

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: **Audio, Music, Multimodal Learning**
- Advisor: Dr. Shinji Watanabe

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

1st Prize, Automated Audio Captioning Challenge | DCASE 2023 06.2023

- Leveraged ChatGPT mix-up augmentations and LLM embedding supervision to achieve new SoTA [[tech report](#)]

Ssu-Nien Fu's Award (1st 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 in AI music generation

SELECTED PUBLICATIONS

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- [7] **Shih-Lun Wu**, Yi-Hui Chou, and Liangze Li. "Listener Model for the PhotoBook Referential Game with CLIPScores as Implicit Reference Chain." *Annual Meeting of the Assoc. for Computational Linguistics (ACL)* 2023. [[pdf](#)] [[code](#)]
 - [6] **Shih-Lun Wu** and Yi-Hsuan Yang. "Compose & Embellish: Well-Structured Piano Performance Generation via A Two-Stage Approach." *Int. Conf. on Acoustics, Speech, & Signal Processing (ICASSP)* 2023. [[pdf](#)] [[code](#)]
 - [5] **Shih-Lun Wu** and Yi-Hsuan Yang. "MuseMorphose: Full-Song and Fine-Grained Music Style Transfer with One Transformer VAE." *IEEE/ACM Transactions on Audio, Speech, & Language Processing (TASLP)* 2023. [[pdf](#)] [[code](#)] [[project website](#)]
 - [4] 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](#)]
 - [3] Antoine Liutkus, Ondřej Čířka, **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 [5])
- 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. [5])
- 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, 2023)
- Journals: TISMIR (2021), ACM Computing Surveys (2023)

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, Advanced NLP, Speech Recognition & Understanding, Multimodal ML