





# VIOLET I JOHNSON, PHD

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Recent CS doctoral graduate with 10+ years scientific research-focused software engineering experience primarily in game programming, ML, & DSP. 4 years related teaching experience. Seeking full-time roles (July '24) in Game Dev, DSP, VR, Robotics, HCI, & ML.

## EDUCATION

University of North Texas, <i>PhD in Computer Science</i>   TX, USA		Jul 2024
University of North Texas, <i>MS in Computer Science</i>   TX, USA	3.8 / 4.0	May 2017
University of North Texas, <i>BS in Computer Science, Minor in Mathematics</i>   TX, USA	3.2 / 4.0	May 2013

Finalist: Aspirations in Computing Award 2024, NCWIT

## DISSERTATION

### Convolutional Neural Networks in the Domain of Non-Lexical Audio Signals Published Jul 2024

My research explored the intersection of convolutional neural networks and raw non-lexical audio signals by designing, training, & testing models for mutation detection, upscaling, classification, & generation. I studied at a granular level all aspects of the application of CNNs to discrete temporal signals with dense periodic features, with a focus on music and audio components for music composition and video game production. All projects demonstrated quantifiably successful approaches to their respective problems, & in the case of generation, provided an extensive ground-up analysis of the impact of 150+ architecture variations on early training inference quality. This included 2 novel architecture categories (PrismGAN & SBIGAN) I proposed and demonstrated to solve an artifacting phenomenon I observed to be uniquely problematic for strided deconvolutional models operating on digital signals.

## PUBLICATIONS

### Articles/Papers

- **V. Johnson, I. Parberry** (2020). Music Upscaling Using Convolutional Neural Networks. *2020 3rd International Conference on Sensors, Signal and Image Processing (SSIP 2020)*, 58-62
- **R. West, V. Johnson, I.C. Yeh, Z. Thomas, E. Mendelowitz, L. Berg** (2018). Instrument | one antarctic night. *ACM SIGGRAPH 2018 Art Gallery (SIGGRAPH '18)*, 439-440
- **R. West, V. Johnson, I.C. Yeh, Z. Thomas, M. Tarlton, E. Mendelowitz** (2018). Experiencing a slice of the sky: Immersive rendering and sonification of Antarctic astronomy data. *Electronic Imaging: The Engineering Reality of Virtual Reality 2018*
- **J.P. Lewis, I.C. Yeh, A. Migalska, V. Johnson, R. West** (2017). Exploring the definition of art through deep net visualization. *31st Conference on Neural Information Processing Systems*
- **M. Parola, V. Johnson, R. West** (2016). Turning presence inside-out: MetaNarratives. *Electronic Imaging 4: 1-9*

### Posters

- **V. Johnson, R. Renka** (2016). Triangle mesh generation combining edge splitting and angle-based smoothing. *Posters, 25th International Meshing Roundtable, Sandia National Laboratories*

### Presentations

- **R. West, V. Johnson, I.C. Yeh, T. Margolis, J. Gossmann, A.S. Horn, J.P. Lewis, R. Singh, J. Schulze, I. Mostafavi, B. Hackbarth, W. Li, T. Henthorn, J.I. Girardo, A. Prudhomme** (2017). ATLAS in silico. *MOFO Festival at the Museum of Old and New Art in Hobart, Tasmania*
- **R. West, T. Margolis, J. Gossmann, A.S. Horn, J.P. Lewis, R. Singh, J. Schulze, V. Johnson, I.C. Yeh, I. Mostafavi, B. Hackbarth, W. Li, T. Henthorn, J.I. Girardo, A. Prudhomme** (2016). ATLAS in silico. *The National Academies Keck Futures Initiative Conference*

## EXPERIENCE

### University of North Texas, xRez Lab, CVAD, *Lead Research Assistant* | TX, USA Aug 2014 - Jul 2018

- Designed & implemented multiple NEA & NSF funded hybrid art-science interactive exhibitions, with focus on 3D data-driven multiplayer VR experiences.
- Contributed to many varied projects as the lab's primary software engineer. The ones I lead involved transforming large-scale scientific datasets into collaborative immersive analytics tools which simultaneously serve as artworks, games, and functional data exploration systems.
- Primarily used, not limited to: Unity, C#, C++, Python, MySQL, PD, Max/MSP, CUDA, HLSL, & OpenCV.

### University of North Texas Dept of Comp Sci & Eng, *Graduate Teaching Assistant, Teaching Faculty, Instructor* | TX, USA Aug 2020 - Jun 2024

- Curriculum design & deployment, tutoring, development of teaching tools, lecturing, grading, & directing labs.
- Game Programming I & II (Instructor) - Game programming techniques for implementation of functional projects from scratch in a combination of Unreal & a pure C++/DirectX engine.
- Game Math & Physics (TA) - OOP linear algebra physics system programming for games.
- Computer Science I & II (TA) - Software design, structured programming, OOP, C/C++ basics.
- Database Admin I & II (TA) - Postgresql management. (More courses unlisted)

- Maintained the college's primary website, full stack.

## SKILLS

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Languages Python, C/C++, C#, DirectX, HLSL, Java, CUDA, Matlab, Git, Bash, LaTeX, PHP, Postgres/MySQL  
Software Linux, Tensorflow, Theano, Keras, Unity, OpenCV, Unreal, PD, Max/MSP, Most DAWs  
Certifications Game Programming Certification, Laboratory for Recreational Computing, UNT CSE

## PROJECTS

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### ML Projects – Doctoral research

Jan 2018 - Jan 2024

- **Generative raw audio adversarial networks** - Implemented ~150 GAN architectures for instrument & sound effect sample generation, for exhaustive granular controlled experimental comparison. This included my own structurally novel PrismGAN & SBIGAN models, which both quantifiably succeed at eliminating spectral artifacts in inference.
- **Music upscaling** - Dilated CNN for raw audio music super-resolution. Outperforms baseline in average 2x case, with increased advantage with repeated upscaling.
- **Instrument sample classification** - Compact CNN for supervised raw audio sample separation, 95%+ accuracy on any class combination.
- **Data mutation detection** - Dilated CNN for detecting the presence of sparse hidden messages injected into online game network traffic by a system resistant to statistical analysis methods. Requires no prior knowledge of network protocol and needs only a partial play session for reasonable confidence.

### ML Projects – Graduate

Jan 2016 - Jan 2018

- **Transform-robust art classification and activation visualization** - Deep CNN for binary classification of images as human-made art, trained on large dataset of human-made artworks along with semi-curated scraped non-art images. The trained network was used to iteratively optimize an image toward maximizing activations, with the idea of visualizing the network's concept of what makes an image qualify as art. Training and image synthesis both used intermediate random transform layers of various types, to vastly increase the network's perceptual range with no needed additional data.

### Research Projects– Graduate

Jan 2014 - Jan 2020

- **Instrument: One Antarctic Night** - Multiplayer VR art-science data exploration system, exhibited at several museums & conferences. Utilizing night sky observation data collected from an antarctic telescope, combined with web-scraped metadata extensions from multiple sources, this system provides a VR interface where users are placed inside the cloud of astronomical bodies and can explore millions of data points through manual manipulation of any individual point. Doing so allows users to drill down to all available metadata about each point, while procedurally generating a unique audio-visual component which can be activated as part of a collaborative composition with other players.
- **Binaural Positional Audio Simulation** - Utilizing sine-sweep inverse convolution of recordings placed around a binaural microphone array, provides a system for artificially positioning audio in a perceptual 3D space as a real-time software effect (similar to HRTFs).

### Game Projects– Undergrad/Graduate - All C++ & DirectX

Jan 2010 - Jan 2017

- **Audio-only experimental game** - Utilizing xAudio and positional audio tools, a 3D world simulation with no graphical interface at all meant to be explored purely through sound with interactable goals throughout. Part of a study I developed to test if humans are capable of navigating game worlds through audio.
- **Soundflight** - A 3D rhythm game wherein a music track is split into stems which can be activated by a player one by one, with the goal of keeping the full composition going. The stems are on individual lanes the player can move between, and activated by moving a flying ship along notes procedurally placed on these lanes using a peak detection algorithm.
- **Stick Fighter** - A 2D fighting game with stick figure characters. The system uses 2D animated sprites for the characters rendered against a 3D background. The game features standard fighting systems like special moves and combos, with features such as a gravity and scaling based juggle system.
- **Bot** - A simple 3D platformer designed around technical movement, with features such as wall-runs and wall-jumps.