





INTERESTS	 Reinforcement Learning  Graphics & AR/VR  Computer Vision  Online Learning
EDUCATION	Indian Institute of Technology, Bombay , Mumbai, India Dual Degree (Bachelor and Master of Technology) July 2016 - June 2021 <ul style="list-style-type: none"> • Majoring in Electrical Engineering with overall CPI: 9.00/10 • Specializing in Communication and Signal Processing (Specialization CPI: 9.57/10) • Completed Minor in Computer Science and Engineering
PUBLICATIONS	<p>[5] 3D-NVS: A 3D Supervision Approach for Next View Selection [Paper] <u>Under review</u> at <i>IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR-21)</i> K. Ashutosh, S. Kumar, S. Chaudhuri</p> <p>[4] Bandit algorithms: Letting go of logarithmic regret for statistical robustness [Paper, Code] <u>Under review</u> at <i>International Conference on Artificial Intelligence and Statistics (AISTATS-21)</i> K. Ashutosh, J. Nair, A. Kagrecha, K. Jagannathan Update: Reviewers' avg. score 7.5/10</p> <p>[3] Lower Bounds for Policy Iteration on Multi-action MDPs [Paper, Code] <i>IEEE Conference on Decision and Control (CDC)</i> 2020 K. Ashutosh[†], S. Consul[†], B. Dedhia[†], P. Khirwadkar[†], S. Shah[†], and S. Kalyanakrishnan</p> <p>[2] Hardware Performance Analysis of Mobile-Based Augmented Reality Systems [Paper, Slides] <i>IEEE International Conference on Computational Performance Evaluation (ComPE)</i>, 2020 K. Ashutosh</p> <p>[1] A Multilayer Network Approach for Studying Creative Ideation Markers from EEG [Paper] <i>Brain Informatics Conference (BI)</i> 2018 R. Bose[†], K. Ashutosh[†], A. Bezerianos, N. Thakor, J. Li and A. Dragomir ^(† joint first-author)</p>
MASTER'S THESIS	Three-Dimensional Shape Reconstruction using View Predictions Jul'20 - Present <i>Guide:</i> Prof. Subhasis Chaudhuri, Director, IIT Bombay <u>Background:</u> SoTA reconstruction algorithms choose highly constrained viewpoints. We propose view-selection aided reconstruction using images without depth values and achieve improvement. <ul style="list-style-type: none"> • Obtained images by rendering 3D meshes from 24 custom viewpoints on ShapeNet dataset • Developed a two-staged CNN to jointly learn view selection and voxel grid reconstruction • Outperformed existing two-view results by obtaining an improvement of 3% in IoU and demonstrated an effective view prediction without direct supervision of ground truth next views
R&D EXPERIENCE	Statistically Robust Multi-armed Bandit Algorithms [Paper, Code, Blog] Jan'20 - Jun'20 <i>Guide:</i> Prof. Jayakrishnan Nair, Electrical Engineering, IIT Bombay <u>Background:</u> Classical MAB algorithms assume a known distribution, or bounds on the rewards, or both. We propose statistically robust algorithms which requires minimal assumption on rewards. <ul style="list-style-type: none"> • Established fragility of classical algorithms with respect to the parameters or class of its reward distribution i.e. these algorithms can incur <i>inconsistent</i> regret with mismatched parameter • Proposed 3 novel statistically robust algorithms incurring a regret <i>slightly worse</i> than logarithmic • Obtained slowly-growing confidence bounds which are oblivious to reward parameters <p>Lower Bounds for Policy Iteration on Multi-action MDPs [Paper, Code, Blog] Sep'19 - Mar'20 <i>Guide:</i> Prof. Shivaram Kalyanakrishnan, Computer Science and Engineering, IIT Bombay <u>Background:</u> Lower bounds for Policy Iterations are either not known or known for fixed states (eg. $n = 2$). We achieve a tight close bounds on a variety of stochastic and deterministic PI algorithms. <ul style="list-style-type: none"> • Proposed a variant of PI, along with MDP construction achieving a lower bound of $\Omega(k^{0.5n})$ • Proved a lower bound of $\Omega(k \cdot 2^n)$ for Simple PI and $\Omega(k \cdot n)$ for Howard's PI (Greedy PI) • Generalised the lower bound for randomized PI having $\log(k)$ scaling for action-selection </p>

RLConnect: a Reinforcement Learning agent to play Dots and Boxes [\[Play\]](#) Sep'20 - Dec'20

Guide: Prof. Amit Sethi, Electrical Engineering, IIT Bombay

Background: We develop a game-playing agent to play Dots and Boxes by choosing appropriate state variables and feature vectors. We minimize the decision time and compare with other SoTA.

- Developed web-based GUI with human-human, human-computer and computer-computer play
- Added feature for self-play to significantly increase number of games for learning optimal policy
- Compared win ratio against humans for agent trained with Q-Learning, SARSA and DQN

Capture the Flag: a novel Augmented Reality based tabletop game [\[Report\]](#) Jan'19 - May'19

Guide: Prof. Parag Chaudhuri, Computer Science and Engineering, IIT Bombay

Background: We propose a novel AR game concept that is spatially-aware and adjusts game elements based on real-world terrain of game area. We show its effectiveness in education and training.

- Surveyed Augmented Reality applications and developed a novel AR-based tabletop game
- Designed challenging levels and added elements like staircase which adapts to real-world terrain
- Conducted user survey to assess novelty, scalability and relevance and obtained positive results

Discriminative Localisation in Medical Images [\[Blog\]](#)

Jan'18 - May'18

Guide: Prof. Amit Sethi, Electrical Engineering, IIT Bombay

Background: Recent work in CNN architectures have enabled us to visualise class specific activation regions. We apply this method to more challenging Pathology Images to explore hidden features.

- Developed algorithm to visualize the parts of an image influencing decision in CNN architectures
- Deployed the algorithm to Breast Cancer Dataset and obtained activation regions in tissues
- Investigated hidden features in 4 classes - Benign, In-Situ, Normal and Invasive tissues

INTERNSHIPS

HoloSnap: Augmented Reality application to share Point Clouds

Budapest, Hungary

Guide: Mr. Zsolt Mihályfi, CEO, 360World

Nov, 2019 - Jan, 2020

- Developed an iOS-based prototype application that uses Depth Capture to record 3D point clouds
- Integrated the application with Spatial Anchors to place the 3D point cloud at a geo-location
- Designed the application in Unity 3D with Firebase backend and tested the app on iOS devices

Prototyping and Signal Processing for around Ear EEG system

Kanagawa, Japan

Guide: Mr. Yota Komoriya, Sony Corporation

May, 2019 - Jul, 2019

- Made prototype devices, experimental protocol and software for evaluation of ear-EEG
- Evaluated EEG signal around ear in the same way as the designated literature

Extended Visualization: Focus in GLSL

Remote

Guide: Prof. Eleftherios Garyfallidis, Indiana University Bloomington

May, 2018 - Aug, 2018

- Employed OpenGL Shading Language to build GPU-accelerated visualisations of high-poly data
- Studied the various uses of Fragment, Vertex and Geometry Shaders and extended the viz module
- Implemented fast Shader-based rendering capable of displaying 10k+ high-poly spheres on GPU

Multi-layered Analysis of Brain Networks [\[Paper\]](#)

Singapore

Guide: Prof. Nitish Thakor, NUS and Johns Hopkins University

May, 2018 - Jul, 2018

- Investigated the differences in Brain Connectivity Pattern during creative ideation using EEG
- Obtained Statistically Significant difference between convergent thinking and divergent thinking

ACHIEVEMENTS

Awarded Department Color for valuable contribution to mentorship program of IITB	2020
Invited to witness Republic Day Parade as a guest of Hon'ble Prime Minister of India	2017
Bagged Rashtrapati Puraskar (President's Award) by the Hon'ble President of India	2016

EXAMS &
SCHOLARSHIPS

JEE Mains - 99.97 %ile out of 1.2 million JEE Advanced - 99.14 %ile out of 0.15 million	2016
Indian National Mathematical Olympiad (INMO) to select team to represent India at IMO	2015
National Talent Search Scholarship (NTSE) to nurture young talent	2012-19
Kishore Vyagyanik Protsahan Yojana (KVPY) scholarship for research in Basic Sciences	2015

TALKS	Augmented Reality Applications - organized by Electronics and Robotics Club, IITB 2020 Teaching Methodology of Mathematics - organized by NERIST, Arunachal Pradesh 2016
ACADEMIC PROJECTS	An Optimizer's approach to Stochastic Control Problems <i>Guide:</i> Prof. Ankur Kulkarni, IIT Bombay Aug, 2020 - Dec, 2020 <ul style="list-style-type: none"> Studied existing literature on general optimization-based framework for solving <i>nonconvex</i> Stochastic Control Problems with Nonclassical Information Structures through <i>convex relations</i> Used data processing inequalities to construct suitable convex relaxations for new cost functions Snapshot Compressed Sensing [Code, Slides] <i>Guide:</i> Prof. Ajit Rajwade, IIT Bombay Jan, 2020 - Jun, 2020 <ul style="list-style-type: none"> Surveyed literature in Snapshot Compression techniques and its application in images and videos Investigated the performance of two recent algorithms - both theoretically and experimentally Compared the reconstruction losses with different sensing matrices, noise levels and distributions Video Cartoonification [Slides] <i>Guide:</i> Prof. Ajit Rajwade, IIT Bombay Aug, 2019 - Nov, 2019 <ul style="list-style-type: none"> Studied various image cartoonification techniques and analysed its generalizability to video frames Applied Edge Tangent Flow (ETF), Flow-Based Bilateral Filter (FBL) to cartoonify videos Achieved 77% faster average time and robustness to noise compared to per-frame cartoonification Kalman Filter based Object Tracking [Report] <i>Guide:</i> Prof. Debraj Chakraborty, IIT Bombay Aug, 2019 - Nov, 2019 <ul style="list-style-type: none"> Demonstrated multi-object tracking in video frames using Kalman Filter and obtained smooth tracking of objects in videos with static camera and additive Gaussian noise Employed standard image algorithms to extract features and chose standard state variables
KEY COURSEWORK	Computer Science: Advances in Intelligent and Learning Agents, Advanced Machine Learning, Computer Graphics, Data Structures and Algorithms, Advanced Image Processing Electrical Engineering: Computer Vision, Advanced Signal Processing, Speech Processing, Control Systems, Analog and Digital Circuits, Microprocessors, Communication Systems Basics: Calculus, Linear Algebra, Probability, Computer Programming, Electricity and Magnetism
OPEN SOURCE	scikit-learn: Contributed 2k+ lines of code & introduced RegressorChain [doc] & other features dipy: Implemented GPU-accelerated OpenGL based rendering of brain image dataset
PROGRAMMING	Python (with PyTorch, TensorFlow etc.), C++, C, OpenGL, MATLAB, Unity3D
POSITIONS OF RESPONSIBILITY	Teaching Assistant in Fall 2020 for EE 635 – Applied Linear Algebra, IIT Bombay <ul style="list-style-type: none"> Conducted online sessions, prepared and assessed assignments and planned the logistics Department Academic Mentor Coordinator , Electrical Engineering, IIT Bombay <ul style="list-style-type: none"> Spearheaded a team of 24 mentors, chosen after a rigorous process of interviewing more than 80 candidates, to guide 150+ students of EE Department facing academic and personal issues Institute and Department Academic Mentor, IIT Bombay <ul style="list-style-type: none"> Assisted more than 30 students over 3 academic years in overcoming academic and co-curricular issues and help them decide between various opportunities in the university
EXTRAS	Storytelling, Football, Long-distance Running, Traveling, Adventure Sports, Trained Scout
REFERENCES	Prof. Subhasis Chaudhuri, Director, IIT Bombay [webpage, email] Prof. Shivaram Kalyanakrishnan, Associate Professor, CSE, IIT Bombay [webpage, email] Prof. Jayakrishnan Nair, Associate Professor, EE, IIT Bombay [webpage, email] Prof. Eleftherios Garyfallidis, Assistant Professor, Indiana University [webpage, email]