

# ZEYU LIU

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## EDUCATION

**University of Southern California**

**Los Angeles, CA**

**Master of Science in Electrical and Computer Engineering in Machine Learning and Data Science track**

August 2021 - May 2023 (Expected)

GPA:3.93/4.00

**Huazhong University of Science and Technology**

**Wuhan, Hubei, China**

**Bachelor of Engineering in Automation**

September 2016 - June 2020

**Coursework:** Pattern Recognition, Computer Organization and Architecture, Data Structure

GPA: 3.70/4.00

## ACADEMIC PROJECTS

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**Training an ultra low-latency spike neural network with a novel spiking strategy**

May 2022 - September 2022

Energy Efficient Secure Sustainable Computing Group (Information Sciences Institute, USC)

Advisor: Peter A. Beerel

- Inspired by Hoyer regularizer, proposed Hoyer extremums, which are input-dependent scale factors to downscale the values of the trainable thresholds to emit more spikes for weight updates and shift the membrane potential values away from the thresholds
- Adopted the approach similar to batch normalization which alleviates the need to re-compute the Hoyer extremums for each input during inference
- Trained one-time-step SNNs from scratch, which surpass the accuracies obtained by SOTA one-time-step SNNs on diverse image recognition datasets with different convolutional architecture, and yield similar test accuracy with about 5 times reduction in the floating point operations (FLOPs) count compared with binary neural networks (BNN) and adder neural network (AddNN) models

**Research on training computer vision models on raw images**

June 2022 - August 2022

Energy Efficient Secure Sustainable Computing Group (Information Sciences Institute, USC)

Advisor: Peter A. Beerel

- Released a large-scale raw image database that can be used to train accurate CV models for low-power ISP-less edge deployments and proposed a low-overhead form of in-pixel demosaicing to reduce the data bandwidth
- Designed a novel application of few-shot learning to further improve the mean average precision of Faster R-CNN and YOLOv3 on PASCALRAW dataset by 18.1% and 28.6% respectively, over the models pre-trained on COCO dataset

**Visual Positioning for Monocular Camera**

January 2020 - May 2020

School of Artificial Intelligence and Automation (HUST)

Advisor: Chao Cai

- Adopted ResNet50 as the basic structure of encoder and constructed decoder with six deconvolution layers to learn depth by image sequences in an unsupervised manner
- Modified the loss function and part of activation functions, reduced the depth prediction error by about 15% on the KITTI driving dataset
- Reconstructed the 3D environment by generating and stitching point clouds, achieved better results than some traditional methods like ORB-SLAM2

## COURSE PROJECTS

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**Single Image Super Resolution**

March 2022 - May 2022

A Computational Introduction to Deep Learning

- Reproduced and compared the performance of two typical neural network architectures, EDSR and SRGAN in different color spaces of the DIV2K dataset

- integrate the newly proposed multi-scale discriminative feature loss and improve the PSNR from 26.26 to 28.20 for SRGAN and from 31.88 to 32.93 for EDSR in the RGB color space, but the improvement is negligible in the YCbCr color space

### Implementation and deployment of the social media application

March 2022 - May 2022

Applied and Cloud Computing for Electrical Engineers

- Designed and Implemented a web application with functions such as login and registration, posting, liking and commenting by using React and MaterialUI
- Developed a node.js server to create, update, read and delete the data of users and posts by using Express.js framework
- Deployed both front-end and back-end to the Amazon Web Services' Elastic Beanstalk by using docker

### Publication

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- G.Datta\*, **Z.Liu\***, P. Beerel. "Hoyer Regularizer is all you need for Ultra Low-Latency Spiking Neural Networks", \*Equal contribution, under review in ICRL 2023
- G. Datta, **Z. Liu**, Z. Yin, L. Sun, A. Jaiswal, P. Beerel. "Enabling ISP-less Computer Vision", WACV 2023 [\[link\]](#)
- G. Datta, H. Deng, R. Aviles, **Z. Liu**, P. Beerel. "Towards Accurate, Energy-Efficient, & Low-Latency Spiking LSTMs", under review in AAAI 2023
- G. Datta et al. "P2M-DeTrack: Processing-in-Pixel-in-Memory for Energy-efficient and Real-Time Multi-Object Detection and Tracking", VLSI-SoC 2022 [\[link\]](#)