

Hongwei (Vincent) Cai

Master of Computer Science
Department of Computer Science
University of Iowa

*“Scio me nescire”, but I am always ready
to learn and overcome new challenges*

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EDUCATION

2025 (Expected)	Master's, Computer Science Coursework: ECE 5450 Machine Learning ECE 5995 Applied Machine Learning MATH 4840 Mathematics of Machine Learning MATH 4820 Optimization Techniques CS 4420 Artificial Intelligence CS 4510 Human-Computer Interaction CS 4300 Theory of Computation CS 3620 Operating Systems CS 4400 Database Systems CS 4330 Design and Implementation of Algorithms CS 4980 Designing Systems and Algorithms for Biomedicine CS 3820 Programming Language Concepts CS 2230 Data Structures CS 2630 Computer Organization CS 3330 Algorithms	University of Iowa, IA GPA: 3.74/4.00
2023	Ph.D., Composition Thesis: Path to the Third Pole for Sinfonietta	University of Iowa, IA
2015	M.M., Composition Thesis: The Compositional process in Trio	Oklahoma City University, OK
2012	B.Lit., Composition	Shenyang Conservatory of Music, China

EXPERIENCE

2023 – 2025	Graduate Teaching Assistant Department of Computer Science, University of Iowa CS:4420 Artificial Intelligence (Spring 2025) <ul style="list-style-type: none">Graded homework and held office hours to support students' learning in topics like Intelligent Agents, various Search algorithms, Bayesian Models and Networks, Markov Models, Feedforward and CNNs, RNNs, and Reinforcement Learning CS:2230 Data Structures (Fall 2024) <ul style="list-style-type: none">Led weekly discussion sessions teaching Java programming, guiding students in algorithm analysis for time and space complexity, and data structures selection for various tasksSupported students in implementing data structures, understanding their operations, and applying object-oriented programming (OOP) principles CS:3820 Programming Language Concept (Spring 2024 & Fall 2024) <ul style="list-style-type: none">Supported instruction in the functional programming language Haskell and programming proofs using AgdaEstablished open communication via office hours, email, and resolved issues in collaboration with fellow TA
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	<p>CS:2630 Computer Organization (Spring 2023)</p> <ul style="list-style-type: none"> • Instructed two cohorts of 20 students during 75-minute classroom sessions in a supportive learning environment • Assistant in teaching C programming, Bash, assembly language programming, X86 Instruction Set Architecture (ISA), memory management, and CPU pipelining
Summer 2024	<p>Software Engineering Intern – Commerce Integration Platform Casey's, Ankeny, IA</p> <ul style="list-style-type: none"> • Gained exposure to Agile methodologies and actively participated in Scrum ceremonies, developing effective communication and fostering teamwork throughout the software development lifecycle (SDLC) • Acquired hands-on experience of CI/CD and DevOps practices by solely responsible for the tech debt project of upgrading all Commerce Integration Platform applications to .NET 8, ahead of the .NET 6 end-of-life in November 2024 • Supported various IT initiatives including decommissioning unused applications, documenting server vulnerabilities, removing EWS firewall rules by submitting tickets through ServiceNow • Obtained in-depth exposure to data-driven decision-making and advanced data strategies through job shadowing in Marketplace Data, Platform Engineering, and Data Science teams • Enhanced understanding of penetration testing and data loss prevention (DLP) through experience in Red Teaming, Data Assurance, and Cyber Intelligence within Cyber Operations
2018 – 2019	<p>Graduate Research Assistant Center for New Music, School of Music, University of Iowa</p> <ul style="list-style-type: none"> • Studied musical scores in detail, gaining a deep understanding of the composer's intentions, musical structure, and interpretive nuances • Assisted in coordinating concerts, workshops, and various events at the Center for New Music • Offered artistic input during rehearsals, discussions with the director, and interpretation of musical pieces • Offered technical support for equipment and displays employed in new music research to enhance concert experiences • Assisted in ensuring the ensemble's performance meets the recording requirements
2017 – 2020	<p>Course Instructor School of Music, University of Iowa</p> <ul style="list-style-type: none"> • Taught Music Composition course MUS: 1020 and MUS:1139 • Coached non-major students in one-on-one setting to enhance their composition skills and musicianship • Developed lesson plans from weekly course outlines and crafted examples to suit needs of the class • Assessed assignments and final project

PROJECTS

In progress	<p>Rapid Diagnosis of Aortic Valve Insufficiency in Aortic Root Enlargement OpenCV, Insight Toolkit (ITK), nnU-Net, JupyterLab, HPC, DataViewerCartesian</p> <ul style="list-style-type: none"> • Developing and implementing an AI-driven pipeline using nnUNet for pre-segmentation and final segmentation of the aortic root and valve from CT scans
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- Designing and evaluating diagnostic measures to classify normal and diseased cases, enhancing existing metrics and integrating novel features for improved accuracy in Aortic Valve Insufficiency detection

Fall 2024

Automatic Speech Recognition (ASR) System

Python, Numpy, Kaldiio, JSON

- Implemented a deep feedforward neural network for Connectionist Temporal Classification (CTC), including dynamic programming and Viterbi search for token alignments in audio streams
- Replicated an ASR system incorporating forced alignment, beam search decoding, and dynamic training for variable-length speech sequences
- Optimized training with custom backpropagation, softmax computation, gradient clipping, and efficient handling of large-scale audio datasets

Spring 2024

Cross-Modality MRI Synthesis with CycleGANs

Google Colab, PyTorch, NumPy, Pandas, Matplotlib, MONAI, Slicer, Horos

- Replicated a 2D CycleGAN model to translate between MRI modalities (T1&T2) using Vestibular-Schwannoma-SEG dataset
- Implemented advanced deep learning techniques including PatchGAN discriminators and residual-based generators for robust image transformation
- Integrated Adam optimizers with exponential decay schedulers to optimize GAN training, ensuring stable and efficient model convergence

Spring 2024

Predicting functional annotations in Gene Ontology with maps of protein structure space

Python, PDB, GO, FATCAT, DALI, Unknome, PCA, MDS

- Replicated algorithms to predict protein functions by analyzing structural similarities using dimensional reduction techniques
- Mapped protein structure space and identified functionally similar clusters based on pairwise structural comparisons
- Generated and analyzed protein similarity matrices using structural alignment tools and predicted Gene Ontology annotations
- Validated functional predictions by comparing them with known annotations, adjusting the model based on validation results

Spring 2024

Enhancing Image Super-Resolution Using EDSR

- Replicated the Enhanced Deep Super Resolution (EDSR) model, using its deep architecture and residual blocks, gaining insights into advanced image resolution techniques compared to traditional methods like SRCNN and SRResNet in image resolution
- Applied a modular block-based approach in a single-scale EDSR model to convert low-resolution images into high-resolution outputs, significantly enhancing visual details

2023

FoodShareConnect, HACKUIOWA Project

Python, Django, JavaScript, ReactJS, HTML, CSS, MariaDB, Git

- Managed front-end development, collaborated efficiently with back-end teammates for seamless integration
- Facilitated effective communication, driving efficient issue resolution, idea sharing, and timely project delivery
- Utilized GitHub for version control, fostering a collaborative development environment

2023	Combination Tone Generator Python, Flask, JavaScript, HTML, CSS, PyCharm, Git <ul style="list-style-type: none"> Implemented input validation for error reduction and enhanced tool reliability Designed a user-friendly responsive interface with CSS adaptable to various screen sizes Developed a note frequency caching mechanism for improved responsiveness
2023	Website Building and Design HTML, CSS, JavaScript, VS Code, Front-end Development, Git <ul style="list-style-type: none"> Rebuilt personal website from scratch, refining HTML, CSS and JavaScript skills for an engaging user experience Created a user-centric, responsive interface with adaptable CSS for seamless browsing on different screen sizes Improved website's SEO, increasing search engine visibility and organic traffic
2022	Build ARM Processor Logisim, Python, Bash, Linux, GitLab <ul style="list-style-type: none"> Designed a complex digital system, adding new instructions to the datapath and control during implementation Applied combinational logic to build ARM processor components in Logisim and created Python test programs Employed robust testing methodologies for digital logic design, ensuring accuracy and reliability

ARTISTIC ACTIVITY

Selected Compositions and Performances

2023	Path to the Third Pole for sinfonietta
2021	Scapulis Suis for SSA choir a cappella
2021	How Soon Hath Time for mixed choir divisi a cappella on John Milton's Sonnet
2021	Dal niente, al niente, a song set to Shelley's "Ozymandias" for soprano, flute, and harp <ul style="list-style-type: none"> The ensemble Dal Niente, University of Iowa (Apr 18, 2021)
2021	Collapsing Shells for solo double bass and live electronics <ul style="list-style-type: none"> Will Yager, double bass, University of Iowa, May 9, 2021 Will Yager, double bass, University of Iowa, Mar 28, 2021
2020	String Quartet No.2 "Poppies Bursting into Bloom in the Wind and Rain" <ul style="list-style-type: none"> The JACK Quartet, Merkin Concert Hall, NYC, Mar 10, 2021
2020	Impulse for solo trombone <ul style="list-style-type: none"> Mark Rheäume, trombone, University of Iowa, Nov 17, 2020
2020	Unrest for solo clarinet <ul style="list-style-type: none"> Arianna Edvenson, clarinet, University of Iowa, Sep 28, 2020
2019	Soaring Over a Storm <ul style="list-style-type: none"> Yixue Snow Zhang, violin, University of Iowa, Dec 8, 2019 Yixue Snow Zhang, violin, Indiana University, Nov 9, 2019
2019	Tempest in Yellow

- Eva Richards, cello, University of Iowa, Sep 8, 2019
- 2018 String Quartet No.1 Attainment of The Other Shore
 - SCI Online National Concert and Workshops, May 6, 2021
 - Contemporary Directions Ensemble, University of Michigan, Apr 10, 2021
 - The JACK Quartet, University of Iowa, Mar 13, 2019
- 2018 You Came from Our Hometown for solo voice, poem by Wang Wei (699-761)
 - Anika Kildegaard, soprano, University of Iowa, Sep 9, 2018
- 2017 Moments for Chamber orchestra
 - CCM Chamber Orchestra, University of Cincinnati, Oct 19, 2018
 - Center for New Music, University of Iowa, Apr 6, 2018
- 2017 Nocturne for clarinet, cello, and piano
 - The Ensemble Accroche Note, University of Iowa, Apr 27, 2019
 - Mauricio Silva, clarinet, Craig Hultgren, cello, Hongwei Cai, piano, University of Michigan, Nov 11, 2017

Selected Performances as a Pianist

- 2018 John Adams: *Gnarly Buttons*
 - Center for New Music, University of Iowa, Dec 2, 2018
- 2018 John Clay Allen: *Light Pillars*
 - Center for New Music, University of Iowa, Apr 6, 2018
- 2018 Qi Jing: *The Hesitation in Your Eyes*
 - Center for New Music, University of Iowa, Apr 6, 2018

CONFERENCES

- 2021 Midwest Graduate Music Consortium
 - Presented String Quartet NO.1 “Attainment of the Other Shore”
- 2019 Midwest Composers Symposium (University of Indiana)
 - Premiered solo violin work “Soaring Over a Storm”
- 2018 Midwest Composers Symposium (University of Cincinnati)
 - Presented chamber orchestral work “Moments” in the opening concert
- 2018 Exchange of Midwest Collegiate Composers (U Iowa)
 - Premiered orchestral work “Moments” in the opening concert
- 2017 Midwest Composers Symposium (University of Michigan)
 - Premiered chamber music work “Nocturne”
 - Participated in two other composers’ works premiere as a pianist
- 2017 Exchange of Midwest Collegiate Composers (UMKC)
 - Participated in two works premiere as a pianist

HONORS & AWARDS

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| 2023 | <u>Marcus Bach Graduate Fellowship</u>
Awarded \$10,500 for promoting intercultural communication and understanding of diverse religious perspectives | University of Iowa |
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2021	Graduate College Summer Fellowship Awarded \$5,000 to support summer research	University of Iowa
2019	Henry and Parker Pelzer Fellowship Award Awarded \$10,000 to one outstanding composer each year	University of Iowa
2017	Henry and Parker Pelzer Fellowship Award Awarded \$10,000 to one outstanding composer each year	University of Iowa
2013 - 2015	Graduate Music Talent Scholarship Awarded \$9,000 to music major student each year	Oklahoma City University
2010	Won first place for the biannual Piano Competition	Shenyang Conservatory of Music
2009 - 2011	SYCM Merit Scholarship	Shenyang Conservatory of Music

CAMPUS INVOLVEMENT

2023	HACKUIOWA, the University of Iowa Hackathon
2023	"Teaching as an International Student" Presentation at New TA Orientation

PROFESSIONAL AFFILIATIONS

2023	Association for Computing Machinery
2018	American Society of Composers, Authors, and Publishers
2017	Golden Key International Honor Society
2017	Phi Beta Delta Honor Society for International Scholars
2016	Society of Composers, Inc

PROFESSIONAL DEVELOPMENT

2023	Introduction to High Performance Computer using Argon Cluster
2023	Cloud Computing Workshop Series using Amazon Web Services
2020	Engaging Across Cultures: Navigating Intercultural Conflicts
2015	Composing for Video Games with Thomas Chance

TECHNICAL SKILLS

Programming Languages: Python, Java, C#/.NET, C/C++, JavaScript, Java, Haskell, HTML5/CSS3

DS/ML Libraries: PyTorch, OpenCV, Insight Toolkit (ITK), nnU-Net, Scikit-Learn, NumPy, Pandas, Matplotlib, Seaborn

Databases: MySQL, PostgreSQL, Microsoft SQL, MongoDB

Tools & Technologies: Jira, New Relic, ServiceNow, Confluence, Microsoft Azure, Azure DevOps, Git/GitHub, Docker, Linux, HPC

OTHER SKILLS

- Music composing
- Piano performance
- Orchestration
- Teaching
- Music Engraving (Avid Sibelius, Finale)
- Post Audio production (Avid Pro tools, Logic Pro)
- Audio-Visual Interface (Max/MSP/Jitter)
- Reference Management (Endnote)

LANGUAGES

- English (American) – Full professional proficiency
- Mandarin Chinese – Primary proficiency