Krishna Murthy JATAVALLABHULA

Postdoc | Massachusetts Institute of Technology

Webpage github.com/krrish94 krrish94@gmail.com linkedin.com/in/krrish94

Cambridge, MA USA

Research objectives: Build *multisensory world models* for intelligent perception, reasoning, and action

Education

2018-2022	**PhD. in Computer Science**, Université de Montréal, Montréal, Canada. Thesis (letter) grade: **exceptional**.	**GPA: 4.15/4.00**
2015-2017	**MS by research in Computer Science and Engineering**, *International Institute of Information Technology, Hyderabad, India*.	**GPA: 10.00/10.00**
2011-2015	**M.Sc. (Tech.) Information Systems** (Bachelor's degree), *Birla Institute of Science and Technology (BITS), Pilani, India.*	**GPA: 6.71/10.00**

Work

March 2022 – Present | **Postdoctoral associate | MIT, (CoCoSci and CSAIL),**
With Joshua Tenenbaum and Antonio Torralba
Multisensory and multimodal perception | Differentiable probabilistic programming | Physical understanding | Robotics

September 2021 – December 2021 | **Course instructor | McGill University, Montreal, Canada,**
Co-designed and taught *Advanced Image Synthesis* (ECSE 446/546)
Computer graphics | Rendering | Differentiable programming

May 2021 – August 2021 | **Research intern | NVIDIA, Seattle Robotics Group, (Remote)**
With Prof. Dieter Fox, Prof. Animesh Garg, and Prof. Fabio Ramos.
Robotics | Deep learning | Computer graphics | Computer vision

May 2019 – August 2019 | **Deep Learning Research Intern | NVIDIA, Toronto AI Lab, Canada**
With Prof. Sanja Fidler. Led the development of Kaolin, a 3D deep learning library for PyTorch.
Deep learning | Computer vision | Computer graphics

November 2017 – June 2015 | **Research Assistant | Robotics Research Center, IIIT Hyderabad, India**
Conducted research in perception for autonomous driving and SLAM, taught graduate classes.
Autonomous Driving | Computer Vision | Robotics | Deep Learning | SLAM

Select Honors and Awards

2021 **NVIDIA graduate fellowship** One of *5* fellowships awarded worldwide
2021 **Google PhD fellowship** One of *3* fellowships awarded in North America in the *Machine perception, Speech technology, and Computer vision* category (*10* worldwide) (**declined**)
2020 **RSS pioneer 2020**. Selected to the *Robotics Science and Systems pioneers* cohort of 2020, a group of 22 leading senior PhD students and postdocs in the field.
2020 **Best paper award**. Our paper titled *Maplite: Autonomous intersection navigation without a detailed prior map* won the best paper award for 2020, announced by *Robotics and Automation Letters*.
2021 **Outstanding reviewer** for the IEEE Robotics and Automation Letters, 2020.
2021 **Outstanding reviewer** for the International Conference on Learning Representations
2021 **Outstanding reviewer** for the IEEE international conference on Computer Vision and Pattern Recognition
2020 **Top reviewer** for the *European Conference on Computer Vision* (ECCV), 2020 (1 out of 215 awards)
2019 **DIRO Excellence Award** for research and academic (second consecutive year)
2018 **ICRA PhD Forum**. Selected to present my work at the PhD Forum, ICRA 2018, in my first semester as a PhD student. Received generous travel support.
2018 **DIRO Excellence Award** for research and academic excellence from DIRO, Université de Montréal.
2017 **Graduated top of class**. Graduated with a GPA of $10.00/10.00$ during my Masters at IIIT Hyderabad.
2017 **RAS travel grant**. Awarded to cover my travel expenses for ICRA 2017, the premier robotics conference.
2017-2018 **Qualcomm Innovation Fellowship Finalist**. A spin-off of my work on Shape Priors for Road-Scene Understanding has been shortlisted as a finalist for the Qualcomm Innovation Fellowship (QINF), India.

2015-2018 **IIIT Hyderabad research fellowship**. Awarded a fellowship to cover tuition and living expenses during my Masters. Total value (approx.):

2012-2015 **Hackatronics**. Won the annual electronics hack contest for three years in a row. Conducted anually at BITS Pilani, Rajasthan India.

Select Grant Proposals

2022 **Army Research Lab**. "*Multimodal generative world models*". Co-written with Antonio Torralba and Josh Tenenbaum.

2020 **IVADO fundamental research grant**. "*Differentiable perception, graphics, and optimization for weakly supervised 3D perception*". Co-written with 3 principal investigators (PI): Liam Paull, James Forbes, Derek Nowrouzezahrai.

2021 **Facebook - unrestricted research gift**. "*Bridging Bayesian optimization and differentiable simulation*". Co-written with Jeannette Bohg (PI) and Rika Antonova (co-PI).

2014 **L K Maheshwari Grant**. Awarded a seed grant for a proposal involving cooperative navigation of a heterogeneous swarm of aerial and ground robots.

Featured publications and preprints

ConceptFusion: Open-set Multimodal 3D Mapping — Preprint

Krishna Murthy Jatavallabhula, Alihusein Kuwajerwala, Qiao Gu, Mohd Omama, Tao Chen, Shuang Li, Ganesh Iyer, Soroush Saryazdi, Nikhil Keetha, Ayush Tewari, Joshua B. Tenenbaum, Celso Miguel de Melo, Madhava Krishna, Liam Paull, Florian Shkurti, Antonio Torralba
Project page

GradSim: Differentiable simulation for system identification and visuomotor control — ICLR 2021

Krishna Murthy Jatavallabhula*, Miles Macklin*, Florian Golemo, Vikram Voleti, Linda Petrini, Martin Weiss, Breandan Considine, Jérôme Parent-Lévesque, Kevin Xie, Kenny Erleben, Liam Paull, Florian Shkurti, Derek Nowrouzezahrai Video OpenReview

gradSLAM: Dense SLAM meets automatic differentiation — ICRA 2020

Krishna Murthy Jatavallabhula, Ganesh Iyer, Liam Paull Video Project page

Other refereed conference publications and preprints

Learning Correspondence Uncertainty via Differentiable Nonlinear Least Squares — CVPR 2023

Dominik Muhle, Lukas Koestler, **Krishna Murthy Jatavallabhula**, Daniel Cremers

PAC-NeRF: Physics-augmented continuum neural radiance fields for geometry-agnostic system identification (Spotlight - Top 25% of accepted papers) — ICLR 2023

Xuan Li, Yi-Ling Qiao, Peter Yichen Chen, **Krishna Murthy Jatavallabhula**, Ming Lin, Chenfanfu Jiang, Chuang Gan

Bayesian Object Models for Robotic Interaction with Differentiable Probabilistic Programming — CoRL 2022

Krishna Murthy Jatavallabhula, Miles Macklin, Dieter Fox, Animesh Garg, Fabio Ramos

Rethinking Optimization with Differentiable Simulation from a Global Perspective (Oral - Top 6.5%) — CoRL 2022

Rika Antonova*, Jingyun Yang*, **Krishna Murthy Jatavallabhula**, Jeannette Bohg

f-Cal: Variational calibration of aleatoric uncertainty in regression — ICRA 2022

Dhaivat Bhatt, Kaustubh Mani, Dishank Bansal, Hanju Lee, **Krishna Murthy Jatavallabhula**, Liam Paull

TASKOGRAPHY: EVALUATING ROBOT TASK PLANNING OVER LARGE 3D SCENE GRAPHS CoRL 2021

Christopher Agia*, **Krishna Murthy Jatavallabhula***, Mohamed Khodeir, Ondra Miksik, Vibhav Vineet, Mustafa Mukadam, Liam Paull, Florian Shkurti

DRACO: WEAKLY SUPERVISED DENSE RECONSTRUCTION AND CANONICALIZATION OF OBJECTS ICRA 2021

Rahul Sajnani, AadilMehdi Sanchawala, **Krishna Murthy Jatavallabhula**, Srinath Sridhar, K. Madhava Krishna Paper Video

Project page

AUTOLAY: BENCHMARKING MONOCULAR LAYOUT ESTIMATION IROS 2020

Kaustubh Mani, N. Sai Shankar, **Krishna Murthy Jatavallabhula**, K. Madhava Krishna Project page

MULTI-OBJECT MONOCULAR SLAM FOR DYNAMIC ENVIRONMENTS IV 2020

Gokul Nair, Swapnil Daga, Rahul Sajnani, Anirudha Ramesh, Junaid Ahmed Ansari, **Krishna Murthy Jatavallabhula**, K. Madhava Krishna

MONOLAYOUT: AMODAL SCENE LAYOUT FROM A SINGLE IMAGE WACV 2020

Kaustubh Mani, Swapnil Daga, Shubhika Garg, N. Sai Shankar, **Krishna Murthy Jatavallabhula**, K. Madhava Krishna Video

KAOLIN: A PYTORCH LIBRARY FOR ACCELERATING 3D DEEP LEARNING RESEARCH WHITEPAPER

Krishna Murthy Jatavallabhula, Edward Smith, Jean-Francois Lafleche, Clement Fuji Tsang, Artem Rozantsev, Wenzheng Chen, Tommy Xiang, Rev Lebaredian, Sanja Fidler Paper Code

INFER: INTERMEDIATE REPRESENTATIONS FOR FUTURE PREDICTION IROS 2019

Shashank Srikanth, Junaid Ahmed Ansari, Karnik Ram R, Sarthak Sharma, **Krishna Murthy Jatavallabhula**, Madhava Krishna K Paper (PDF)

Project Page

CALIBNET: GEOMETRICALLY-SUPERVISED EXTRINSIC CALIBRATION USING 3D SPATIAL TRANSFORMER NETWORKS IROS 2018

Ganesh Iyer, Karnik Ram R., **Krishna Murthy atavallabhula**, K. Madhava Krishna Paper(PDF) Project page

THE EARTH AIN'T FLAT: RECONSTRUTION OF VEHICLES ON STEEP AND BUMPY ROADS FROM A MONOCULAR CAMERA IROS 2018

Junaid Ahmed Ansari, Sarthak Sharma, Anshuman Majumdar, **Krishna Murthy Jatavallabhula**, K. Madhava Krishna Paper(PDF)

Project page

CONSTRUCTING CATEGORY-SPECIFIC MODELS FOR MONOCULAR OBJECT SLAM ICRA 2018

Parv Parkhiya, Rishabh Khawad, **Krishna Murthy Jatavallabhula**, Brojeshwar Bhowmick, K. Madhava Krishna Paper(PDF)

BEYOND PIXELS: LEVERAGING GEOMETRY AND SHAPE CUES FOR MULTI-OBJECT TRACKING ICRA 2018

Sarthak Sharma, Junaid Ahmed Ansari, **Krishna Murthy Jatavallabhula**, K. Madhava Krishna Paper(PDF) Code

SHAPE PRIORS FOR REAL-TIME MONOCULAR OBJECT LOCALIZATION IN DYNAMIC ENVIRONMENTS IROS 2017

Krishna Murthy Jatavallabhula, Sarthak Sharma, and K. Madhava Krishna Paper(PDF)

RECONSTRUCTING VEHICLES FROM A SINGLE IMAGE: SHAPE PRIORS FOR ROAD SCENE UNDERSTANDING ICRA 2017

Krishna Murthy Jatavallabhula, G.V. Sai Krishna, Falak Chhaya, and K. Madhava Krishna Paper(PDF)

CLUSTER, ALLOCATE, COVER: AN EFFICIENT APPROACH FOR MULTI-ROBOT COVERAGE SMC 2015

Avinash Gautam, **Krishna Murthy Jatavallabhula**, Gourav Kumar, SP Arjun Ram, Bhargav Jha, and Sudeept Mohan

Maxxyt: An Autonomous Wearable Device for Real-Time Tracking of a Wide Range of Exercises UKSIM 2015
Danish Pruthi, Ayush Jain, **Krishna Murthy Jatavallabhula**, Ruppesh Nalwaya, and Puneet Teja

Refereed journal publications

MapLite: Autonomous intersection navigation without a detailed prior map (Best paper award) RAL 2020
Teddy Ort, **Krishna Murthy Jatavallabhula**, Rohan Banerjee, Sai Krishna Gottipati, Dhaivat Bhatt, Igor Gilitschenski, Liam Paull, Daniela Rus
Video Paper

Deep Active Localization RAL 2019
Sai Krishna*, Keehong Seo*, Dhaivat Bhatt, Vincent Mai, **Krishna Murthy Jatavallabhula**, Liam Paull Paper (PDF) Code

FAST: Synchronous Frontier Allocation for Scalable Online Multi-Robot Terrain Coverage JIRS 2017
Avinash Gautam, Bhargav Jha, Gourav Kumar, **Krishna Murthy Jatavallabhula**, SP Arjun Ram, and Sudeept Mohan

Refereed workshop publications

RobustPointSet: A Dataset for Benchmarking Robustness of Point Cloud Classifiers ICLR Workshops 2021
Saeid Asgari Taghanaki, Jieliang Luo, Ran Zhang, Ye Wang, Pradeep Kumar Jayaraman, **Krishna Murthy Jatavallabhula** Paper Code

GradSLAM: Automagically differentiable SLAM CVPR Workshops 2020, RSS Workshops 2020
Krishna Murthy Jatavallabhula, Ganesh Iyer, Soroush Saryazdi, Liam Paull Video Project page

Probabilistic object detection: Strengths, Weaknesses, Opportunities ICML Workshops 2020
Dhaivat Bhatt, Dishank Bansal, Gunshi Gupta, Hanju Lee, **Krishna Murthy Jatavallabhula**, Liam Paull

Reconstruct, Rasterize and Backprop: Dense shape and pose estimation from a single image CVPR Workshops 2020
Aniket Pokale, Aditya Aggarwal **Krishna Murthy Jatavallabhula**, K. Madhava Krishna

Geometric Consistency for Self-Supervised End-to-End Visual Odometry CVPR Workshops 2018
Ganesh Iyer*, **Krishna Murthy Jatavallabhula***, Gunshi Gupta, K. Madhava Krishna, and Liam Paull. Paper (PDF) Project page

Professional Service and Volunteering

2022-Present	Associate editor; IROS
2017-Present	Reviewer; robotics (ICRA, IROS, RAL, RSS, CoRL), Vision (CVPR, ICCV, ECCV, ACCV, WACV, ICVGIP, CRV), and ML (Neurips, ICML, ICLR, AAAI) venues
2020-2021	Student Volunteer, ICML (International Conference on Machine Learning)
2020	Student Volunteer, RSS (Robotics Science and Systems)
2020-2021	Student Volunteer, ICLR (International Conference on Learning Representations)

Outreach and Inclusion

2022-present	Mentor - Mila mentorship program
2022	Mentor - Black in AI academic program
2021	Student member, Mila equity, diversity, and inclusion (EDI) committee (1 of 7 student representatives)

2020 Mentor, Neurips workshop (DiffCVGP)
2020 Diversity and inclusion panel, RSS (Robotics Science and Systems)
2018 Mentor, AI for social good workshop. McGill University.

Workshops and Sessions Co-organized

Dec 2021 *Program co-chair*, Physical reasoning and inductive biases for the real world (Neurips 2021 workshop) Webpage
Oct 2021 *Program co-chair*, Differentiable 3D computer vision and graphics (ICCV 2021 workshop). Webpage
Jul 2021 *Program co-chair*, Robotics Science and systems pioneers workshop (RSS 2021). Webpage
May 2021 *Program co-chair*, Beyond the research paper: Rethinking how we share scientific understanding in ML (ICLR 2021 workshop). Webpage
Jan-May 2021 *Lead Organizer*, Robot learning seminar series: Mila and REAL - Winter 2021. Webpage
Dec 2020 *Program co-chair*, Differentiable vision, graphics, and physics applied to machine learning (Neurips 2020). Webpage
Sep-Dec 2020 *Lead Organizer*, Robot learning seminar series: Mila and REAL - Fall 2020. Webpage
Nov 2019 *Breakout session organizer*, Pan-Canadian SOCMLx.

Talks

Apr 24 2023 Invited talk - Stanford SVL
Apr 24 2023 Invited talk - Microsoft Mixed Reality Seminars
Mar 23 2023 Invited talk at Cornell Robotics
Feb 23 2023 Invited talk - Katerina Fragkiadaki's group (CMU)
Feb 22 2023 Invited talk - Scene representations group (MIT)
Jan 14 2023 Invited talk - IIT Kanpur robotics club
Dec 16 2022 Guest lecture - ROBGY 6203 - Robot perception - New York University (NYU)
Dec 2 2022 MIT BCS physical reasoning meeting - **Physical understanding: An AI perspective**
Dec 1 2022 Guest speaker - MIT EECS 6.S980 - Machine learning for inverse graphics (Instructor: Vincent Sitzmann)
Oct 6 2022 Invited talk - MIT Machine Intelligence Research Forum - **Differentiable programming for spatial AI**
Dec 2021 Invited talk - Talking robotics series [video]
Nov 2021 Guest lecture - Introduction to autonomous vehicles (Duckietown) - Université de Montréal
Oct 2021 Structural and Compositional Learning on 3D Data, ICCV 2021 Workshop - **Taskography: Task planning over large 3D scene graphs**
Aug 2021 AI for Autonomous Driving workshop, IJCAI 2021 - [video]
July 2021 Tartan SLAM series - Carnegie Mellon University - [video]
June 23 2021 Invited talk - ML reading group at the University of Sydney
June 15 2021 Invited talk - Dynamical systems reading group, Mila
Apr 7 2021 Microsoft autonomous systems - **gradSim: A differentiable simulation framework**
Mar 26 2021 AI in robotics (University of Toronto) - **gradSLAM + gradSIM** [video]
Feb 23 2021 KUIS AI (Istanbul) - **Building differentiable models of the 3D world** [video]
Jan 19 2021 MIT Vision seminar - **Building differentiable models of the 3D world** [video]
Oct 11 2020 IEEE chapter, Indonesia - **Deep learning for robot perception**
Sep 22 2020 Cornell robotics group - **gradSLAM: Dense SLAM meets automatic differentiation**
Aug 29 2020 CV Talks, India: Computer vision talks - **gradSLAM: Automagically differentiable SLAM** [video]
Jul 2020 Robotics Science and Systems pioneers - **gradSLAM: Dense SLAM meets automatic differentiation**
Jul 2020 Robotics Science and Systems: structured approaches to robot learning workshop - **gradSLAM: Automagically differentiable SLAM**
Jun 2020 CVPR: Deep declarative networks workshop - **gradSLAM: Automagically differentiable SLAM**
Feb 2019 NVIDIA Webinar - **3D deep learning with Kaolin**

Teaching

2021 (Instructor) **Realistic / Advanced image synthesis** (ECSE 446/546) at McGill, Montreal.
2021 (Teaching assistant) **Representation Learning** at Mila and Université de Montréal, with Aaron Courville.
2020 (Teaching assistant) **Advanced projects in deep learning** at Mila, with Pierre-Luc Carrier and Joumana Ghosn.

2017 (Designed and co-taught) **Mobile Robotics and Computer Vision** at IIIT Hyderabad, with Prof. K. Madhava Krishna.
2016 (Teaching assistant) **Mobile Robotics** at IIIT Hyderabad, with Prof. K. Madhava Krishna.

Students Mentored

A list of students I have closely mentored (e.g. on a research or technical project). (Criteria: Mentorship lasted 3 months or longer)

5 Students at their PhD level or equivalent.
20 Students pursuing Masters programs
18 Students at their undergraduate level of study (includes UROP students at MIT, visitors / interns at Mila, Université de Montréal and IIIT Hyderabad, India)