# Vaibhav Balloli

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## Education

**University of Michigan, Ann Arbor** *2023 - Present*
*Ph.D. in Computer Science and Engineering*

**BITS Pilani, Hyderabad Campus** *2016 - 2020*
*B.E in Electronics and Communication Engineering*
GPA: 8.46/10
TOEFL: 111(R:30, L: 28, S: 25, W: 28)
Courses: Machine Learning, Information Retrieval, Computer Graphics, Game Theory, Information Theory and Coding, Computer Architecture.

## Research Experience

**Microsoft Research India** *June 2022 - Present*
*Research Fellow*
Advisors: Dr. Akshay Nambi & Tanuja Ganu
Topics: Reinforcement Learning, Integer Linear Programming, Large-scale Optimization, Large Language Models.
Projects: Vasudha, VeLLM

**Microsoft Research India** *June 2021 - June 2022*
*SCAI Research Fellow*
Advisors: Dr. Akshay Nambi, Tanuja Ganu & Dr. Venkat Padmanabhan
Topics: Computer Vision, Contextual Bandits, Visual Localization, End-to-End systems
Projects: HAMS

**Distributed Systems and Algorithms Lab, IST Austria** *June 2020 - April 2021*
*Research Intern*
Advisors: Prof. Dan Alistarh
Topics: Structured Pruning using Reinforcement Learning and Approximate Hessian Inverse

## Publications

### Under review

3. **Breaking Language Barriers with a LEAP: Learning Strategies for Polyglot LLMs**
   Akshay Nambi, **Vaibhav Balloli**, Mercy Ranjit, Kabir Ahuja, Tanuja Ganu, Sunayana Sitaram, Kalika Bali
   *Topics: Large Language Models, Contextual Bandits, Multilingual Evaluation, Human Feedback.*

2. **EnCortex: A General, Extensible and Scalable Framework for Decision Management in New-age Energy Systems**
   **Vaibhav Balloli**, Millend Roy, Anupam Sobti, Tanuja Ganu, Akshay Nambi.
   *Topics: Large-scale Reinforcement Learning(Model-free, Offline), Imitation Learning, Integer Linear Programming.*

1. **Chanakya: Learning Tradeoffs for Adaptive Streaming Perception via Contextual Bandits**
   Anurag Ghosh, **Vaibhav Balloli**, Aditya Singh, Harish YVS, Akshay Nambi, Tanuja Ganu.
   *Topics: Contextual Bandits, Streaming Object Detection and Tracking, Reward design.*

### Conference Publications

1. **Video Streaming using Scalable Video Coding over Opportunistic Networks**
   Abhishek Thakur, **Vaibhav Balloli**, Arnav Dhamija.
   *WiSPNET'19*

### Theses

1. **Multi-objective Neural Architecture Search via Reinforcement Learning**.
   **Vaibhav Balloli**.
   *Undergraduate Thesis, 2020. A Grade.*

## Software

1. **EnCortex - Stochastic Optimization for Renewable Energy sources**.
   *Microsoft Research India*
   Reinforcement Learning(PyTorch, Stable-Baselines3) | Stochastic Optimization | MLOps on Azure.
   RL and Stochastic optimization algorithms running large-scale optimizations that are currently used by customers at Microsoft to maximize their profitability and sustainability goals.
2. **Automated License Testing - Microsoft Research India**.
   *Microsoft Research India*
   This system contains Computer Vision algorithms that perform Visual SLAM, Object Detection, and Trajectory analysis. As of August 2022, 4 sites have been deployed successfully in different parts of India.

## Internships

1. **IST Austria**
   •Explored how RL algorithms can be adapted for Structured Pruning(channel, 2:4 sparsity) in computer vision models.
2. **AlphaICs**
   •Devised efficient data structures, algorithms, and protocols for AlphaIC's hardware accelerator and deep learning library.
   •Built an application in Python for the inter-operability of deep learning models and quantization of these models for faster inference using TensorFlow, ONNX, and PyQT5.

## Projects

1. **Offlax**
   Offline Reinforcement Learning library in JAX. Implements SOTA algorithms with an efficient file IO interface.
2. **NFNets and Adaptive Gradient Clipping GitHub 317★**
   Re-implemented DeepMind's NFNets and Adaptive Gradient Clipping for all optimizers in PyTorch..
3. **SmartCampus**
   •Co-founded SmartCampus, a student group that built Cashless system on campus, handling transactions worth 25 million rupees during my tenure.
   •Built an Android app and a web backend on a free server to handle **3000 active users per minute**.
   •Built a prototype recommender system using information retrieval and modern recommender system techniques.
4. **VECTORS**
   •Scalable Video Coding encoded video on a DTN(Disruption Tolerant Network) developed for Android devices under the supervision of Dr. Abhishek Thakur.
   •Developed an Android App cross-compiling SHM and JSVC for ARM processors to encode recorded video to send on the network
   •Used Opportunistic Network Environment(ONE) to run simulations and automatic generation of reports from results.
5. **Open Source: Google's Swift For Tensorflow, JAX/Flax**
   •Contributed to the core framework implementing different optimization algorithms and layers.
   •Image classification models to the Swift for TensorFlow models repository.
   •Feature additions to JAX/Flax.

## Select Awards and Honors

- Selected for the HAIST/MAIA Intro Fellowship on AI Safety
- **Press:** HAMS Automated License Testing featured in Punjab News Express *2022*
- **Winner** of Microsoft Global Hackathon, 2021(Future Of Edge Computing Track) *2021*
- **SmartCampus** successfully managed **₹25 million** in transactions. *2020*

- Talk at WiSPNET'19 presenting our paper Video Streaming using Scalable Video Coding over Opportunistic Networks(VECTORS). *2019*

## Professional Responsibilities

- Selected as Teaching Assistant for ClimateChange.ai Summer School *2023*
- **Head of SmartCampus** at BITS Pilani Hyderabad Campus
- **Member of Automation and Robotics Club** at BITS Pilani Hyderabad Campus. Organized microcontroller workshop for a group of 100 students
- **Volunteer** at ClimateChange.ai
- **Founder and Organizer** of ML Reading Group at BITS Pilani Hyderabad Campus
- **Mentorship**
  - •Jonathan Samuel (Research Intern @ MSR -> SDE Gojek )
  - •Isha Singh (Research Intern @ MSR)