

Prakash Kumar

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Education	University of Southern California , Los Angeles, CA <i>PhD, Electrical Engineering.</i> Current Cumulative GPA: 3.70	Sept 2020 - Present
	University of Michigan , Ann Arbor, MI <i>B.S., Computer Engineering. Minor in Multidisciplinary Design</i> GPA: 3.667	Sept 2016 - May 2020
Honors and Distinctions	Dean's List University Honors	
Research Experience	Magnetic Resonance Engineering Lab , Los Angeles, CA <i>PhD Student</i> <ul style="list-style-type: none">- Second Year student working on magnetic resonance imaging, particularly in low-latency real-time MRI image reconstruction using Machine Learning/AI.- Presented at the International Society for Magnetic Resonance in Medicine (ISMRM) on my work in speech real-time MRI super-resolution reconstruction.- Presented Abstract: Low Latency Real-Time MRI at 0.55T using Self-Calibrating Through-Time GRAPPA at the International Society for Magnetic Resonance in Medicine (ISMRM)	Sept 2020 - Present
	Radiation Oncology Panel Imager Group , Ann Arbor MI <i>Research Assistant, Electronics Lab</i> <ul style="list-style-type: none">- Researched the concept of a new x-ray imager under Larry Antonuk that decreases the amount of noise x-ray images have, producing better image quality at a much lower radiation dose to a patient.- Wrote System Verilog to program FPGA boards to interface with flat panel X-ray arrays, using UART and SPI communications to help aid research team in debugging X-ray communications.- Soldered components onto the lab's custom boards, testing functionality using oscilloscopes.- Researched and developed FPGA solutions using protocols including TCP and UDP to enhance communication from ADC through MAXIM serializer-de serializers using I2C to a computer.	Nov 2017 - May 2019
Work Experience	Keysight Technologies , Novi, MI <i>Research and Development Intern, Automotive Engineering</i> <ul style="list-style-type: none">- Tested and developed an PAM3 automotive ethernet signal separation signal processing algorithm to replace a directional coupler, by reverse-engineering expired patents.- Created a MATLAB user defined function that does signal separation in real-time on Keysight oscilloscopes	Jan 2020 – Aug 2020
	University of Michigan ECE Staff , Ann Arbor, MI <i>Grader, Introduction to Signals and Systems (EECS 216)</i> <ul style="list-style-type: none">- Grader for EECS 216, Signals and Systems Class- Graded homework and assignments for students on a weekly basis.	May 2019 – Aug 2019
	Texas Instruments , Santa Clara, CA <i>Test Engineering Intern, Front Panel Display-Link (FPD-Link)</i> <ul style="list-style-type: none">- I worked in the FPD-Link team in Texas Instruments' Santa Clara office as a Test Engineering Intern. FPD-Link is a product line consisting of serializers and deserializers to transmit high-speed data.- Built software tools and scripts to help reduce time spent on the test floor, reducing costs.- Wrote a cost report for using a Xilinx FPGA board and external hardware to implement the MIPI Alliance D-PHY communication protocol, commonly used in displays and cameras.	May 2019 – Aug 2019
	HealthPals , San Francisco Bay Area <i>Software Engineering Intern</i> <ul style="list-style-type: none">- HealthPals is a healthcare technology company founded by Dr. Rajesh Dash and Sushant Shankar, working to combine medical science and data science to give doctors medical guideline driven treatments to their patients to reduce medical errors, with a primary focus in the cardiovascular health space.- During my internship, I served as a liaison between the frontend and backend engineering teams in the development of the CLINT product (developed in python and react.js), designed to give value-based decisions to clinicians at the point of care. I analyzed several thousand anonymous patient records while	May 2017 – Aug 2017

providing useful insights on patients' risk for cardiovascular disease by writing a Population Dashboard using JavaScript, python/pandas, and seaborn.

**Self Guided
Course
Projects**

Homomorphic Encryption Acceleration

Sept 2019 – Dec 2019

EECS 598, Hardware Acceleration for Health and AI (Major Design Experience)

- Homomorphic Encryption is a process that allows for data manipulation to occur on encrypted data. This allows for a wealth of opportunity in healthcare as operations can be done on sensitive patient data without seeing the data itself.
- Currently developing a homomorphic accelerator using SystemVerilog to speed up homomorphic matrix multiplication using a method called CKKS.
- Used Microsoft's SEAL library to profile and benchmark accelerator performance against a groundtruth.
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Automatic Drumming Transcription: Downbeat

Sept 2019 – Dec 2019

EECS 452, Digital Signal Processing (Major Design Experience)

- Designed, built and tested a system that processes drum audio inputs and classifies them in real time, creating sheet music in accordance to the instruments hit and their corresponding onset.
- Developed a heuristic based off spacings between transients in an input signal to accurately transcribe hits as specific note lengths and types using a STM Nucleo DSP chip
- Built a GUI interface that runs on a Raspberry Pi and renders sheet music in real-time using the GUIDO music notation library

Structure from Motion Ann Arbor MI

Jan 2019 – May 2019

EECS 442, Computer Vision

- Developed algorithms for structure from motion, a process that creates 3D visualizations from 2D images.
- Used several techniques including camera calibration, feature matching, epipolar geometry, and difference images to create a robust pipeline to conduct structure from motion.
- Tested algorithms on user generated images as well as ground-truth data from the internet, using output to tweak algorithms.

Real-time Vocal Harmonizer Using Phase Vocoding, Ann Arbor MI

Jan 2019 – May 2019

EECS 351, Digital Signal Processing

- Developed a pitch shifting algorithm using the work from other papers such as Jean LaRoche's *New Phase-Vocoder Techniques for Pitch Shifting, Harmonizing and Other Exotic Effects.*
- Created real-time harmonies from a single vocal input by "duplicating" the voice of the input across the frequency domain. This was achieved with short-time Fourier transforms, frequency analysis, and appropriate efficient "stacked" windowing methods.

Buddy Bot, an Infrared Sensing Following Robot, Ann Arbor MI

Jan 2019 – May 2019

EECS 373, Embedded Systems

- Designed a prototype for Buddy Bot, a following robot designed to help carry objects around the house for you. This is done by following an IR-emitting anklet strapped around one's ankle.

Built and tested the device using an FPGA with an on-board ARM processor. Wrote hardware libraries for I2C, UART, PWM, and Memory Mapped IO in Verilog and interfaced with the hardware in C.

MAX/MSP Polyphonic Frequency Modulation Synthesizer, Ann Arbor MI

Sept 2018 – Dec 2018

PAT 202, Computer Music

- Wrote a Frequency Modulation Synth that modulates a sine wave input with an ADSR (attack decay sustain release) with a modulator that also has an ADSR along with a "brightness" and "ratio" knob in Max MSP. I used this to do a live performance in my PAT 201(Performing arts technology) class and used the output of the synth as a vocoder input as I sang live into the microphone.

MAESTRO Music Conduction Simulation, Ann Arbor MI**Jan 2018 – Dec 2018***Multidisciplinary Design Program, School of Music*

- The goal of Maestro 2018 is to build a virtual conducting system for the University of Michigan's School of Music, Theatre, and Dance to assist new conductors in practicing their art. With Maestro, conductors can practice with a computer-simulated ensemble, thereby eliminating the need for live musicians as well as the stress that comes with performing in front of them. New conducting students would use this system in tandem with a traditional classroom experience.
- Designed signal processing algorithms to interpret music conductors' gestures at various dynamic levels (loudness), articulation (style of sound), and tempos (beats per minute) using an Inertial Measurement Unit.
- Developed MATLAB and Python/Pandas algorithms for time/frequency analysis and transformation on sampled data. Later on, I worked on integrating the system to the Apple ecosystem, converting the algorithms into real-time using swift to be processed using an Apple iPhone's IMU and a Mac computer for sound synthesis.

Skills

Software: MATLAB, SystemVerilog, Python, JavaScript, C/C++, Bash, LATEX, Java, **Jan 2020 – Aug 2020**
Swift, MongoDB, Redis, SQL

Hardware: Embedded Systems, Soldering, Diptrace (Basic PCB design), Vivado, Oscilloscopes, Xilinx SDK

Audio: Logic Pro X, Ableton Live, Max MSP, Matlab Audio Toolbox

Outreach*MindsMatterLA*

- Mentor for low-income high school students in the Los Angeles area. Guide students (typically first-gen) navigate through high school and the college application process.

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Student Groups*Maize Mirchi A cappella***Sept 2016 – May 2020**

- Music director, South Asian interest group on campus. Led rehearsals, arranged/composed a large portion of the music for the group to sing.
- Worked on an upcoming album as a culmination of our work from the past two years and features much of the music that I arranged for the group during my time as music director. It will feature eight of our best songs and will be coming out later this year.
- Performed in the International Championship of Collegiate A Cappella, placing 1st in the Midwest Quarterfinals in 2017. Also competed in various South Asian competitions, placing 1st at Awaazein in Dallas.
- Performed at local gigs, helping bring music to the community around us!

Audio Engineering Society (AES)

- Part of the Audio Engineering Society's University of Michigan Chapter. Attended events on audio production and digital signal processing.

Michigan Project Music

- Worked on engineering projects involving music, such as a musical chessboard that maps the pieces on a chessboard using reflectance sensors to MIDI and audio.

Burlsey Residence Hall Council President

- President of the Burlsey Residence hall council. I managed funds, sponsored local organizations and led community events for the benefit of residents.