

# Somnath Sendhil Kumar

https://hex-plex.github.io

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## EDUCATION

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- **Indian Institute of Technology (BHU), Varanasi** Varanasi, India  
*Bachelors of Technology in Electrical Engineering; GPA: 8.59 / 10.0* *Jul. 2019 – May 2023*

## PUBLICATION

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1. **Somnath Sendhil Kumar**, Qin Lin, John M. Dolan, "LatentCBF: Control Barrier Definition on Latent Space"
2. **Somnath Sendhil Kumar**, Pavan Kulkarni, Yuvaraj Govindarajulu, "VidModEx: Black Box Model Extraction for Video Classification models with Efficient Query Samples"
3. Aditya Shirwatkar, **Somnath Kumar**, Shishir Kolathaya, Bharadwaj Amrutur, Shalabh Bhatnagar, Shamrao Garur, Vinod Kumar, "Realizing Linear Controllers for Quadruped Robots on Planetary Terrains"
4. **Somnath Sendhil Kumar**, Pratik Chattopadhyay, Lipo Wang, "BGaitR-Net: Occluded Gait Sequence reconstruction with temporally constrained model for gait recognition"

## EXPERIENCE

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- **Microsoft Research India** Bangalore, India  
*Research Fellow* *July 2023 - Present*
  - **Copilot for Training and Education:** Worked on integration of LLMs and ML pipelines for building Co-pilot. I was responsible for building various use cases of LLM from assessments to Bring your own data. [link]. Also assisted integrating the copilot into Microsoft Community Training with 10.4+ M users
  - **Model Optimization:** Finetuning new models based on user feedback from the deployed copilot. Mainly focusing on increasing inference throughput and scalability.
  - **Visual Reasoning:** Currently working on Improving the Visual Reasoning capability of the Foundational Vision-Language Model, coupled with an external LLM for better reasoning and analyzing models. Investigating the use of Hierarchical RL as a dialogue-level optimization for such interactions.
  - **Technologies:** Deepspeed, vLLM, Torch, RLHF, Hierarchical RL, MultiModal Reasoning
- **Carnegie Mellon University** Pittsburgh, Pennsylvania  
*Research Assistant Under Dr. John Dolan* *Mar 2022 - Mar 2023*
  - **Control Barrier Definition on Latent Space:** Learning Control Barrier functions for a non linear latent space, aimed to guide the learning to converge to a robust safety critical Policies.
  - **lipschitz Generative Adversarial Networks:** Evaluated lipschitz Conditional GAN for learning representation using bjourck Conv2D for learning a lipschitz representation a constrain for a CBF.
  - **Technologies:** CVXOPT, Torch, QPOases, GAN, Bjorck Conv2D, Reinforcement Learning
- **Indian Institute of Science Supported by Microsoft Research** Bangalore, India  
*Summer Internship supported by Microsoft Research India* *May 2022 - Jul 2022*
  - **Improving Sample Efficiency in Evolutionary RL using Off-policy Ranking:** A novel off-policy alternative for ranking with state-of-the-art ES method called the Augmented Random Search (ARS). Demonstrated efficiency on MuJoCo tasks, achieving reward thresholds with about 70% less data in comparable running times.[link]
  - **Hardware to Simulation Sync:** Compiled framework for syncing data with Simulation for analyzing the current state of the robot, and deployment of various policies on the fly. This enabled automated training on hardware.
  - **Technologies:** Torch, OROCOS, ROS, Isaac gym, MPC, QPOases, C++, Offpolicy Reinforcement Learning
- **Bosch Global Software Technologies, AIShield Department** Bangalore, India  
*Data Scientist Intern* *Mar 2022 - May 2022*

- **Vulnerability Analysis for Video Classification Model against Black Box Extraction:** Successfully integrated various Black Box Model Extraction algorithms into the existing pipeline, enabling comprehensive analysis of vulnerabilities in video classification models and the formulation of potential prevention strategies. Significantly enhanced the baseline, achieving an extraction accuracy that surpassed previous benchmarks by 213%.
- **Technologies:** Torch, Video Generative networks, Kubernetes, Azure, Adversarial Learning

### ● NimbleEdge

San Francisco, California

Research Engineer Intern

Jan 2022 - Mar 2022

- **Federated Learning:** Integrated Meta Learning based Recommendation system in a custom Federated Learning Simulator called EnvisEdge
- **Distributed Computing:** Implemented Trainer and Actor Methods in Scala based back-end to enable deployment of edge computation framework
- **Technologies:** Torch, Scala, PySyft, Edge Computing, Meta Learning, Federated Learning

### ● Indian Institute of Science

Bangalore, India

Summer Research Internship Under Dr. Shishir N Kolathaya, IISc.

April 2021 - Jan 2022

- **ROS Development and Optimal Control:** Developed the Stochlite (Quadruped Robot) ROS Package and Integrated a Model Predictive Control for the quadruped, that contributed to robust locomotion in irregular and unknown terrains. [link]
- **Reinforcement Learning:** Worked on the Linear Policy based Controller Designed for the platform [link]. While working on Model based Learning methods for challenging irregular terrains. Contributed in training the policies on Isaac gym based environment.
- **Technologies:** Torch, OROCOS, ROS, Isaac gym, Pybullet, MPC, QPOases, C++, Reinforcement Learning

## PROJECTS

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- **Few Shot Learning for Domain Adaption for QA Tasks** Meta Learning [link]  
Deployed meta-learned models for few-shot adaptations in Comprehensive Question Answering Task.
- **Black Box Model Extraction Attacks for Video Classification** Model Extraction Attacks [link]  
Attacking Teacher models to distill into student without Any Data.
- **Graph Neural Network based communication in Multi Agent Reinforcement learning** MARL [link]  
Graph Neural Network based communication in MARL based on different heuristics.

## RELEVANT COURSE'S TAKEN

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- ○ **MA-101** Engineering Mathematics-I (Real analysis)
- **Linear Algebra** by MIT OpenCourseWare [Unofficial].
- ○ **Machine Learning** and **Deep Learning** by Andrew NG on Coursera
- **Reinforcement Learning Specialization** by University of Alberta on Coursera.
- **CS224n** Natural Language Processing with Deep Learning by Stanford [Unofficial].
- **CSO302** Ubiquitous Computing and Federated Learning

## ACHIEVEMENTS

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- Awarded the prestigious **Institute Blue, highest recognition for contributions to the Institute**, emblematic of notable achievements and exemplary leadership exhibited within Science & Technology Council.
- **2nd place in All Indian Institute of Technology Robotics Association 2021** Challenge by for Maximum coverage of warehouse using Mutliple Agents, and stood second against all prestigious institutions in India.
- Lead the team and ranked **2** in **Inter-IIT 2022 Bosch's Model Extraction Attack For Video Classification** Challenge by developing black-box model extraction solution using generative models [More Details]
- **Leadership:**
  - **Joint Secretary** of the Club of Programmers, IIT (BHU) [link].
  - **Tech lead** at RoBoReG [link], A student research based group in the domain of Intelligent Robotics.
  - **Founding Member** of IG group [link], A student based research group in the field of Machine learning focusing majorly on NLP and RL at IIT(BHU), Varanasi.