

# ILANA SHAPIRO

## CONTACT

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## RESEARCH INTERESTS

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My interests lie in the integration of programming languages, generative AI, and human-computer interaction. I aim to develop human-interpretable structural constraints on sequence models for the controllable generation of well-formed sequence data. My goal is to create a richly interactive, human-machine co-creation process enabling end-users to produce structurally sound media.

## EDUCATION

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**University of California, San Diego**, La Jolla, CA

2023-present

Ph.D. Computer Science

Programming Systems Group, advised by Professor Sorin Lerner

GPA: 4.0/4.0

**Pomona College**, Claremont, CA

2018-2022

B.A. Computer Science/Music (Flute) double major, minor in Mathematics

GPA: 4.0/4.0, Summa Cum Laude, Distinction in Senior Exercises

- **Computer Science Thesis:** "MusAssist: A Domain Specific Language for Music Notation"
  - Advised at Harvey Mudd College by Professor Ben Wiedermann
- **Music Thesis and Recital:** "Mieczysław Weinberg: Music Transcending Tragedy"
  - Advised by Professors Alfred Cramer, Joti Rockwell, and Eric Lindholm

## RESEARCH PROJECTS

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**Synthesizing Composite Hierarchical Structure from Music Corpora** [\[AAAI preprint\]](#)[\[code\]](#) 2024

- Introduced a unified, hierarchical meta-representation of music structure as a  $k$ -partite DAG. Combined stochastic and formal logic techniques to frame and solve the dually NP-hard combinatorial optimization problem of music structure summarization. Under final round review at the 2025 AAAI Conference on Artificial Intelligence.

**pgen-rs: LLM-Aided Efficient and User-Friendly Genomic Data Wrangling** [\[paper\]](#)[\[code\]](#)[\[slides\]](#) 2024

- Developed pgen-rs, a tool enabling end-users to write genomic data wrangling requirements in natural language and execute with Rust-based high-performance genomic data processor.

**ProCon: Continuous Enumeration for Just-In-Time Bottom-Up Synthesis** [\[paper\]](#)[\[code\]](#) 2024

- Introduced continuous, rule-based enumeration for just-in-time bottom-up search in SyGuS problems, where programs are enumerated in order of continuous, nonrounded weights as determined by a probabilistic weighting function.

**MusAssist: A Domain Specific Language for Music** [\[TENOR paper\]](#)[\[thesis2\]](#)[\[code\]](#)[\[demo\]](#) 2022

- Published at 8th International Conference on Technologies for Music Notation and Representation 2023. Created DSL bridging the abstraction gap between music theoretical structures and notation. Wrote Haskell-based compiler to MusicXML.

**Mieczysław Weinberg: Music Transcending Tragedy** [\[thesis1\]](#)[\[recital\]](#) 2022

- Published in Scholarship@Claremont. Wrote extensive musicology thesis examining narrative and memory in Weinberg's *Kaddish* Symphony. Presented flute recital of my transcriptions of Weinberg's cello works.

**Markov Chain Music Generation** [\[JHM paper\]](#)[\[code\]](#) 2021

- Published in *Journal of Humanistic Mathematics*. Created a novel system of Markov chains using inverse transform sampling, enabling end-users to rapidly generate musical sketches.

**Virtual Ensemble Assembly: Musicality in Separation** [\[WAC paper\]](#)[\[code\]](#) 2020

- Published at Web Audio Conference 2022. Assisted on Prof. Christopher Raphael's research at Indiana University Bloomington exploring synchronizing audio tracks without click tracks.

**DNA to Music (MIDI) Translation** [\[paper\]](#)[\[code\]](#) 2019

- Created original Python-based model translating DNA to MIDI. Analyzed result for harmonic sequences to classify species into taxonomic classes. Ranked species by musicality.

## RESEARCH ARTIFACTS

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\*equal contribution

**Ilana Shapiro**, Ruanqianqian (Lisa) Huang, Zachary Novack, Cheng-i Wang, Hao-Wen Dong, Taylor Berg-Kirkpatrick, Shlomo Dubnov, and Sorin Lerner. "Synthesizing Composite Hierarchical Structure from Music Corpora." Under review. 2024. [\[paper7\]](#)

Cole Kurashige,\* Savitha Ravi,\* and **Ilana Shapiro**.\* "pgen-rs: LLM-Aided Efficient and User-Friendly Genomic Data Wrangling." Unpublished manuscript, 2024. [\[paper6\]](#)

Ani Canumalla,\* **Ilana Shapiro**,\* and Kyle Thompson.\* "ProCon: Continuous Enumeration for Just-In-Time Bottom-Up Synthesis." Unpublished manuscript, 2024. [\[paper5\]](#)

**Ilana Shapiro**. "MusAssist: A Domain Specific Language for Music Notation." *Proceedings of the International Conference on Technologies for Music Notation and Representation (TENOR'23)*, pp. 75-82, Northeastern University, Boston, MA, 2023. [\[paper4\]](#)

Kaitlin Pet, **Ilana Shapiro**, and Christopher Raphael. "Virtual Ensemble Assembly: Musicality in Separation." In *Web Audio Conference (WAC'22)*, Cannes, France, 2022. [\[paper3\]](#)

**Ilana Shapiro**. 2022. *MusAssist: A Domain Specific Language for Music Notation*. Bachelor's thesis. Pomona College. [\[thesis2\]](#)

**Ilana Shapiro**. 2022. *Mieczysław Weinberg: Music Transcending Tragedy*. Bachelor's thesis. Pomona College. [\[thesis1\]](#)

**Ilana Shapiro** and Mark Huber. "Markov Chains for Computer Music Generation." In *Journal of Humanistic Mathematics, Volume 11 Issue 2 (July 2021)*, pp. 167-195. [\[recital\]](#)

**Ilana Shapiro**. "Converting DNA to Music: Sonifying Structure, Splicing, and Translation." Unpublished manuscript, 2019. [\[paper2\]](#)

## Talks

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"Synthesizing Composite Hierarchical Structure from Music Corpora." *Programming Systems Group, UC San Diego*, Apr. 2024.

"MusAssist: A Domain Specific Language for Music Notation." *International Conference on Technologies for Music Notation and Representation*, May 2023.

## ACADEMIC HONORS

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**The Phi Beta Kappa Award** 2022

- Endowed by the Pomona Chapter of Phi Beta Kappa, awarded to one senior selected for high quality of scholarship and promise of future distinction.

**The Rena Gurley Archibald High Scholarship Prize** 2022

- Awarded to the member(s) of the Pomona College graduating class ranking highest in scholarship.

**Distinction in Senior Exercise (Computer Science)** 2022

- Exceptional work on the senior exercise is awarded based on review by the entire faculty of the Computer Science Department at Pomona College.

**Distinction in Senior Exercise (Music)** 2022

- Exceptional work on the senior exercise is awarded based on review by the entire faculty of the Music Department at Pomona College.

**The Katherine J. Hagedorn Prize** 2022

- Awarded annually to the Pomona College student(s) demonstrating exceptional loyalty and dedication to their music studies.

**Phi Beta Kappa Induction (Junior Year) - Pomona College Chapter** 2021

- 1 of 8 juniors awarded for "good moral character," distinguish in "breadth of culture," and "excellence of scholarship."

**The William F. Russell Prize** 2020

- Awarded annually to the Pomona College prospective music major(s) showing substantial accomplishment and significant promise in their study of music.

## INDUSTRY EXPERIENCE

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### Freelance Software Engineer, Stainless

*Feb. 2023-present*

- Make open-source contributions to codebases such as Stoplight Prism, node-tree-sitter, Microsoft Pyright, NPM Trends, and json-schema-benchmark.

### Software Engineer, Meta

*Oct. 2022-Nov. 2022*

- Improve type safety of Python and Hack code in engineering bootcamp. Impacted by the 13% company layoff as a new hire.

### 3x Software Engineering Intern, Facebook

*Summers of 2019, 2020, 2021*

- iOS/serverside fullstack intern on Facebook Events and Groups.

## SKILLS

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**Programming Languages:** Python • Haskell • TypeScript • Java • Objective-C • SQL • GraphQL

**Tools/Frameworks:** LaTeX • Git • Functional and Object-Oriented Programming

**Domain Knowledge:** Domain Specific Languages • Parsing/Compilers • Stochastic/Combinatorial Optimization • User Studies • Human-Centered Design • Constrained Generative Models

## TEACHING EXPERIENCE AND LEADERSHIP

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### Mentorship Co-Chair, GradWIC UCSD

*Fall 2024-present*

- Manage the UCSD Graduate Women in Computing Mentorship Program. Pair 174 mentees with mentors, personally mentor 2 students, host inclusive group activities.

### Teaching Assistant, Database Systems, Pomona College

*Spring 2020*

- Hold twice-weekly mentor hours, monitor Piazza forums, and reply when appropriate.