

# Raghavasimhan Sankaranarayanan

Ph.D. candidate

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## Education

### Georgia Institute of Technology, Atlanta, GA

2018 – . . . . **Ph.D. candidate**, Music Technology  
Minor: Robotics and Machine Learning  
*Fully Funded with stipend through Graduate Research Assistantship*

2020 – . . . . **MS** Computer Science  
Machine Learning Specialization  
GPA 4.0/4.0  
*Fully Funded with stipend through Graduate Research Assistantship*

2018 – 2020 **MS** Music Technology  
GPA 4.0/4.0  
*Fully Funded with stipend through Graduate Research Assistantship*

### Massachusetts Institute of Technology (MIT), Massachusetts, MA

2014 – 2015 **Undergraduate Special Student**  
Electrical Engineering and Computer Science  
GPA 5.0/5.0  
*Fully Funded through SAP Scholarship*

### SRM University, Chennai, India

2012 – 2016 **B.Tech.** in Electronics and Communication Engineering

## Research Publications

- 1 **Sankaranarayanan, R.**, & Weinberg, G. (2021). Design of hathaani-a robotic violinist for carnatic music, NIME.
- 2 Yang, N., Sha, R., **Sankaranarayanan, R.**, Sun, Q., & Weinberg, G. (2021). Drumming arm: An upper-limb prosthetic system to restore grip control for a transradial amputee drummer. In *2021 IEEE international conference on robotics and automation (icra)* (pp. 10317–10323). IEEE.
- 3 Yang, N., Savary, R., **Sankaranarayanan, R.**, Zahray, L., & Weinberg, G. (2020). Mechatronics-driven musical expressivity for robotic percussionists. NIME.

## Selected Accolades

### Awards

- 2020 **Guinness Book of Records** - Shimon the Robot - First robot to participate in a rap battle
- 2018 **B-high award for violin performance** - All India Radio
- 2015 **Best Instrumentalist** - MILAN 2015, Chennai, India
- 2014 **Lalgudi G. Jayaraman Endowment Award** - Krishna Gana Sabha, Chennai, India

## Selected Accolades (continued)

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- 2013 **Best Violin Solo** - TechoFes 2013, Chennai, India
- 2012 **T. Kesavalu Endowment Award** - Krishna Gana Sabha, Chennai, India
- 2010 **Valayapatti Kashyap Award (Youth artist award)** - Valayapatti Sabha, Chennai, India  
**Best Stall Award** - Youth Association of Classical Music  
**Winner - Solo Violin** - The Music Academy, Madras

## Scholarships

- 2014 **SAP Scholarship**, SRM University
- Only 8 were awarded out of the whole University with about 50,000 students
  - Only 1 student was awarded in the ECE Department
  - Tuition and living expenses fully covered for the semester at MIT

## Certifications

- 2014 **Associate LabView Developer**  
National Instruments Corp.

## Teaching Experience

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- Spring 2022 **Robotic Musicianship** - MUSI 8803, Georgia Institute of Technology
- Intro level course for Robotic Musicianship
  - Students learning outcome include
    - Electronics, circuit and PCB design
    - Embedded systems
    - Mechanical design and manufacturing, kinematics and controls
    - Music Information Retrieval
    - Generative and interactive music techniques for robotics
  - End-of-semester concert featuring the robots built by students
- Spring 2021 **Vertically Integrated Program (VIP)** - Robotic Musicianship Lab, GTCMT
- Advised 8 undergrad and grad level students on projects related to robotic musicianship
  - Led graduate students software team
- Digital Signal Processing (DSP) - Music** - MUSI 6202, Georgia Institute of Technology
- Fundamentals of DSP including sinusoids, spectra, filters and Fourier analysis
  - Applications in Music processing
  - Audio effects such as fast convolution, vocoder, reverb, chorus/flanger, pitch-shifting, etc.
  - Practical in-class exercises and assignments on music processing algorithms
- Fall 2018 **Vertically Integrated Program (VIP)** - Robotic Musicianship Lab, GTCMT
- Advised 4 undergrad students on Machine learning and interactive music projects
  - Led the research and development team of undergraduate students
  - Developed an interactive concert player Web App. Please visit [concertstitch.com](http://concertstitch.com)

## Teaching Experience (continued)

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Fall 2015 **Hands on with Arduino and Raspberry Pi**, SRM University

- 4-week long workshop series for undergrad and grad level students
- Outcome includes hands on experience in embedded systems ranging from timer and external interrupts to communication protocols and sensor interfacing.
- Additionally covered concepts related to Internet of Things (IoT) and Computer Vision

## Research Labs

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2018 – . . . . **Robotic Musicianship Lab - led by Prof. Weinberg - GTCMT**

*Robot prosthesis, guitar robot, hathaani the robot, shimon the robot, Cobots, Music Information Retrieval, Music Generation and synthesis*

- Lead developer for low level control of robots
- Lead researcher for Machine Learning and Deep learning based projects
- Lead Circuit and PCB designer for various musical robots
- Manage and advice different groups of graduate students on their research

Fall 2014 **Prof. Sass's Lab - MIT School of Architecture & Planning**

*Blocks world redox, Material based interaction, spacial awareness with vision*

- Analyze the scene and detect boundaries, position and shape of objects in 2d space
- Use vision to interact in real-time with a robotic arm (kuka) by creating geometric reflections

**Prof. Vandiver's Lab - MIT School of Mechanical Engineering**

- Researched and developed a dynamic vibration absorber with 2 other undergrad students
- Uses variable magnetic field to actively damp mechanical vibrations
- Demonstrated fast response, higher damping ratio and significantly less damping time

## Selected Current Research

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<b>Gamakanet</b>	A deep learning approach to synthesizing Gamaka in Carnatic Music
<b>Instrument Awareness</b>	Using computer vision techniques to control the robot arm position to stay at a constant distance from the musical instrument
<b>Jazz Music Generation</b>	An hierarchical neural network architecture to gain control over aspects of jazz music generation

## Industry Experience

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### Technology

Summer 2021 **Luthier Intern** - Fourness Fuse Violins

Learnt luthiering electric violins that include Pickup design, CAD and CAM, machining, digital signal processing and the art of wood carving

Summer 2020 **Research and Development Intern** - Google.Inc

Worked on a prosthetic Drumming Arm for Amputee Drummer Jason Barnes in collaboration with Georgia Tech, fully funded by Google. Worked closely with my advisor (Gil) and Research scientists at google on the electronics and Deep Learning aspects of the project.

## Industry Experience (continued)

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- Summer 2019 **Applied Scientist Intern** - Amazon Web Services (AWS)  
Worked on the Alexa voice service and their embedded echo devices on improving various audio algorithms
- Summer 2014 **Circuit Design Intern** - UCAL Fuel Systems, Pvt. Ltd  
Designed a Schmitt trigger based realtime analog signal detector to detect the crank positions of the automobiles using the Crank Shaft Position Sensor (CPS)

## Music

I have been undergoing professional and intense violin training in Indian Classical Carnatic music **since age of 4**. Trained under the guidance of Sangeeta Kalanidhi, Padmashri. Kanyakumari Avasarala, I have performed in **2000+ concerts across the world**, recorded for **200+ feature films and albums**. I have been collaborating with various artists, bands and orchestras in India and across the world. I have also composed, arranged, produced, programmed and mixed for various independent and commercial productions. I am the **first to use a Talk-box in Indian Classical music** to make the violin sing with lyrics!

## Selected self funded Projects

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- Philharmonic strings** Enable a soloist to perform and record all the parts of the orchestra and mix it to sound philharmonic. Has been successfully used in various Tamil feature film scores.
- Harpiolin** A new instrument that is a hybrid of the "Sarangi", the "Violin" and the "Harp". It uses 7 playing, 14 sympathetic and 13 plucking strings. The sympathetic strings are positioned precisely such that the bridge divides the string length in a 2:1 ratio, which enables it to resonate 2 octaves of each pitch at the same time
- Editable Theremin** World's first Theremin with editable recording capability. Like any other MIDI performance, it records instructions rather than audio. Thus it's totally modifiable after the performance.
- Xpression Controller** It is a MIDI Expression controller hardware developed for the Roland GR55 whose instantaneous values are determined by the envelope of the input from the pickup
- Chord Matrix** iOS app interface using touchOSC that sends OSC wirelessly to nodeMCU (wifi enabled micro-controller) which translates it to MIDI to be used with any midi device.
- "Chutti" - the robot** A robotic arm that plays chords on the iPad. It accompanies the soloist and listens to the bass lines to predict the chord as it plays
- MIDI Violin** A truly MIDI violin that doesn't involve audio-MIDI conversion. The sensors directly maps to MIDI parameters and no audio is involved in the process. Eliminating false positives and true negatives.

## Selected Press and Features

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- 2021 **Google IO 2021**  
Featured for the Drumming Arm we researched and developed for the amputee drummer Jason Barnes
- 2020 **The Path Forward: Creativity in New Instruments**  
A panel discussion with experts for a thought-provoking questions in the field of Music Technology  
**Music Tech is Different Here**  
Featured in the gatech music website for research and experience in Music Technology at Gatech
- 2019 **The Age of A.I. - How Far is Too Far?**  
Featured in the S1.E1 of the 8 part series hosted by Robert Downey Jr. covering the ways Artificial Intelligence, Machine Learning and Neural Networks will change the world.

## **Selected Press and Features (continued)**

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2018 **BIG FM 92.7**

Featured the first ever talkbox violin performance with the band - staccato

**The Quint**

A talk about world fusion and electronic music with the band -staccato

**BBC Radio**

Arranged and performed a tamil thirupugazh which was featured as one of the top-rated tracks

2017 **Provoke Lifestyle Magazine**

Article on the future of Music and Technology