

# Shih-Lun Wu

Student, **M.Sc. in Language Technologies (MLT)**, School of Computer Science  
Carnegie Mellon University (CMU), Pittsburgh, PA, United States

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## EDUCATION

**Master of Science (M.Sc.)** | Carnegie Mellon University 08.2022 ~ 08.2024 (expected)

Language Technologies major

- Research areas: **Music, Speech, Multimodal Learning**
- Advisors: Dr. Shinji Watanabe, Dr. Daniel Fried

**Bachelor of Science (B.Sc.)** | National Taiwan University 09.2017 ~ 06.2021

Computer Science major • Economics minor

- Cumulative GPA -- Overall: **4.28/4.30**, Major: **4.28/4.30**, Rank: **1/176**
- Bachelor's thesis: "**Bridging Transformers and Latent Variable Models for User-Controllable Conditional Music Generation.**" Committee members: Dr. Yi-Hsuan Yang, Dr. Yun-Nung Chen, Dr. Lin-shan Lee [[pdf](#)] [[defense slides](#)]

## HONORS

**Ssu-Nien Fu's Award (1<sup>st</sup> Prize), Best Bachelor's Thesis** | National Taiwan University 06.2021

- Awarded to only 6 out of 3500+ students in the graduating class for outstanding research

**1<sup>st</sup> Prize, Best Undergraduate Research** | Dept. of CSIE, NTU 06.2020, 06.2021

- Won twice with works on evaluation metrics for AI music, and deep music generation models (publ. [2] & [4])

**Dean's List** | National Taiwan University Fall '17, '18, '19 & Spring '18, '19, '21

## SELECTED PUBLICATIONS

- [6] **Shih-Lun Wu** and Yi-Hsuan Yang. "Compose & Embellish: Well-Structured Piano Performance Generation via A Two-Stage Approach." Submitted to *Int. Conf. on Acoustics, Speech, & Signal Processing (ICASSP)* 2023. [[pdf](#)]
- [5] Yi-Jen Shih, **Shih-Lun Wu**, Frank Zalkow, Meinard Müller, and Yi-Hsuan Yang. "Theme Transformer: Symbolic Music Generation with Theme-Conditioned Transformer." *IEEE Transactions on Multimedia (TMM)* 2022. [[pdf](#)] [[code](#)] [[project website](#)]
- [4] **Shih-Lun Wu** and Yi-Hsuan Yang. "MuseMorphose: Full-Song and Fine-Grained Music Style Transfer with One Transformer VAE." Submitted to *IEEE/ACM Transactions on Audio, Speech, & Language Processing (TASLP)*. [[pdf](#)] [[code](#)] [[project website](#)]
- [3] Antoine Liutkus, Ondřej Cífka, **Shih-Lun Wu**, Umut Simsekli, Yi-Hsuan Yang, and Gaël Richard. "Relative Positional Encoding for Transformers with Linear Complexity." *International Conference on Machine Learning (ICML)* 2021. (Long talk, acceptance rate: **3.0%**) [[pdf](#)] [[code](#)] [[presentation video](#)] [[project website](#)]
- [2] **Shih-Lun Wu** and Yi-Hsuan Yang. "The Jazz Transformer on the Front Line: Exploring the Shortcomings of AI-Composed Music through Quantitative Measures." *International Society for Music Information Retrieval Conference (ISMIR)* 2020. [[pdf](#)] [[code](#)] [[poster](#)] [[presentation video](#)]
- [1] **Shih-Lun Wu\***, Ching-Yuan Bai\*, Kai-Chieh Chang, Yi-Ting Shieh, Chao Huang, Chung-Wei Lin, Eunsuk Kang and Qi Zhu. "Efficient System Verification with Multiple Weakly-Hard Constraints for Runtime Monitoring." *International Conference on Runtime Verification (RV)* 2020. (\*: equal contribution) [[pdf](#)] [[publisher page](#)]

## RESEARCH EXPERIENCE

**Research Engineer** | Taiwan AI Labs 08.2021 ~ 03.2022

**Research Intern** | Taiwan AI Labs 07.2020 ~ 07.2021

**AI Music Team, Human-Computer Interaction Group**

- Designed mechanisms to exert time-varying control on Transformers for sequence generation (see publication [4])
- Bridged Transformers, the mechanism above, and Variational Autoencoders for fine-grained style transfer of long musical pieces, allowing users to harness harmonic & rhythmic intensities down to the bar level (publ. [4])
- Made a 3-stage model to generate well-structured music with recurring & developing content (some results in [6])

## RESEARCH EXPERIENCE (Cont'd)

**Undergraduate Research Assistant** | Academia Sinica 02.2020 ~ 06.2021

**Music and AI Lab, Research Center for IT Innovation.** Advisor: Dr. Yi-Hsuan Yang

- Collaborated with researchers @ INRIA / Télécom Paris on positional encodings for O(n) Transformers (publ. [3])
- Developed a set of widely-used quantitative metrics to assess the quality of AI music (publ. [2])
- Improved generative Transformers by inserting structure-related tokens from WJazzD music database (publ. [2])

**Undergraduate Research Assistant** | National Taiwan University 02.2019 ~ 06.2020

**Cyber-Physical Systems Lab, Dept. of CSIE.** Advisor: Dr. Chung-Wei Lin

- Formulated the formal verification problem under multiple weakly-hard constraints on environmental faults
- Discovered and proved the mathematical properties between pairs of weakly-hard constraints
- Devised a lowest-cost-first heuristic using the properties, accelerating verification algorithm by up to 12x (publ. [1])

## OTHER WORK EXPERIENCE

**Teaching Assistant** | National Taiwan University 09.2019 ~ 01.2020

**Algorithm Design & Analysis (CSIE 2136), Prof. Hsu-Chun Hsiao & Prof. Yun-Nung Chen**

- Designed homework problems for the rigorous course emphasizing on both theoretical depth & coding skills
- Held weekly TA hours to help students on coding problems and mathematical reasoning

**Software Engineering Intern** | Asus Inc. 07.2019 ~ 08.2019

**Cloud Infrastructure Team, Asus Intelligent Cloud Services (AICS) Center**

- Gained experience with CI/CD tools: Travis CI, Sonar Cloud, and MS Azure Pipelines
- Co-developed a Kubernetes + Python (Flask) template for launching containerized, cloud-based ML solutions
- Integrated Azure Key Vault, Mutual TLS auth & Azure App Insights to the template to streamline model deployment

## OTHER SELECTED PROJECTS

**MuseOptimus: Interactive AI Composition Webapp** | ReactJS · PyTorch 01.2021

- Realized a dynamic user interface for my music generation model developed @ Taiwan AI Labs
- Implemented comprehensive features, including dynamic note display, song rating, and song recommendation
- Scored the highest among 100+ final projects in NTU's Web Programming course (by Prof. Ric Huang) [\[slides\]](#)

**CSIE Multi-Player Online Gaming Platform** | Python · SQLAlchemy · Socket.IO 06.2020

- Took charge of the system design; modularized the project and assigned tasks to individual team members
- Designed database schema and used SQLAlchemy to achieve database CRUD using Python native APIs
- Handled concurrency in multi-player games with Socket.IO, a real-time, bi-directional communication library

## EXTRACURRICULAR ACTIVITIES & SERVICE

**Pianist, Violist, & Director of General Affairs** 09.2018 ~ 06.2021

**Symphony Orchestra, National Taiwan University**

- Participated actively in concerts [\[playlist\]](#) and handled procurement, musical scores, and transportation affairs

**Peer Reviewer**

- Conferences: ICMLA (2020), ISMIR (2021, 2022)
- Journals: TISMIR (2021)

## SKILLS & QUALIFICATIONS

- GRE: 332 (V: 162, Q: 170, AW: 4.5); TOEFL: 107 (R: 30, L: 28, S: 24, W: 25)
- Programming Languages & Infrastructure: Python · C/C++ · JavaScript · ReactJS · LaTeX · Linux · Kubernetes
- Machine Learning Frameworks: PyTorch · Keras · Tensorflow
- Selected Coursework: **Straight A+'s** in the following courses
  - CS fundamentals: Data Structures & Algorithms, Algorithm Design & Analysis, Operating Systems, Discrete Math, Linear Algebra, Probability, Formal Language & Automata Theory
  - ML/DL-related: ML Techniques, Special Topics on ML, Deep Learning for Human Language Processing