

# Chun-Min Chang

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I am a machine learning engineer with three-year research and work experience. I am interested in developing efficient and robust deep learning models for mobile devices and productizing deep learning models for healthcare applications. I am thrilled to work in a fast-paced environment and have work experience in startups.

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## Education

**University of Wisconsin-Madison**, M.S. in Electrical and Computer Engineering *expected Aug. 2020*

- Machine Learning and Signal Processing (GPA: 4.0/4.0, image processing, computer vision, machine learning)

**National Taiwan University**, M.S. in Electrical Engineering *Aug. 2015*

**National Taiwan University**, B.S. in Electrical Engineering *Jun. 2013*

## Work Experience

**Machine Learning Engineer, Cardinal Blue Software Inc. (PicCollage), Taiwan** *Jan. 2019 - Jul. 2019*

*Focused on building deep learning models for computer vision tasks on mobile.*

- Developed efficient models to execute image segmentation on mobile devices in less than 0.5 seconds.
- Used network pruning, quantization, and knowledge distillation to improve efficiency by 50%.
- Developed compact deep learning models for image super-resolution and enhancement, smaller than 1MB.

**Research Assistant, Data Insight Research Lab at Academia Sinica, Taiwan** *Oct. 2015 - Dec. 2018*

*Conducted research on the efficiency and robustness of deep learning and its applications in healthcare.*

- Built a nephrologist-level chronic kidney disease diagnosis system using TensorFlow.
- Built a 3D CNN to predict patients' chronological age by CT images and detect neurodegeneration.
- Proposed a multi-scale CNN to process ECG and PPG signals for non-invasive glucose estimation.
- Other research projects: crime factor analysis and quantitative evaluation of VR systems.

## Selected Projects

**Automation of Kidney Functionality Prediction and Classification** *Sep. 2017 - Nov. 2018*

*Nature Digital Medicine (2<sup>nd</sup> author) cooperated with China Medical University Hospital in Taiwan*

- Built automatic programs to extract massive kidney ultrasound images from 200,000 reports in 12 hours.
- Designed a residual neural network to predict kidney functionality (e-GFR) using TensorFlow.
- Achieved a nephrologist-level classification accuracy for diagnosing chronic kidney disease.

**Efficient and Robust Deep Learning for Mobile Applications** *Dec. 2018 - Mar. 2019*

*2019 IEEE International Joint Conference on Neural Networks (1<sup>st</sup> author)*

- Proposed to train a compact and dynamic CNN that allows to trade off accuracy for efficiency.
- Reduced 90+% model size with only a 1-3% accuracy drop in VGG-16 over CIFAR-10 and CIFAR-100.
- Improved the robustness against various adversarial attacks like I-FGSM by at least 10%.

**Non-invasive Glucose Prediction using ECG/PPG Signals by 1-D CNN** *May. 2018 - Jun. 2018*

- Performed extensive signal processing techniques to filter out noises and enhance signals.
- Built a multi-scale CNN that made all predictions in the safe zones of Parke/Clarke Error Grid.

**Brain Health Evaluation using CT Images by a Compact 3-D CNN** *May. 2018 - Jun. 2018*

- Built a 3-D CNN to predict patient's age and compare with chronological age to evaluate brain health.
- Used pointwise convolution to reduce heavy computations caused by the large volume of CT images.

## Skills

**Programming language:** Python, R, Matlab, C++, SQL, Swift, git, LaTeX

**Library/Package:** TensorFlow, Keras, PyTorch, CoreML, cleverhans, scikit-learn, OpenCV, ggplot2, dplyr

## Other Research Projects

### Demystifying the Insect Colour Diversity along Elevational Gradients

May. 2018 - Jul. 2019

Nature Communications (co-first author)

cooperated with Bio-diversity Research Institute at Academia Sinica

- Trained a residual neural network to learn the embedding of color traits in insects using Keras.
- Analyzed the relationship between color traits, weather, and habitat by structural equation modeling.
- Concluded that colder environments selecting for darker coloration limit the color trait diversity.

### Why Batch Normalization Works so Well

May. 2017 - Jun. 2017

Best Project Award among 32 teams in Machine Learning Course at NTU

- Demonstrated that adding BN will push the distribution of singular values of the Jacobian matrix toward one.
- Found that BN has a better norm-preserving property and also benefits gradient flows through networks.
- Showed that BN has the effect of weight regularization and can improve model generalization like dropout.

### Face Recognition on Mobile Devices

May. 2018 - Jun. 2018

Best Project Award in the Deep Learning for Computer Vision Course at NTU

- Built a compact deep learning model (0.7 MB) to recognize 2,360 identities with 86.5% accuracy.
- Applied the concept of center loss to boost performance by 5% and used L1 loss for network pruning.
- Outperformed state-of-the-art compact models such as MobileNet-V1 and SqueezeNet by 10+%.

### Progressive GAN for Biomedical Signal Generation

Sep. 2018 - Sep. 2018

- Implemented the progressive generative adversarial network to produce realistic bio-signals.
- Found that BN has a better norm-preserving property and also benefits gradient flows through networks.

## Publications

1. Shipher Wu<sup>†</sup>, Chun-Min Chang<sup>†</sup>, et al. "Artificial Intelligence Reveals Environmental Constraints on Colour Diversity in Insects.", Nature communications 10.1 (2019): 1-9. (†: equal contribution)
2. Chun-Min Chang, Chia-Ching Lin, and Kuan-Ta Chen (2019). "Efficient and Robust Convolutional Neural Networks via Channel Prioritization and Path Ensemble.", 2019 31st IEEE International Joint Conference on Neural Networks (IJCNN).
3. Chin-Chi Kuo, Chun-Min Chang, et al. (2019). "Automation of the kidney function prediction and classification through ultrasound-based kidney imaging using deep learning.", Nature Digital Medicine. 2. 10.1038/s41746-019-0104-2.
4. Nathan Kuo, Chun-Min Chang, and Kuan-Ta Chen (2017). "Exploring spatial and social factors of crime: a case study of Taipei City.", Asian Conference on Intelligent Information and Database Systems. Springer, Cham, 2017.
5. Chun-Min Chang, Shi-Chung Chang, and Chun-Hung Chen (2017). "How simplified models of different variability affects the performance of ordinal transformation.", 2017 13th IEEE Conference on Automation Science and Engineering (CASE).
6. Chun-Min Chang, et al (2016). "Performance measurements of virtual reality systems: Quantifying the timing and positioning accuracy." Proceedings of the 2016 ACM on Multimedia Conference.