Chethan M. Parameshwara

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Research Interests

Computer Vision, Machine Learning, and Robotics with a special focus on
- 3D Computer Vision (3D object detection and tracking, visual/visual-inertial odometry, SLAM, sensor fusion)
- Edge Machine Learning (self-supervised learning, differential programming, few/zero-shot learning, multi-modal learning)

Education

University of Maryland, College Park, MD — *Aug 2017 – May 2022 (Expected)*
Ph.D. in Neuroscience and Cognitive Science
Advisors: Prof. Yiannis Aloimonos, Dr. Cornelia Fermüller
Thesis: Bio-inspired Motion Perception: From Ganglion Cells to Autonomous Vehicles

University of Maryland, College Park, MD — *Aug 2015 – May 2017*
M.Eng. in Robotics

Visvesvaraya Technological University, India — *Aug 2010 – May 2014*
B.Eng. in Electronics and Communications

Honors and Awards

- **William Hodos Dissertation Assistantship**, University of Maryland, College Park — *Aug 2021*
- **Graduate School Summer Research Fellowship**, University of Maryland, College Park — *May 2020*
- **Ministry of Human Resources Development Scholarship**, Government of India — *2010 – 2014*
- **Summer Research Fellowship**, Indian Science Academies — *Aug 2013*
- **National Talent Search Scholarship**, Government of India — *May 2008*

Skills

- *Programming Languages:* Python, C++, MATLAB
- *Software:* Deep Learning (PyTorch, TensorFlow, Caffe), Robotics (ROS), Computer Vision (OpenCV, PCL, Kornia), Simulators (Blender, Unreal Engine, Unity)
- *Hardware:* Neuromorphic Event cameras (Samsung, Sony Prophesee, iniLabs), Velodyne Puck (VLP-16) LiDAR, Intel Aero Quadcopter, Rethink Baxter Robot, Vicon Motion Capture

Relevant Experience

- **University of Maryland**, College Park, MD — *Aug 2017 – Present*
  Graduate Research Assistant || *Advisors*: Prof. Yiannis Aloimonos, Dr. Cornelia Fermüller
  - Designed differentiable optimization layers (combination of optimization and learning-based) for visual/visual-inertial odometry and SLAM to improve robustness and generalization across datasets
  - Developed zero-shot multi-motion detection algorithm for high speed and challenging lighting scenarios, which outperforms existing approaches (by 12%) on event camera datasets
  - Implemented and deployed classical and learning-based visual odometry (VO), visual-inertial odometry (VIO), and object detection approaches for dodging/detecting multiple dynamic obstacles on Intel Aero quadcopter
  - Developed an asynchronous spiking neural network for the motion segmentation problem, which consumes 50× less power than existing learning methods
- **SRI International (formerly Stanford Research Institute)**, Princeton, NJ — *Jun 2021 – Aug 2021*
  Research Intern || *Advisors*: Dr. David Zhang, Michael Piacentino
  - Developed a novel gradient-free learning approach for few-shot image classification with a faster convergence rate (10×) and consumes low memory (20×) than existing few-shot approaches

- **Neurala**, Boston, MA *Jun 2019 – Aug 2019*
  Research Intern || *Advisors*: Dr. Anatoli Gorchet, Dr. Matthew Luciw
  - Developed custom deep learning layers to improve few-shot learning capabilities for object detection tasks and deployed proposed layers on Neurala's Brain Builder software
- **Robot Training Academy**, College Park, MD *Sep 2016 – Dec 2016*
  Software Engineering Intern
  - Developed hand gesture tracking software for human-robot interaction in kitchen environments and performed testing of perception software modules on Rethink Baxter robot
- **Bosch**, Bengaluru, India *Aug 2014 – Jul 2015*
  Software Engineer
  - Developed and integrated vehicle software (AUTOSAR) modules into Bosch Engine Control Unit (ECU) and ensured robust functionalities by running tests in hardware-in-the-loop testing bench

Selected Publications

Please see Google Scholar for the complete list of publications.

[10] DiffPoseNet: Direct Differentiable Camera Pose Estimation
Parameshwara, C. M., Hari, G., Fermüller, C., Sanket, N. J., Aloimonos, Y.
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2022 (under review)

[9] TP-RLS: Gradient-free Few-shot Learning with Target Projected Recursive Least Squares
Parameshwara, C. M., Lomnitz, M., Zhang, D.
AAAI Conference on Artificial Intelligence (AAAI), 2022 (under review)

[8] AI Music Guru: Music Assisted Human Pose Correction
Shrestha, S., Fermüller, C., **Parameshwara, C. M.**, Win, P. T., Huang, T., Zukerman, A., Aloimonos, Y.
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2022 (under review)

[7] SpikeMS: Deep Spiking Neural Network for Motion Segmentation
Parameshwara, C. M.*, Li, S.*, Fermüller, C., Sanket, N. J., Evanusa, M. S., Aloimonos, Y.
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021 (* equal contribution)

[6] EVPropNet: Detecting Drones By Finding Propellers For Mid-Air Landing And Following
Sanket, N. J., Singh, C. D., **Parameshwara, C. M.**, Fermüller, C., de Croon, G.C.H.E., Aloimonos, Y.
Robotics: Science and Systems (RSS), 2021

[5] 0-MMS: Zero-Shot Multi-Motion Segmentation With A Monocular Event Camera
Parameshwara, C. M., Sanket, N. J., Singh, C. D., Fermüller, C., Aloimonos, Y.
IEEE International Conference on Robotics and Automation (ICRA), 2021

[4] NudgeSeg: Zero-Shot Object Segmentation by Repeated Physical Interaction
Singh, C. D.*, Sanket, N. J.*, **Parameshwara, C. M.**, Fermüller, C., Aloimonos, Y.
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021 (* equal contribution)

[3] EVDodgeNet: Deep Dynamic Obstacle Dodging with Event Cameras
Parameshwara, C. M.*, Sanket, N. J.*, Singh, C. D., Kuruttukulam, A., Fermüller, C., Scaramuzza, D., Aloimonos, Y.
IEEE International Conference on Robotics and Automation (ICRA), 2020 (* equal contribution)

[2] Event-based Moving Object Detection and Tracking
Mitrokhin, A., Fermüller, C., **Parameshwara, C. M.**, Aloimonos, Y.
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018

[1] Automated Mouse Behavior Recognition using VGG Features and LSTM Networks
Kramida, G., Aloimonos, Y., **Parameshwara, C. M.**, Fermüller, C., Francis, N. A., Kanold, P.
In Visual Observation and Analysis of Vertebrate And Insect Behavior Workshop (VAIB), 2016

Invited Talks

Conference talks and course guest lectures are excluded in this list.

- SRI International, Princeton, NJ — *Jun 2021*
  Title: Bio-inspired Motion Perception: From Ganglion Cells to Autonomous Vehicles
- Telluride Neuromorphic Cognition Engineering Workshop, Telluride, CO — *Sep 2020*
  Title: Insights into the Early Motion Pathway
- Telluride Neuromorphic Cognition Engineering Workshop, Telluride, CO — *Jul 2018*
  Title: Motion Segmentation with Event Cameras
- Portable Assisted Mobility Device Challenge, PACE Global Annual Forum, Turin, Italy — *Jul 2014*
  Title: STAG: Personal Assistive Mobility Device
- Collaborative Innovation Challenge, PACE Global Annual Forum, Pasadena, CA — *Jul 2013*
  Title: Black Box Alerting and Monitoring System for Automotive Vehicles

Teaching Experience

- **CMSC733 - Geometric Computer Vision**, University of Maryland — *Spring 2020, Spring 2021*
  Graduate Teaching Assistant || *Instructor*: Prof. Yiannis Aloimonos
- **CMSC426 - Computer Vision**, University of Maryland — *Fall 2018, Fall 2019, Fall 2020*
  Graduate Teaching Assistant || *Instructor*: Prof. Yiannis Aloimonos
- **CMSC434 - Human Computer Interaction**, University of Maryland — *Spring 2019*
  Graduate Teaching Assistant || *Instructor*: Dr. Vibha Sazawal

Volunteering Experience

- **Reviewer** — *Jan 2019 – Present*
  - IEEE Robotics and Automation Letters (RA-L)
  - International Conference on Robotics and Automation (ICRA)
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
  - IEEE Sensors Journal
  - IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
  - Winter Conference on Applications of Computer Vision (WACV)
- **Co-Chair**, NACS Grant Review Committee, University of Maryland — *Aug 2019 – Present*
  - Reviewed grant applications and coordinated between applicants and committee members/previous year recipients
- **Representative**, Graduate Student Government, University of Maryland — *Aug 2020 – Aug 2021*
  - Represented Neuroscience and Cognitive Science (NACS) in Graduate Student Government(GSG) and was a member of GSG Budget & Finance Committee

Mentoring/Advising

- Gokul Hari — *May 2021 – Present*
  Currently M.Eng. student in Robotics at University of Maryland, College Park
- Neal Anwar — *Sep 2021 – Present*
  Currently B.S. student in Computer Science and Mathematics at University of Maryland, College Park
- Simin Li — *Jun 2020 – May 2021*
  Currently Software Engineer at Nuro
- Max Morrison — *May 2019 – Jul 2020*
  Currently Software Engineer at Microsoft
- Rohith Jayarajan — *Aug 2018 – Jan 2019*
  Currently Software Engineer at AutoX