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

Chowdhury DSP — *Denver, C0*
AUDIO SIGNAL PROCESSING ENGINEER — *Oct. 2021 - PRESENT*
- Developed signal processing algorithms for real-time audio processing and synthesis.
- Developed audio plugins including DSP, UI implementation, preset management, installers, etc.
- Contributed to open-source audio plugins and signal processing libraries.

Tesla Motors — *Palo Alto, CA*
AUDIO TEST ENGINEER — *Aug. 2020 - Oct. 2021*
- Developed audio system signal flow layouts for vehicles using AudioWeaver.
- Contributed to audio system testing and tuning including telephony, equalization, and spatialization.
- Developed end-of-line tests to ensure vehicle audio system quality using Python and C++.
- Contributed to the signal processing and tuning for the vehicle pedestrian warning speaker.
- Contributed to testing and validation software for audio system firmware.

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:
  - Parametric EQ, with smoothly varying parameters and five filter types.
  - Dynamic range compression, with virtual analog models of an optical compressor, and 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.

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 DSP features for the application including panning algorithms, level detection, and "smart" track exporting.
- Developed UX features for the application including meters, file browsers, and tempo controls.
- Integrating the application 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
ENGINEERING TUTOR

Los Angeles, CA
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
DISC JOCKEY, JAZZ DIRECTOR

Los Angeles, CA
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
INSTRUCTOR

Denver, CO
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, Bash, MATLAB, Faust, LaTex, Rust, Javascript
Signal Processing	Virtual analog modelling, filter design, neural networks, time-frequency analysis
Frameworks	JUCE API, TensorFlow, Web Audio API, Arduino
Tools	Linux CLI, Visual Studio, Xcode, CMake, Git, GitHub Actions, Inno Setup

Publications

A Wave Digital Filter Modeling Library for the Faust Programming Language
PROC. OF THE 18TH SOUND AND MUSIC COMPUTING CONFERENCE

June 2021
Torino, IT

- Co-authored with Dirk Roosenburg, Eli Stine, and Romain Michon.
- Available on the GitHub.

RTNeural: Fast Neural Inferencing for Real-Time Systems
ARXIV E-PRINTS: AUDIO AND SPEECH PROCESSING

June 2021
Online

- Presents a neural network inferencing library for real-time systems.
- Available on the ArXiv.

Water Bottle Synthesis with Modal Signal Processing
PROC. OF THE 23RD INTERNATIONAL CONFERENCE ON DIGITAL AUDIO EFFECTS

Sept. 2020
Vienna, Austria

- Presented at the DAFx-2020 conference.
- Available on the DAFx Archives.

Stable Structures for Nonlinear Biquad Filters
PROC. OF THE 23RD INTERNATIONAL CONFERENCE ON DIGITAL AUDIO EFFECTS

Sept. 2020
Vienna, Austria

- Presented at the DAFx-2020 conference.
- Available on the DAFx Archives.

Real-Time Physical Modelling for Analog Tape Machines
PROC. OF THE 22ND INTERNATIONAL CONFERENCE ON DIGITAL AUDIO EFFECTS

Sept. 2019
Birmingham, UK

- Presented at the DAFx-2019 conference.
- Available on the DAFx Archives.

The CHIME Fast Radio Burst Project: System Overview
THE ASTROPHYSICAL JOURNAL

Aug. 2018
Vol. 836, No. 1

- Co-authored with the CHIME/FRB Collaboration
- Available on the ArXiv.

Presentations

CI/CD for Audio Plugin Development
AUDIO DEVELOPER CONFERENCE

November 2021
London, UK

- Discussed the basic concepts and motivations for continuous integration and continuous deployment (CI/CD).
- Discussed the usefulness of CI/CD for developing audio plugins.
- Demonstrated several CI/CD workflows in the context of audio plugin development.

Creating Audio Effect Plugins for the 21st Century
SARC VIRTUAL EVENTS SERIES

February 2021

Belfast, UK

- Presented at the Sonic Arts Research Centre (SARC) at Queen's University Belfast.
- Presented a paradigm for developing original and innovative digital audio software.
- Discussed techniques and philosophies for designing audio software as part of a creative process, including signal processing algorithms and user interfaces.

A Comparison of Virtual Analog Modelling Techniques
AUDIO DEVELOPER CONFERENCE

November 2020

London, UK

- Presented a virtual analog model of the Klon Centaur guitar pedal developed using multiple modelling techniques, including nodal analysis, Wave Digital Filters, and Recurrent Neural Networks.
- An accompanying paper is published on the ArXiv.

Complex Nonlinearities for Audio Signal Processing
CCRMA DSP SEMINAR

May 2019

Stanford, CA

- Presented at the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University.
- 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
CCRMA DSP SEMINAR

Apr. 2019

Stanford, CA

- Presented at the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University.
- 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.

Research

Real-Time Neural Network Inferencing
LEAD RESEARCHER

Stanford, CA

June 2020 - June 2021

- Developed a C++ library for performing neural inferencing for real-time audio systems.
- Developed benchmarks to compare the library performance with the PyTorch C++ API.
- Project documentation is available on GitHub.

Klon Centaur Emulation
LEAD RESEARCHER

Stanford, CA

Mar. 2020 - Aug. 2020

- Developed a digital emulation of the Klon Centaur guitar distortion pedal.
- Used circuit modelling methods including nodal analysis, Wave Digital Filters, and Recurrent Neural Networks.
- Developed emulation as an audio plugin and guitar pedal using an Arduino Teensy microcontroller.
- Project documentation is available on GitHub.

Modal Waterbottles
RESEARCHER

Stanford, CA

June 2019 - April 2020

- Worked with a team of researchers to develop 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.

Complex Nonlinearities
LEAD RESEARCHER

Aug. 2019 - June 2020

- Built frameworks for developing complex nonlinear audio signal processors.
- Developed a series of open-source plugins to demonstrate the nonlinear frameworks.
- Published a series of Medium articles explaining nonlinear signal processing techniques for a non-technical audience.
- Project documentation can be found on GitHub.

Bad Circuit Modelling
LEAD RESEARCHER

Nov. 2019 - June 2020

- 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.
- Project documentation can be found on GitHub.

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.

notGuitar   *Los Angeles, CA*
RESEARCH PARTNER   *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.

Projects

Chowdhury DSP
FOUNDER, ENGINEER   *June 2018 - PRESENT*
- Developed audio plugins including:
    - ChowTapeModel: An analog tape emulation based on the DAFx-19 paper "Real-Time Physical Modelling for Analog Tape Machines".
    - ChowMatrix: A dynamic matrix of stereo delay effects.
    - ChowKick: A kick drum synthesizer based on creative circuit modelling.
    - ChowCentaur: A digital emulation of the Klon Centaur distortion pedal, using Wave Digital Filters and recurrent neural networks.
    - ChowPhaser: A phaser effect based loosely on the Schulte Compact Phasing 'A' circuit.
- Contributed audio effects and other DSP code to the open-source Surge Synthesizer project.
- Developed modules for the VCV Rack modular synthesis environment.
- For more information, see the Chowdhury DSP website.

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.

audio-dspy
PROGRAMMER   *Oct. 2019 - June 2020*
- Created a Python package for audio signal processing.
- Currently includes tools for filter design, impulse response manipulation, modal modelling, and nonlinear processing.
- Development and documentation can be found on GitHub.

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.

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.

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 studio equipment.