

AKSHIT KUMAR

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RESEARCH INTERESTS

Interests Wireless Networks, Internet of Things, Robotics, Optimization Theory, Communication Theory

EDUCATION

Bachelor of Technology in Electrical Engineering (Minor in Robotics) Indian Institute of Technology, Madras, CGPA: 8.64/10.00 (Minor GPA : 9.00/10.00) Eligible for <i>Honours Program</i> at IIT Madras	2014 - 2018
Central Board of Secondary Education, Class XII Delhi Public School, R.K.Puram , 97.6%	2013 - 2014
Central Board of Secondary Education, Class X Delhi Public School, R.K.Puram , CGPA: 10.00/10.00	2011 - 2012

SCHOLASTIC ACHIEVEMENTS

- Industry Category Winner at Microsoft OneWeek Hackathon¹ (2016)
- Gold Medalist at Inter IIT Tech Meet² 2016 in Internet of Things Category (2016)
- Recipient of Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship by Government of India (2014)
- Recipient of National Talent Search Examination (NTSE) scholarship by Government of India (2011)
- Recipient of Junior Science Talent Search Examination (JSTSE) scholarship by Government of Delhi (2012)
- All India Computer Science Topper in Central Board for Secondary Education in Grade 12th (2014)

PATENTS

- Provisional patent application 400838-US-NP "*Low-cost, Long-term Aerial Imagery*"
- Provisional patent application 400837-US-NP "*Aerial Imaging of a Region using Helium-filled Balloons*"

RESEARCH PROJECTS

Performance Analysis of Tunable Servers with Finite Buffer Capacities <i>Guide: Dr.Rahul Vaze, Tata Institute of Fundamental Research</i>	May 2017 - Present
<ul style="list-style-type: none">· Worked on optimizing the dynamic speed scaling problem in servers with finite buffers and hard QoS constraint of packet drop probability in an online stochastic setting· Characterized a general lower bound & showed a fixed fraction policy to be near-optimal· Derived tighter lower bounds for Bernoulli arrivals in the cases of arbitrarily small packet drop constraints	
Development of IoT system to enable long-term aerial imagery <i>Guide: Dr.Ranveer Chandra & Dr. Swaminathan Manohar, Microsoft Research</i>	June 2016 - July 2016
<ul style="list-style-type: none">· Developed a low-cost long-term aerial imagery system with lighter-than-air gas filled balloon system which includes development of novel battery efficient application and instant feedback system for online path planning· Proposed and implemented a duty-cycling algorithm for control of various smart phone elements i.e. camera, WiFi, GPS to enable long-term aerial imagery to enable robust data acquisition for data driven precision agriculture	

OTHER RELEVANT PROJECTS

Classification of Sketches for Information Retrieval <i>Guide: Dr. A.N.Rajagopalan & Dr. Kaushik Mitra, Indian Institute of Technology Madras</i>	September 2017 - Present
<ul style="list-style-type: none">· Formulated and implemented a residual network (ResNet) to benchmark results on the TU Berlin dataset, achieving an accuracy of 66.2%, surpassing the accuracy using traditional ML techniques· Implemented Binary Sketch-A-Net architecture achieving 2\times speed and 18\times memory savings	
Wireless Gripper Control for Tele-Operated Robotic Arm <i>Guide: Dr. T Asokan, Indian Institute of Technology Madras</i>	August 2017 - Present

¹Internal Microsoft Hackathon which comprises of one week long hacking by interns and full time employees

²Pan-IIT technical meet comprising of events in various technical categories

- Developed a gesture recognition based wireless controlled Robot Operating System (ROS) compliant gripper which can perform grasp action and roll motion using just one primary actuator
- Developed the first known open source library for ESP32 to enable serial communication using TCP over WiFi

Development of Student Mars Rover, University Rover Challenge

December 2016 - Present

- Developed the entire software and communication stack in Robot Operating System (ROS) for the manual and autonomous control systems on board, including setting up of P2P link over 1 kilometer range.
- Developed a gesture recognition based controller for control of the arm and drive of the rover in order to provide the base station controller with intuitive arm and drive control.

LDPC Codes For Compressive Sensing

October 2016 - November 2016

Guide : Dr. Pradeep Sarvepalli, Indian Institute of Technology Madras

- Surveyed a paper as a part of the course - Error Correcting Codes, relating the bridge between compressive sensing and channel coding and transfer of performance guarantees as presented by *Dimakis et al.*
- Showed the transfer of performance guarantees from the domain of channel coding to compressive sensing for Binary symmetric channels in the paper to hold for parity check matrices of (7, 4) Hamming Code

Development of IoT enabled smart home devices

June 2016 - July 2016

- Developed a smart switch board as a plug and play module in order to provide a non invasive alternative for real time control and monitoring of devices with remote controllability
- Demonstrated a proof of concept during Inter IIT Tech Meet by controlling devices in CFI³, IIT Madras while operating the system from IIT Mandi and getting real time sensor notifications

TALKS

- “Performance Limits of Tunable Servers of Finite Buffer Capacities and Packet Drop Constraint” at School of Technology and Computer Science, TIFR discussing performance of fixed fraction policy for Bernoulli arrivals
- “AgriTye - Data Driven approach to Precision Agriculture” to the Mobility, Networks and Systems & Technology For Emerging Markets Group at Microsoft Research India discussing the development of IoT based low-cost long-term platform for doing aerial imagery to enable data driven precision agriculture
- “Smart Home Devices” at IIT Mandi as a part of Internet of Things events at Inter IIT Tech Meet 2016 discussing the development and field deployment of low-cost non invasive smart switch boards for real time control and monitoring of household devices
- “LDPC Codes For Compressive Sensing” to the Coding Theory group at IIT Madras discussing the transfer of performance guarantees from channel coding domain to compressive sensing

RELEVANT COURSEWORK

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| - Communication Networks | - Synthesis of Control Systems |
| - Introduction to Robotics | - Error Control Coding |
| - Convex Optimization | - Communication Systems |
| - Machine Learning for Computer Vision | - Deep Learning for Imaging |
| - Probability Foundations (Measure Theoretic) | - Computer Architecture & Organization |
| - Data Structures and Algorithms | - Networks and Systems |
| - Digital Signal Processing | - Control Engineering |
| - Complex Analysis | - Computational Engineering |
| - Pseudorandomness | - Approximation Algorithms |

REFERENCES

Dr. Ranveer Chandra
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³Stands for Center For Innovation, is a student run lab of IIT Madras enabling students to work on innovative independent projects