

Ting-Wei Wu

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Research Interests in *deep learning, natural language processing, vision & conversational AI*.

EDUCATION

Georgia Institute of Technology

Ph.D. in Machine Learning; GPA: 3.90

Advised by Dr. Biing-Hwang Juang

Atlanta, GA

Aug. 2019 - Jul. 2023

University of California, Berkeley

M.Eng. in Bioengineering; GPA: 3.83

Advised by Dr. Aaron Streets

Berkeley, CA

Aug. 2017 - May. 2018

National Taiwan University

B.S. & M.S. in Electrical Engineering; GPA: B.S. 3.82 (3.93/4.3); M.S. 4.00 (4.22/4.3)

Advised by Dr. Chih-Ting Lin

Taipei, Taiwan

Sep. 2012 - Jul. 2017

SKILLS

Languages: Python, C & C++, MATLAB, SQL, Verilog, VBA, Java

Technologies: Pytorch, Tensorflow, Data Science, Docker, GPU, Flask, AWS, Linux OS, Git, AutoCAD, Photoshop, COMSOL

Coursera Certificates: Advanced ML (DL, Bayesian, RL, NLP), Deep Learning Specialization, Machine Learning

Courses: Math in ML, Probabilistic Graphical Model, Computational Data Analysis, Convex Optimization, Deep Learning, Deep Learning for texts, Digital Image Processing, Data Structures and Programming, Computer Vision, Operating Systems

PROFESSIONAL EXPERIENCE

- **Research Scientist Intern, Meta** Sunnyvale, CA
Meta Reality Labs, Fast AI team (**pytorch, transformers, pytext, fairseq**) *Aug. - Nov. 2022*
 - Cross-lingual transfer: Devised a seq2seq framework with MT pretraining for dialog benchmark tasks in low-resource language.
- **Applied Scientist Intern, Amazon** Seattle, WA
Alexa AI - Natural Understanding team (**pytorch, T5, VAE**) *May. - Aug. 2022*
 - Data augmentation in skill routing: Devised a new heterogeneous data augmentation framework with conditional generative network with variational latent space to increase model robustness of Alexa skill routing and action planning components.
 - Replication policy: Showed replication rate improvement on utterances on over 70% low-count and low-accuracy intents with augmented data from joint T5 seq2seq models and conditional variational BERT.
- **Applied Scientist Intern, Amazon** Seattle, WA
Alexa Speech - Language Modeling team (**pytorch, transformers, lightgbm, libsvm**) *May. - Aug. 2021*
 - ASR second pass rescoring: Adopted LambdaMART with listwise loss to rescore N -best hypotheses with miscellaneous linguistic/non-linguistic signals. Introduced WER reduction of 5.16 % in Alexa dataset and 9.38 % in Librispeech test-clean.
 - Feature engineering: Proposed a new ensemble approach of ASR BERT-based confidence sub-models to digest group information and other customer-related signals like query rewrites and error detection signals. Published in **INTERSPEECH'22**.
- **Machine Learning Research Intern, VMware** Palo Alto, CA
Storage IO & Performance Engineering team (**pytorch, transformers, nltk, mysql, gensim**) *May. - Oct. 2020*
 - Causality Extraction: Devised a new two-stream attention BiLSTM-CRF model on causality inference and paragraph-level pairing, enhancing F1 benchmark score to 0.74. Published in two internal conferences **VML'20, RADIO'21**.
 - Knowledge Graph: Established an end-to-end nlp pipeline for inter/intra sentence causality retrieval to extract 2300 useful causal relations out of 20000 problem requests within seconds to construct knowledge network for troubleshoot diagnosis.
 - Few-shot Learning: Introduced new ProtoNet-based method for few labeled data in casual tagging, boosting F1 by 11%.
- **Graduate Researcher, Speech & Spoken Language Processing Lab** Atlanta, GA
Task-oriented dialog understanding, advised by **Dr. Biing H, Juang** (IEEE Fellow, NAE member) *Aug. 2019 - now*
 - Low-resource: Developed a zero-shot multi-intent label-aware BERT framework for dialog turns. Published in **EMNLP'21**.
 - Context/Act-aware: Devised a new multi-turn dialog context-ware hierarchical BERT mechanism for multi-task training and exploited dialog act signals in state tracking. Three papers published in **INTERSPEECH'21, '22**.
 - Knowledge base: Context and knowledge attention for mutual SLU detection. Published in **ICASSP'22, EACL'23**.
 - Machine introspection: Adapted continual learning in task-oriented dialogue domain adaptation tasks and reinforced downstream dialogue tasks on MultiWOZ/DSTC8 dialogue datasets with online response evaluation mechanism.
- **Graduate Teaching Assistant, Signal Processing & Electronic Device Innovation** Atlanta & Taipei
Intro to Signal Processing (ECE 2026) & Device Innovation at NTU (**matlab, SP-First**) *2016-2017, 2019*
 - Matlab sessions: Supervised and lectured in lab & recitation sessions with matlab programming on digital signal processing. Provided signal processing (FT, DTFT, DFT, z-transform) and matlab skills for undergraduate teaching.
 - Entrepreneurship development: Led discussions & project management for 3 courses in Device Innovation and meetings with 100+ industry experts and students to develop new business models and research technology transfer, incubating 2 AI startups.

HIGHLIGHTED PROJECTS

- **DeepEyeNet: Image Captioning with keyword-driven report generation** *Image Captioning & NLP*
Research Project collaborated with Gatech, UvA, KAUST (*keras, tensorflow, pandas*) *Feb. 2019-Nov. 2021*
 - Dataset preparation and evaluation: Prepared 18,854 images annotated by experienced ophthalmologists and designed a new evaluator for the caption generator jointly in adversarial training. Work published in **WACV'21**.
 - Transformer: Devised a new contextual transformer decoder with semantic attention of technical keywords and retinal images for medical image captioning. Introduced BLEU-avg and CIDEr 74% and 87% increase over baseline models and improved abnormality interpretability. Published works in **ICMR'21, ICIP'21, WACV'22, WACV'23**.
- **Machine Translation Quality Estimation** *Natural Language Processing*
Deep Learning (CS7643) Research Project advised by Facebook AI (*pytorch, transformers, polyglot*) *Jan.-May. 2020*
 - Transfer learning: Exploited predictor-estimator model with new transformer structure to pretrain large quality-labeled translation corpus in common languages and adapt to other scarce language QE data with semi-supervised self training.
 - Ensembling: Ensembled predictions from fine-tuning an estimator and various pretrained predictors in several languages like English, Chinese, German to Estonian, Nepali with XGBoost Model, where Pearson score beats baseline 0.11 by 2 times.
- **StackBoxer: Chatroom with bilingual AI chatbots - <https://chatbox.cc>** *Natural Language Processing*
Full-stack online platform for functional chatbots (*Pytorch, Django, Docker, PostgreSQL*) *Jan.-Mar. 2019*
 - StackBot: Modeled intent/tag identifier from tfidf features and Starspace embeddings for matching Stackoverflow queries.
 - Movie Bot, ChickBot, YourFbBot: Established a customized 2-layer seq2seq model with attention mechanism and self-designed reward mechanism with policy gradient reinforcement set up in Django+Docker+nginx backend environment.
- **Novelty Intervention in Hunter-Gatherer Game of Polycraft** *Reinforcement Learning*
Research project in DQN funded by DARPA (*pytorch, gym, socket*) *Apr.-Nov. 2020*
 - Target-DQN: Designed a vision-based DQN agent to perform tasks of navigation and localization in Polycraft simulation.
 - Novelty: Introduced adaptation mechanism to new environments with novelty intervention and measure success of actions.
- **Cellspectra: Unsupervised cell image segmentation** *Computer Vision*
Graduate Lab Researcher advised by Dr. Peng Qiu at Gatech (*keras, tensorflow, MATLAB*) *Jan.-May. 2020*
 - Bacterial segmentation: Developed CNN-based unsupervised object segmentation modules for cell counting and tracking.
 - Raman spectra clustering: Exploited deep embedding clustering on raman vectors from 1-d autoencoder for segmentation.
- **PillNet: A medicine pill recognition search tool in the mobile device** *Computer Vision*
Entrepreneurship Startup Team with Ministry of Science and Technology in Taiwan (*tensorflow, opencv, c++*) *Apr.-Jul. 2019*
 - SSD-MobileNet: Developed a pharmaceutical pill identification module in real-time mobile camera to identify pill location with single shot detection model in tensorflow trained with FDA pill image database.
 - Pill recognition: Trained siamese network by minimizing triplet loss to recognize pills and retrieve relevance information.
- **Integrated Cell-sorting Sensor System** *Semiconductor*
UC Berkeley Streets Lab and NTU CMOS Biotechnology Lab Graduate Researcher (*python, sklearn, R*) *2014-2016, 2018*
 - Platform: Devised new impedance-based flow cytometry approach with PDMS nano-fabrication to collect impedance signals and classify cell properties with frequency analysis.
 - ML data analysis: Utilized clustering methods (Naive-Bayes, GMM, K-means, NN) and MATLAB to extract impedance data for library creation. Published work in **MicroTAS'17, IEEE NEMS'17, IMCS'16**.
 - Chip design: Expedited high-throughput droplet grabbing hydrogel beads with parameters by ML optimization.
- **Other cs-related projects:**
Comics generation from wGAN, Chinese lyrics generation by charRNN, Fire event data management with selenium, pandas, SQL, Malaria cell prediction, Kaggle Sales prediction competition, Circuit Fraig and Simulation with C++.

HONORS & AWARDS

- **Serving Program Review Committee:** WACV, ECCV, EMNLP, AAAI, CVPR, ACL, Interspeech *2022*
- **Travel Award:** ISCA travel grant for Interspeech 2022 *2022*
- **Taiwan Government Scholarship to Study Abroad,** Taiwan Ministry of Education *2021*
- **Graduate Research Assistantship,** Georgia Tech Electrical & Computer Engineering *2019*
- **Graduate Honor Fellowship,** UC Berkeley Fung Institute of Engineering *2018*
- **Member,** UC Berkeley Golden Key International Honor Society *2018*
- **Graduate Honor Fellowship,** National Taiwan University Graduate Institute of Electronics Engineering *2017*
- **Travel Award,** Taiwan Ministry of Science and Technology. IMCS conference 2016 *2016*
- **Delegate,** Taiwan Model APEC 2014 *2014*
- **School Delegate,** AIESEC Asia-Pacific Exchange and Leadership Development Seminar Symposium *2010*
- **Nominee of Representative of Taiwan,** Global Yong Leaders Conference *2010*

- **Ting-Wei Wu** and Biing Juang, “Infusing Context and Knowledge Awareness in Multi-turn Dialog Understanding” *The 17th Conference of the European Chapter of the Association for Computational Linguistics (EACL) (Findings)*, May 2023.
- **Ting-Wei Wu** and Biing-Hwang Juang, “Induce Spoken Dialog Intents via Deep Unsupervised Context Contrastive Clustering.” *The 23rd Annual Conference of the International Speech Communication Association (Interspeech)*, Sep 2022.
- **Ting-Wei Wu**, I-Fan Chen, Ankur Gandhe, “Learning to rank with BERT-based confidence models in ASR rescoring.” *The 23rd Annual Conference of the International Speech Communication Association (Interspeech)*, Sep 2022.
- **Ting-Wei Wu** and Biing-Hwang Juang, “Knowledge Augmented BERT Mutual Network in Multi-turn Spoken Dialogues.” *2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, May 2022.
- **Ting-Wei Wu**, Ruolin Su and Biing Juang, “A Label-Aware BERT Attention Network for Zero-Shot Multi-Intent Detection in Spoken Language Understanding.” *The 2021 Conference on Empirical Methods in Natural Language Processing (EMNLP)*, Nov 2021.
- **Ting-Wei Wu**, Ruolin Su and Biing Juang, “A Context-Aware Hierarchical BERT Fusion Network for Multi-turn Dialog Act Detection.” *The 22nd Annual Conference of the International Speech Communication Association (Interspeech)*, Aug 2021.
- Ruolin Su, **Ting-Wei Wu** and Biing Juang, “Act-Aware Slot-Value Predicting in Multi-Domain Dialogue State Tracking.” *The 22nd Annual Conference of the International Speech Communication Association (Interspeech)*, Aug 2021.
- **Ting-Wei Wu**, Jia-Hong Huang, Joseph Lin, Marcel Worring, “Expert-defined Keywords Improve Interpretability of Retinal Image Captioning.” *The 2023 IEEE Winter Conference on Applications of Computer Vision (WACV)*, Jan 2023.
- **Ting-Wei Wu**, Jia-Hong Huang, Chao-Han Yang, Zenglin Shi, I-Hung Lin, Jesper Tegner, Marcel Worring, “Non-local Attention Improves Description Generation for Retinal Images.” *The 2022 IEEE Winter Conference on Applications of Computer Vision (WACV)*, Jan 2022.
- **Ting-Wei Wu**, Jia-Hong Huang, Chao-Han Yang, Elbert Liu, Hiromasa Morikawa and J. N. Tegner, “Deep Context-Encoding Network for Retinal Image Captioning.” *2021 IEEE International Conference on Image Processing (IEEE ICIP)*, Sep 2021.
- Jia-Hong Huang, **Ting-Wei Wu** and Marcel Worring, “Contextualized Keyword Representations for Multi-modal Retinal Image Captioning.” *ACM International Conference on Multimedia Retrieval (ICMR)*, Apr 2021.
- **Ting-Wei Wu**, Changsheng Zhao, Ernie Chang, Yangyang Shi, Pierce I-Jen Chuang, Vikas Chandra and Biing-Hwang Juang, “Towards Zero-Shot Multilingual Transfer for Code-Switched Responses” Submitted to *The 61st Annual Meeting of the Association for Computational Linguistics (ACL)*, Jul 2023.
- **Ting-Wei Wu**, Fateme Sheikholeslami, Mohammad Kachuee, Jaeyoung Do, Sungjin Lee, and Biing-Hwang Juang, “Heterogeneous Data Augmentation for Conversational Skill-routing System” Submitted to *The 61st Annual Meeting of the Association for Computational Linguistics (ACL)*, Jul 2023.
- **Ting-Wei Wu**, Chien-Chun Hung, Chien-Chia Chen, Razvan Cheveresan, Rajesh Somasundaran, “Two-stream Self-attentive Network for Cross-sentence Causality Reasoning.” *The 3rd VMware Machine Learning Conference (VML)*, Oct 2020. *Largest VMware General Research Conference (RADIO)*, May 2021.
- **Ting-Wei Wu**, Yung-An Hsieh and Yi-Chieh Liu, “Ensemble-based Transfer Learning for Low-resource Machine Translation Quality Estimation.”, *arXiv:2105.07622*, May 2021.
- J. H. Huang, C. H. Yang, F. Liu, M. Tian, Y. C. Liu, **T. W. Wu**, I. H. Lin, K. Wang, H. Morikawa, H. H. Chang J. N. Tegner, “DeepOpht: Medical Report Generation for Retinal Images via Deep Models and Visual Explanation.” *The 2021 IEEE Winter Conference on Applications of Computer Vision (WACV)*, Jan 2021.
- **Ting-Wei Wu** and Chih-Ting Lin, “The development of a microfluidic particle-analyzing device by impedance Spectroscopy” *Master Thesis, Submitted in American Chemical Society (ACS) Sensors*, May 2018.
- **Ting-Wei Wu**, Chia-Hong Gao, Yi-Zhan Huang, Ting-Wei Lin and Chih-Ting Lin, “Electrode Spatial Design for a New Microfluidics Impedance Cytometer,” *The 21st International Conference on Miniaturized Systems for Chemistry and Life Sciences (MicroTAS)*, October 2017.
- **Ting-Wei Wu**, Chia-Hong Gao, Fan-En Chen and Chih-Ting Lin, “Impedance Spectroscopy for Microfluidic Particle-analyzing Device with Spatial-Coplanar Electrode Design,” *The 12th Annual IEEE International Conference on Nano/Micro Engineered and Molecular Systems (IEEE NEMS)*, April 2017.
- **Ting-Wei Wu**, Chia-Hong Gao and Chih-Ting Lin, “A microfluidic cell counting device based on impedance sensing,” *16th International Meeting on Chemical Sensors (IMCS)*, July 2016.