

Nadina Zweifel

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Professional Summary

An engineer and data scientist with 4+ years of experience in signal processing and data analysis to solve computational research problems. Used signal processing techniques, optimization, and machine learning to analyze experimental and simulated data as well as to build and validate now publicly available biomechanical simulation software. Eager to improve, expand, and apply these skills to real-world signal processing and data science problems.

Professional Experience

NORTHWESTERN UNIVERSITY, Evanston, IL

PhD Candidate | 2016 - 2022

- Developed software in C++ to simulate the mechanical dynamics of rat whiskers to generate synthetic datasets (Linux)
- Performed large scale batch simulations on the university's CPU cluster (Python, Bash scripts)
- Performed data analysis on experimental and synthetic data using conventional statistical methods and machine learning (Python, Matlab)
- Visualized research results (Matplotlib, Seaborn)
- Mentored and supervised undergraduate and Master students

SHURE INCORPORATED, Niles, IL

Data Science Intern | Summer 2021

- Implemented and tested various speech synthesis and voice conversion models using convolutional and recurrent neural networks (PyTorch & AWS Sagemaker)
- Performed acoustic simulations to simulate room impulse responses (EASE)

UNIVERSITY OF PENNSYLVANIA, Philadelphia, PA

Research Assistant | Summer 2016

- Collection and analysis of physiological data (skin conductance, heart rate, and pupil measurements) to predict state of arousal and attention during psychophysical experiments

SONOVA GROUP (PHONAK AG), Staefa, Switzerland

Research & Development Intern | Summer 2012

- Assisted in quality control of hearing aids and accessories
- Consulted in audio engineering related issues to improve functionality of audiology testing rooms
- Performed sound measurements in a reverberation room to enable simulation of different acoustical testing scenarios

AUDIOCONSULTING AG, Volketswil, Switzerland

Audio Engineer | 2010 – 2013

- Supervised audio network center to guarantee flawless transmission of audio signals from stadia to consumer
- Mixed sound in live sport television studio
- Recorded, edited, mixed sound and designed sound effects for television shows, audio plays, radio and television commercials

Technical Skills

- Programming languages like **C/C++, Python, Matlab**, including **Tensorflow** and **Keras**
- **Collection, analysis, and visualization of real-world (physiological) data.**
- **Classical signal processing techniques** for filtering, artifact removal, and spectrum analysis of (physiological) data
- Development and Validation of **analytical and predictive models** based on experimental data
- **Dimensionality reduction algorithms** and **feature extraction** using machine learning
- **Predictive modeling** using **artificial neural networks**
- **Genetic and evolutionary algorithms** to optimize artificial neural networks
- Acquisition, processing, and analysis of **3D scanning data**

Professional Skills

- **Critical thinking** and **problem-solving skills**
- **Initiative** and **creative attitude, adaptability** and **propensity to learn** new methods and techniques
- Writing **scientific publications** and delivering **presentations to technical and non-technical audiences**
- Demonstrated **leadership and mentoring skills**
- Written and oral fluency in **English**, native language **German** and **Swiss German**, basic level Italian/French

Education

NORTHWESTERN UNIVERSITY, Evanston, IL

PhD in Biomedical Engineering | 2016 – 2022

Track: Neural Engineering

Thesis: *Towards modeling closed-loop sensorimotor integration in tactile sensing systems: Development of simulation software in C++ to simulate the mechanical dynamics of rat whiskers*

GRAND VALLEY STATE UNIVERSITY, Grand Rapids, MI

Master of Science in Engineering | 2014 – 2016

Major: Biomedical Engineering

Thesis: *Single subject study to measure and quantify the effect of locomotion on the frequency spectrum of a child's brain activity (EEG)*

ZURICH UNIVERSITY OF APPLIED SCIENCES, Switzerland

Bachelor of Science in Engineering | 2011 – 2014

Major: Systems Engineering with specialization in Biomedical Engineering

Thesis: *Enhancement of medical images using stochastic resonance*

Awards

- 2020 RESEARCH PROGRESS AWARD IN NEURAL ENGINEERING**
Northwestern University
- 2016 ACADEMIC EXCELLENCE AWARD IN ENGINEERING**
Grand Valley State University

Extracurricular Activities

QUEER PRIDE GRADUATE STUDENT ORGANIZATION
Executive Board Member (Treasurer) | 2020 - 2021
Northwestern University, Evanston, IL

QUEER PRIDE GRADUATE STUDENT ORGANIZATION
Executive Board Member (Web & Design Chair) | 2019 - 2021
Northwestern University, Evanston, IL

GRADUATE STUDENT ASSOCIATION
Executive Board Member (Treasurer) | 2015 – 2016
Grand Valley State University, MI

Peer-reviewed Journal Publications

Zweifel NO & Hartmann MJZ (2020) Defining “active sensing” through an analysis of sensing energetics: homeoactive and alloactive sensing. *Journal of Neurophysiology* Jun 2020, 124:1, 40-48; DOI: 10.1152/jn.00608.2019

Zweifel NO, Bush N, Abraham I, Murphey T, Hartmann MJZ (2021) A dynamical model for generating synthetic data to quantify active tactile sensing behavior in the rat. *Proceedings of the National Academy of Sciences* Jul 2021, 118 (27) e2011905118; DOI: 10.1073/pnas.2011905118
Software: <https://github.com/SeNSE-lab/whiskitphysics>

Zweifel NO, Solla SA, Hartmann MJZ (2022) Statistical characterization of tactile scenes in three-dimensional environments reveals filter properties of somatosensory cortical neurons. *Nature Communications (in review)*
Preprint: <https://www.biorxiv.org/content/10.1101/2022.08.03.502632v1>

Conference Presentations

BARRELS XXXII 2019 (TALK)

Zweifel N, Bush N, Abraham I, Murphey T, Hartmann M (2019)
A three-dimensional dynamical model of the rat vibrissal array.
Short platform talk at: Barrels XXXII 2019; Chicago, IL.

SOCIETY OF NEUROSCIENCE 2019 (POSTER)

Zweifel N, Bush N, Abraham I, Murphey T, Hartmann M (2019)
A three-dimensional dynamical model of the rat vibrissal array.
Program No. 485.14. 2018 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2019. Online.