Jatin Chowdhury
Audio Signal Processing Engineer

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Education

Stanford University, Center for Computer Research in Music and Acoustics *Palo Alto, CA*
M.A. IN MUSIC, SCIENCE, AND TECHNOLOGY *Sept. 2018 - June 2020*
- Denning Family Fellowship for the 2018-2019 academic year.
- Relevant Coursework: Physical Audio Signal Processing, Time Frequency Audio Signal Processing, Machine Learning, Digital Instrument Design, Spatial Audio, Music Recording.

University of Southern California *Los Angeles, CA*
B.S. IN ELECTRICAL ENGINEERING *Aug. 2014 - May 2018*
- USC Presidential Scholarship for outstanding academic achievement.
- Completed Minors in Physics and Music Recording.
- USC Renaissance Scholar certificate for excelling academically while pursuing separate fields of study.
- Relevant Coursework: Signal Processing, Circuit Design, Digital Logic, Electromagnetics, Software Design.

Experience

Tesla Motors *Palo Alto, CA*
AUDIO QA INTERN *April 2020 - June 2020*
- Developed end-of-line tests to ensure audio system quality for vehicles coming off the production line.
- Developed signal processing methods for detecting audio system defects using a sine sweep measurement.
- Ported existing audio tests written in Python to C++ for improved performance.

Persp3ctive VR *Los Angeles, CA*
SOFTWARE/DSP ENGINEER *June 2019 - Mar. 2020*
- Developed and implemented audio effects for use in a VR audio production environment including:
    - Lowpass and highpass filters with smoothly varying cutoff frequency and rolloff rate.
    - EQ filters for a parametric EQ including bell, notch, and shelf filter shapes.
    - Dynamic range compression, including virtual analog models of an optical compressor circuit, an analog level detector circuit, and an output transformer.
- Implemented the audio effects as an audio plugin with a fully featured UI.
- Built DSP framework for integrating effects made by other engineers into the plugin.
- Implemented OSC communication for sharing parameters and metering data with VR headset.
- Developed unit testing framework to make overall software more robust.
- Built software installers for Windows platform using Inno Setup.

Audioworks Technologies *Toronto, ON*
SOFTWARE ENGINEER *July 2018 - Dec. 2018*
- Member of of the SoundsUnite developement team: building a digital audioworkstation (DAW) using JUCE/C++.
- Developed and implemented DSP features for the application including panning algorithms, level detection, and "smart" track exporting.
- Developed UX features for the application.
- Developed file management features for the application, including integrating the file management system with the SoundsUnite web store.
- Presented work to engineering team, managers, and investors.

McGill Space Institute *Montreal, QC*
RESEARCH TRAINEE *May 2017 - Aug. 2017*
- Recipient of an Undergraduate Student Research Award from the National Sciences and Engineering Research Council of Canada.
- Member of the CHIME/FRB Working Group: building a software pipeline to detect Fast Radio Bursts (FRBs).
- CHIME is a telescope in British Columbia; has detected more FRBs in the Northern Hemisphere than any other telescope to date.
- Developed a "Flux Estimator" module for the CHIME/FRB software pipeline: Use incoming data from the telescope to estimate the intrinsic brightnes of the astrophsyical source.
- Contributed to science and unit testing frameworks for the CHIME/FRB software pipeline.
- Presented work for CHIME/FRB Working Group and CHIME/FRB Pipeline Gamma Release.

USC Viterbi Academic Resources Center

Los Angeles, CA

Engineering Tutor

Aug. 2018 - May 2018

- Tutored undergraduate engineering students in math, physics, and electrical engineering classes.
- Served as a tutor for the university chapter of the Society of Hispanic Professional Engineers.
- Trained new tutors in interacting with students and presenting material in a clear, concise, and cohesive manner.

KXSC Radio

Los Angeles, CA

Disc Jockey, Jazz Director

Jan. 2015 - May 2018

- On-air host and disc jockey for live jazz radio program "Jam Sessions".
- Co-host of live radio talk-show programs "Squaminous Science Hour", and "TeXulous Talk Show".
- KXSC Jazz Director tasked with researching, reviewing, and organizing jazz music for the station library.

iD Technology Camps

Denver, CO

Instructor

May 2015 - Aug. 2016

- Taught students age 12-17 programming in C++ and Arduino.
- Taught students age 6-12 in building simple robots using LEGO Mindstorm kits.

Skills

Programming Languages	C/C++, Python, MATLAB, Faust, LaTex, Javascript
Frameworks	JUCE API, VST SDK, AAX SDK, Web Audio API, Arduino
Tools	Linux CLI, Visual Studio, CMake, Git, Travis CI, Inno Setup

Publications

Stable Structures for Nonlinear Biquad Filters

Sept. 2020

Proceedings of the 23rd International Conference on Digital Audio Effects (DAFx-20)

Vienna, Austria

- Accepted for presentation at the DAFx-2020 conference.

Real-Time Physical Modelling for Analog Tape Machines

Sept. 2019

Proceedings of the 22nd International Conference on Digital Audio Effects (DAFx-19)

Birmingham, UK

- Presented at the DAFx-2019 conference.
- Available on the DAFx Archives: `http://www.dafx.de/paper-archive/2019/DAFx2019_paper_3.pdf`.

The CHIME Fast Radio Burst Project: System Overview

Aug. 2018

The Astrophysical Journal

Vol. 836, No. 1

- Co-authored with the CHIME/FRB Collaboration
- Available on the arXiv: `https://arxiv.org/abs/1803.11235`.

Cassettes - An Online Audio Editor

Dec. 2019

Web Audio Conference 2019

Trondheim, Norway

- Poster session and demonstration by project leader Xingxing Yang at WAC-2019.
- Presented an online audio editor built with the Web Audio API and Audio Worklet.

Presentations

Complex Nonlinearities for Audio Signal Processing

May 2019

CCRMA DSP Seminar

Stanford, CA

- Presented a series of audio effects constructed from innovative uses of nonlinear signal processing techniques.
- Audio effects presented include harmonic exciters, hysteresis, nonlinear filters, subharmonics generators, and more.

Exploring Real-Time DSP Systems for Mixing and Performance

Apr. 2019

CCRMA DSP Seminar

Stanford, CA

- Presented overview of previous research and projects to an audience of peers, professors, and the public.
- Discussed topics including real-time timbral conversion, methods of integrating "imperfection" into audio DSP systems, and designing user interfaces for DSP systems as an extension of the DSP systems themselves.

Web Audio Module (WAM) Distortion

Mar. 2019

CCRMA Open House

Stanford, CA

- Presented a distortion effect originally made in C++, then ported to Web Audio using the Emscripten toolchain.

Research

Modal Waterbottles
RESEARCHER

Stanford, CA

June. 2019 - April 2020

- Worked with a small team of researchers to develop accurate acoustical models of water bottles using modal signal processing.
- Developed a real-time water bottle synthesizer using the JUCE framework.
- Project documentation is available on GitHub: `https://github.com/jatinchowdhury18/modal-waterbottles`.

Complex Nonlinearities
LEAD RESEARCHER

Aug. 2019 - PRESENT

- Built frameworks for developing complex nonlinear audio signal processors, largely independent of analog signal processing concepts.
- Developed a series of open-source plugins to demonstrate the nonlinear frameworks: `https://github.com/jatinchowdhury18/ComplexNonlinearities`.
- Published a series of articles explaining nonlinear signal processing techniques for a non-technical audience: `https://medium.com/@jatinchowdhury18/complex-nonlinearities-episode-0-why-4ad9b3eed60f`.

Bad Circuit Modelling
LEAD RESEARCHER

Nov. 2019 - PRESENT

- Researched methods for virtual analog circuit modelling to account for imperfections that exist in real-world circuits.
- Developed simulations and real-time circuit-modelling systems that accurately model the aging and component tolerances of resistors and capacitors.
- Ongoing documentation of the project can be found on GitHub: `https://github.com/jatinchowdhury18/Bad-Circuit-Modelling`.

Analog Tape Modelling
LEAD RESEARCHER

Jan. 2019 - Apr. 2019

- Researched and developed a physical model of an analog, reel-to-reel tape machine.
- Modelled the nonlinear process of analog tape recording using the Jiles-Atherton model for magnetic hysteresis.
- Modelled other effects created by analog tape machines, including flutter, playhead loss effects, and biasing effects.
- Developed an open-source audio plugin implementing the analog tape model as a real-time system. Source code and documentation are available on GitHub: `https://github.com/jatinchowdhury18/AnalogTapeModel`.

Non-Uniform Perfect Reconstruction Filterbanks
LEAD RESEARCHER

Mar. 2019 - Jun. 2019

- Researched and developed a method for real-time filterbank analysis and synthesis, with perfect magnitude reconstruction and linear phase reconstruction.
- Implemented the filterbank in digital audio effect plugins including a Graphic Equalizer and real-time Noise-Supressor.
- Ongoing documentation can found on GitHub: `https://github.com/jatinchowdhury18/NUPR-Filterbanks`.

notGuitar
RESEARCH PARTNER

Los Angeles, CA

Jan. 2018 - May 2018

- notGuitar is real-time timbral conversion system designed to process a guitar input signal to sound like a saxophone.
- notGuitar was implemented using a Texas Instruments DSK6713 DSP board in May 2018.
- Documentation for the project can be found on GitHub: `https://github.com/jatinchowdhury18/notGuitar`.

Projects

Chowdhury DSP
FOUNDER, ENGINEER

June 2018 - PRESENT

- Developed audio plugins including:
  - ChowPhaser: A phaser effect based loosely on the Schulte Compact Phasing 'A' circuit.
  - ChowTape Model: An analog tape emulation based on the DAFx-19 paper "Real-Time Physical Modelling for Analog Tape Machines".
  - ChowCentaur: A digital emulation of the Klon Centaur distortion pedal, using Wave Digital Filters and recurrent neural networks.
  - DrumFixer: A plugin that uses modal signal processing to fix drum sounds with unpleasant "ringing".
  - CHOW: A maximally truculent distortion effect.
  - How Much Spaghetti: A dynamic matrix of stereo delay effects.
  - Chowdhury Distortion: A "crunchy" distortion effect with adjustable stereo imperfection.
- For more information, see the Chowdhury DSP website: `https://ccrma.stanford.edu/~jatin/chowdsp`.

Wave Digital Filters
PROGRAMMER   *Jan. 2020 - PRESENT*
- Created a minimal C/C++ Library for modelling circuits with Wave Digital Filters (WDFs).
- Currently includes WDF implementations for basic circuit elements (resistors, capacitors, inductors), basic circuit adaptors (series, parallel), and several nonlinear circuit elements.
- Includes several example WDF models implemented as audio plugins using the JUCE framework, as well as a graphical WDF prototyping tool.
- Ongoing development and documentation can be found on GitHub: `https://github.com/jatinchowdhury18/WaveDigitalFilters`.

audio-dspy
PROGRAMMER   *Oct. 2019 - PRESENT*
- Created a Python package for audio signal processing.
- Currently includes tools for filter design, impulse response manipulation, modal modelling, and nonlinear processing.
- Ongoing development and documentation can be found on GitHub: `https://github.com/jatinchowdhury18/audio_dspy`.

NewMixer
CREATOR   *Dec. 2018 - Dec. 2019*
- A unique digital audio workstation designed to break away from the traditional "virtual console" user interface.
- Individual audio sources are visualized as sound sources in a room; the user can arrange the sources to create a mix with stereo width, and reverberative depth.
- NewMixer is currently a fully functional mixing tool, supporting saving, exporting, automation, plugin hosting and more.
- Documentation of NewMixer can be found on GitHub: `https://github.com/jatinchowdhury18/NewMixer`.

Destroy All Circuits
DSP ENGINEER   *June 2019 - PRESENT*
- Developed DSP models for various effects and characteristics of vintage synthesizers, tape machines, and effects.
- DSP methods include recording and manipulating impulse reponses, circuit modelling, and physical modelling.

The SGUM (Squaminous Geometrically Uncanny Matrix)   *Stanford, CA*
CREATOR   *Mar. 2019*
- The SGUM is an expressive standalone drum machine, comprised of nine velocity-sensitive drum pads, with programmable samples and configurations.
- Designed and built from the SGUM from scratch, including drum pads, circuitry, frame, etc.
- Programmed firmware for the SGUM, which runs on a Teensy 3.6 microcontroller with an audio shield and uses embedded Faust processing.
- The entire process was completed in two weeks, and for less than $100 USD.
- Documentation for the SGUM can be found on YouTube: `https://www.youtube.com/watch?v=NOcPRS4LxpQ`.

Cassettes: A Web Audio Digital Audio Workstation   *Stanford, CA*
CONTRIBUTOR   *June 2019 - Sept. 2019*
- Developed digital audio effects using the Web Audio API and Audio Worklet.
- Effects include:
  - Delay: Stereo, Ping-Pong
  - Harmonic: Soft-Clipping Distortion, Aural Exciter
  - Modulation: Chorus, Flanger
  - Dynamics: Limiter, Gate

NoLava Recording Studios   *Los Angeles, CA*
CO-FOUNDER, AUDIO ENGINEER, TECHNICAL ADVISOR   *Aug. 2017 - July 2018*
- Recorded, mixed, and mastered for artists of various styles including acoustic, electronic, rock, country, and punk.
- Installed, repaired, and maintained speakers, microphones, keyboards, amplifiers, and other musical equipment.