

# Dharanipathi Rathna Kumar

Maynooth, Ireland

Mobile : +353 89 221 2887

Email : dharanipathirk@gmail.com

 dharanipathirk

 /dharanipathirk

## ABOUT ME

---

I am a PhD researcher specializing in the development and exploration of real-time neural audio effects. My work centers on creating efficient neural network-based audio effects that integrate seamlessly into existing music production workflows. Given that most music production tools rely on CPU computation and that the current DAW and plugin ecosystem emphasizes real-time performance, efficiency is paramount. My research addresses these challenges by exploring enhancements to neural network architectures and employing model compression techniques, such as pruning, knowledge distillation and quantization.

## EDUCATION

---

### • Maynooth University

*PhD in Computer Science*

Ireland

*Oct. 2020 – Present*

Supervisor: Dr. Joseph Timoney

**Research areas:** Music Information Retrieval, Neural audio effects, Real-time audio in music production

- Developed a robust multi-GPU deep learning audio pipeline using PyTorch with multi-threaded pre-processing, version control, and containerization via Singularity.
- Curated custom datasets encompassing audio effects parameters and semantic descriptions, sourced from crowdsourced and open-source resources. Custom Python audio effects and VST plugins with pedalboard libraries were utilized for extensive audio processing.
- Constructed end-to-end neural audio effects models using TCN and LSTM architectures, capable of processing equalization and reverberation from audio effect word labels with various encoding approaches.
- Performed real-time performance evaluations of models using RTneural and Neutone, among other tools.
- Working on implementing model compression techniques, such as pruning and quantization, to enhance the real-time performance of deep learning audio models in computationally restricted environments.

### Publications:

- Dharanipathi Rathna Kumar, Joseph Timoney. "Word based end-to-end real time neural audio effects for equalisation." Audio Engineering Society Convention 155. Audio Engineering Society, 2023.

### Talks:

- ADCx India, 7th Jan 2024. Title - "*Leveraging Pruning and Quantization for Efficient Real-Time Audio Applications*"  YouTube link

### • Maynooth University

*Master of Arts in Creative Music Technologies, 1:1*

Ireland

*Sep. 2017 – Aug. 2018*

**Modules:** Acoustics, Music systems programming, Software Sound Synthesis, Audio Signal Processing

### Academic projects:

- 2D Ray tracing Convolution Reverb in Csound: Implemented a 2D ray tracing algorithm in Csound to model a space in 2D and create an IR function table to convolute with the incoming audio signal to achieve the desired reverb.
- CombLoop: Developed a SuperCollider program for Roli Seaboard which lets the user play any loop as a pitched note using comb filtering technique.
- Tap Tap Echo: Developed a unique convolution based echo processor in Cabbage which creates its own IR based on the settings rather than using an external Impulse Response.

### • KM College of Music and Technology

*Russian Piano Studio Program - Western Classical Piano*

Chennai, India

*Mar. 2011 – Aug. 2014*

## EXPERIENCE

---

### • Maynooth University

*Part-time Lecturer and Teaching Assistant, Department of Computer Science*

Maynooth, Ireland

*Sep 2019 - Present*

Lecturing Modules	Teaching Assistant Modules
CS620C - Structured programming BI425 - End user computing CS321 - Music programming 1 CS425 - Audio and Speech Processing	CS261 - Multimedia Technology CS210 & CS211 - Algorithms and Data structures CS321 - Music Programming 1 CS322 - Music Programming 2 CS335 - Software Engineering and Software Process CS265 - Software Testing CS225 - Introduction to computational thinking

- Developed and delivered an introductory programming module focused on Python and bio data analysis using pandas for the Biology department, enhancing interdisciplinary understanding.
- Designed and instructed a Java programming module for Higher Diploma and Master's students.
- Served as the Head Demonstrator for all aforementioned modules, ensuring the smooth operation of lab sessions and efficient management of teaching assistants.
- Supervised a team of 18 demonstrators for the CS210 and CS211 modules, handling lab sessions for approximately 320 students.
- Managed and compiled all lab grades, while also providing guidance on code debugging and problem-solving strategies to enhance students' programming proficiency.

### • SA Studios

*Recording and Mix Engineer, Freelance Music Producer*

Chennai, India

*Sep 2014 to Jul 2017*

- Responsible for session preparation, client management, cable construction, outboard gear and patch-bay.
- Provided post-production mix assistance, sound design, and Foley.
- As a freelance music producer, programmed various soundtracks, delivering client-specific sounds and mixes to meet their requirements.

## FREELANCE PROJECTS

---

- **Learn to sing songs app for iPad** Working on an iOS app aimed at helping users learn to sing songs better. It involves beat tracking, time stretching and track separation. Using SwiftUI, Core Media, MusicKit, CoreML, etc.
- **Staff Notation Learning App for iPad** Developed an iOS app for a client that helps kids learn music staff notation using colours. Used SwiftUI, UIKit, Core Media, MusicKit, etc.
- **Speech Recognition software** Developed an end-to-end scalable speech recognition system using deep learning for automatic number plate transcription using DeepSpeech engine and Kaldi toolkit.

## COMPUTER SKILLS

---

**Languages:** Python, C++, Csound, Java, JavaScript, Swift

**Libraries and Tools:** PyTorch, JUCE, Scikit-Learn, Pandas, Git, Shell scripting, Audition, Pure Data, Logic Pro X, Singularity

## AUDIO TECHNOLOGY SKILLS

---

- Comprehensive knowledge of Acoustics and Psychoacoustics.
- Experience with Software Sound Synthesis – Physical Modelling, Additive, Subtractive, Granular and Distortion synthesis.
- Solid understanding of signal processing concepts such as discrete signals, sampling theory, z-transforms, fourier transforms, FIR / IIR filter design.
- Proficiency in audio domain specific programming languages - Csound and SuperCollider.

## CO-CURRICULAR ACTIVITIES

---

- Member of the machine learning reading group at Maynooth University where we present and discuss about latest developments in computer vision and machine learning.
- Member of Hack Club at Maynooth University, where we build creative DIY music and audio devices.