mode)

- ✚ Teaching online courses to corporate professionals (Cisco, Cognizant, Wipro) through work-integrated learning programs of BITS for the Master of Technology in Data Science program. (Class size – 90 ~ 225 students)

✚ Course offered – Data Visualization and Interpretations (Tableau, Prep Builder, Matplotlib, Bokeh, Seaborn), Introduction to Machine Learning (Supervised learning algorithms, NumPy, Pandas, Scikit-learn), Deep Learning (CNN, RNN, Transformers, Tensorflow framework)

### ✚ Pedagogical Approach

- ✚ Outcome-based course modules.
- ✚ Courses include semester-long group projects.
- ✚ Courses include tools-based individual assignments integrating research exploration and programming tasks.
- ✚ Courses include In-class activities such as rapid programming sessions to encourage problem-solving and utilization of tools and methods fostering interactive learning environments.

### ✚ Teaching During Early Career

- ✚ Five years of teaching experience – undergraduate-level courses. (C, C++, Data Structures, Algorithm Design, Computer Networks, Programming the Web)
- ✚ Involved in organizing various faculty workshops, and student-level hackathons.
- ✚ Led coding clubs to promote collaborative learning.
- ✚ Represented student projects, resulting in several award-winning achievements.

### ✚ Courses of Interest to Offer (Selected)

- ✚ Computer Vision / Neuromorphic Vision for Intelligent Transportation Systems.
- ✚ 3D Modelling, 3D Interactions, AR/VR/XR Technologies, Human-Computer Interactions, Interactive Graphics.
- ✚ Machine Learning, Deep Learning.

## Funding

- ✚ **PFI-TT** (Partnership for Innovation – Technology Transfer): Broadening Real-Time Continuous Traffic Analysis on the Roadside using AI-Powered Smart Cameras, Funding Source: Partnerships for Innovation Technology Translation (PFI-TT) from **National Science Foundation** (NSF), September 1, 2023, to August 31, 2025, Total Award Amount: \$549,998.00, Role – Senior Personnel (Postdoc Fellow).

- ✚ **CIRC**: Planning-C: RoSA- An Open Research Platform for Roadside Traffic Situation Awareness, Funding Source: Community Infrastructure for Research in Computer and Information Science and Engineering (CIRC) from **National Science Foundation** (NSF), Proposed duration: January 1,

2024 to December 31, 2024 (Estimated), Total Requested Amount: \$100,00.00, Role – Senior Personnel (Postdoc Fellow). [Submitted, Under Review]

- ✚ **MASIS: Multi-pillar Approach to Strengthening Intersection Safety**, Submitted to **U.S. DOT Intersection Safety Challenge: Stage 1A (Concept Paper) Prize Competition**, Total Prize Money: \$100,000, Selection and Awards – December 2023, Role – Co-Lead. [Submitted, Under Review]
- ✚ **3rd ORKG (Open Research Knowledge Graph) Curation Grants**, Funding Source – The TIB Leibniz Information Centre for Science and Technology, Duration: July 1, 2023, to Dec 31, 2023, Total Award Amount: €2,400; Role – Principal Contributor.
- ✚ **2nd ORKG (Open Research Knowledge Graph) Curation Grants**, Funding Source – The TIB Leibniz Information Centre for Science and Technology, Duration: July 1, 2022, to Dec 31, 2022, Total Award Amount: €2,400; Role – Principal Contributor.
- ✚ **Proxemics-based pervasive interactions for wide-area and high-speed serial motion recognition**, Funding Source – **Institute of Information and Communication Technology Planning and Evaluation, Government of the Republic of Korea**, Duration: August 2018 to August 2022, Individual Award Amount: ₩159,485,400.00 Role: Participating Researcher.

## Publications

### Conference (Selected)

- ✚ Aayush, V., Bharatesh, C., Arpitsinh, V., Hua, W. and Yezhou, Y, 2024. eTraM: Event-based Traffic Monitoring Dataset. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR 2024).
- ✚ B. Chakravarthi, P. P. B. M, R. Imandi and P. K. B. N, "A Comprehensive Review of Leap Motion Controller-Based Hand Gesture Datasets," 2023 International Conference on Next Generation Electronics (NEleX), IEEE, Vellore, India, 2023.
- ✚ TS AM, BN PK, Chakravarthi B, Manjunath KV, Girish GN, Prasad P. 2023, November. Kinect Sensor-Based Indoor 3D Reconstruction-A Pilot Study. in 2023 7th International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS 2023). IEEE.
- ✚ Pahadia, H., Lu, D., Chakravarthi, B. and Yang, Y., 2023. SKoPe3D: A Synthetic Dataset for Vehicle Keypoint Perception in 3D from Traffic Monitoring Cameras. in 2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC 2023). IEEE
- ✚ Chakravarthi, B., Manoj Kumar, M. and Pavan Kumar, B.N., 2023, July. Event-Based Sensing for Improved Traffic Detection and Tracking in Intelligent Transport Systems Toward Sustainable Mobility. In International Conference on Interdisciplinary Approaches in Civil Engineering for Sustainable Development (pp. 83-95). Singapore: Springer Nature Singapore.
- ✚ Shravan, N., Manoj Kumar, M., Chakravarthi, B. and Bhargavi, C., 2023, July. Innovative Exploration Techniques: Utilizing IoT-Enabled Robots for Safe and Efficient Underground Tunnel Investigation. In International Conference on Interdisciplinary Approaches in Civil Engineering for Sustainable Development (pp. 71-81). Singapore: Springer Nature Singapore.
- ✚ Chakravarthi, B., Prasad, B.P., Chethana, B. and Kumar, B.P., 2022, July. Real-time human motion tracking and reconstruction using IMU sensors. In 2022 International Conference on Electrical, Computer and Energy Technologies (ICECET) (pp. 1-5). IEEE.
- ✚ Balasubramanyam, A., Patil, A.K., Chakravarthi, B., Ryu, J. and Chai, Y.H., 2021, October. Kinematically admissible editing of the measured sensor motion data for virtual reconstruction of plausible human movements. In 2021 IEEE International Conference on Systems, Man, and Cybernetics (SMC) (pp. 283-288). IEEE.

- ✚ Kim, D., Chakravarthi, B., Kim, S.H., Balasubramanyam, A., Chai, Y.H. and Patil, A.K., 2020, March. MotionNote: A Novel Human Pose Representation. In 2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW) (pp. 696-697). IEEE.
- ✚ Patil, A.K., Kim, S.H., Balasubramanyam, A., Ryu, J.Y. and Chai, Y.H., 2019, June. Pilot experiment of a 2D trajectory representation of quaternion-based 3D gesture tracking. In Proceedings of the ACM SIGCHI Symposium on Engineering Interactive Computing Systems (pp. 1-7).
- ✚ Lohith, J.J. and SB, B.C., 2015, June. Intensifying the lifetime of Wireless Sensor Network using a centralized energy accumulator node with RF energy transmission. In 2015 IEEE International Advance Computing Conference (IACC) (pp. 180-184). IEEE.

### Journal (Selected)

- ✚ Lohith, J.J., Kunwar, Singh. and Chakravarthi, B., 2023. Digital Forensic Framework for SmartContract Vulnerabilities using EnsembleModels. Multimedia Tools and Applications, Springer.
- ✚ Krishnappa, R.B., Subramanya, S.G., Deshpande, A. and Chakravarthi, B., 2023. Effect of Serpentine Flow Field Channel Dimensions and Electrode Intrusion on Flow Hydrodynamics in an All-Iron Redox Flow Battery. Fluids, 8(8), p.237.2
- ✚ Chakravarthi, B., Patil, A.K., Ryu, J.Y., Balasubramanyam, A. and Chai, Y.H., 2022. Scenario-Based Sensed Human Motion Editing and Validation Through the Motion-Sphere. IEEE Access, 10, pp.28295-28307.
- ✚ Ryu, J., Patil, A.K., Chakravarthi, B., Balasubramanyam, A., Park, S. and Chai, Y., 2022. Angular features-based human action recognition system for a real application with subtle unit actions. IEEE Access, 10, pp.9645-9657.
- ✚ Ryu, J.Y., Chakravarthi, B., Balasubramanyam, A., Patil, A.K. and Chai, Y.H., 2021. Motion Data Editing and Augmentation Method by Using the Motion-Sphere's Trajectory. Moving Image & Technology (MINT), 1(1), pp.10-14.
- ✚ Patil, A.K., Balasubramanyam, A., Ryu, J.Y., Chakravarthi, B. and Chai, Y.H., 2021. An open-source platform for human pose estimation and tracking using a heterogeneous multi-sensor system. Sensors, 21(7), p.2340.
- ✚ Patil, A.K., Balasubramanyam, A., Ryu, J.Y., BN, P.K., Chakravarthi, B. and Chai, Y.H., 2020. Fusion of multiple lidars and inertial sensors for the real-time pose tracking of human motion. Sensors, 20(18), p.5342.
- ✚ Balasubramanyam, A., Patil, A.K., Chakravarthi, B., Ryu, J.Y. and Chai, Y.H., 2020. Motion-sphere: Visual representation of the subtle motion of human joints. Applied Sciences, 10(18), p.6462.

### Public Work

#### Peer Review (Selected)

- ✚ Journals – MDPI Sensors, Applied Sciences, Sustainability, Applied System Innovation, vehicles, AI, Processes, Remote Sensing, Electronics, Energies, Machines, Elsevier – ISPRS Journal of Photogrammetry and Remote Sensing, Springer Nature – BMC Musculoskeletal Disorders, IEEE- Access, Robotics and Automation, Taylor & Francis- The Imaging Science Journal, Frontiers- Artificial Intelligence.
- ✚ Conferences – ICRA 2024, IROS 2023, CVPR 2023, CHI 2023, SMC 2022, VRST 2022, VRST 2021.

## Invited Talks

- ✚ Vision only Tech for AVs?", Trends and Recent Advancements in ITS, School of Computer Science and Engineering, Reva University, 5th October 2023, Reva University, Bengaluru, India.
- ✚ Blockchain IoT Integration- Recent Trends and Futuristic Applications, Collaboration with the Indian Society for Technical Education (ISTE), Department of Computer Science and Engineering, BMS College of Engineering, Bangalore, Karnataka, India on 23rd and 24th March 2023.
- ✚ Human Pose Estimation- A Fascinating Aspect of Computer Vision, The Research, Innovation and Consultancy Committee of the IT Department, College of Computing and Information Sciences, University of Technology and Applied Sciences - Ibri Sultanate of Oman on 10th November 2022.
- ✚ Blockchain and Internet of Things, AICTE Training and Learning (ATAL) Academy Sponsored Faculty Development Program organized by Department of Computer Science and Engineering, UIT-RGPV, Bhopal, Madhya Pradesh, India on 31st July 2021.
- ✚ Blockchain of Things, AICTE Training and Learning (ATAL) Academy Sponsored Faculty Development Program organized by Department of Computer Science and Engineering, BNMIT, Bengaluru, Karnataka, India on 18th January 2021.
- ✚ Challenges and Research Directions for Blockchains, AICTE Sponsored Faculty Development Program, organized by the Department of Computer Science and Engineering, Sona College of Technology, Salem, Tamilnadu, India on 10th February 2021.
- ✚ Human-Computer Interaction in Virtual Environments, Faculty Development Program, organized by Department of Computer Science and Information Science Engineering, R R Institute of Technology, Bengaluru, Karnataka, India on 17th August 2021.
- ✚ Mobile App Development using Android Studio- Hands-on Session, Indian Society For Technical Education sponsored Student Development Program, organized by Department of Computer Science and Engineering, Sri Venkateshwara College of Engineering, Bengaluru, Karnataka, India on 24th February 2018.
- ✚ IoT and its Applications, Student Development Program, organized by the Department of Computer Applications, Dr. Ambedkar Institute of Technology, Bengaluru, Karnataka, India on 1st March 2017.
- ✚ Opportunities in the field of IoT, Technical Education Quality Improvement Programme of Government of India Sponsored Student Development Program, organized by Department of Computer Science and Engineering, BMS College of Engineering, Bengaluru, Karnataka, India on 6th March 2017.
- ✚ Programming and Application Development using Python, Student Development Program Organized by Department of Computer Applications., Sir MVIT, Bengaluru, Karnataka, India on 11th March 2017.

## Achievements and Awards (Selected)

- ✚ Professor of Impact Award recognized and awarded by Ira A. Fulton Schools of Engineering, Arizona State University, Course offered- SER 594: Human-Computer Interaction, Spring 2023.

## Professional Body Membership

- ✚ Association for Computing Machinery (ACM).
- ✚ Computer Society of India (CSI) (Lifetime Membership)
- ✚ Indian Society for Technical Education (ISTE) (Lifetime Membership).

## Personal Information

- ✚ Full Name: Bharatesh Chakravarthi
- ✚ Nationality: Indian
- ✚ Languages Known: English, Kannada (Indian), Korean (elementary)
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