Yilun ZHAO

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Education Background

- **Beijing University of Posts and Telecommunications (BUPT)**, Beijing, China — Sept. 2018 - Present
  M.Eng. in Information and Communication Engineering (expected in Jun. 2021) — Overall GPA: 85.48/100
- **Huazhong University of Science and Technology (HUST)**, Wuhan, China — Sept. 2014 - Jun. 2018
  B.Eng. in Photoelectric Information Science and Engineering — Overall GPA: 3.73/4.00
- **Technical skills & tools**: C/C++, MATLAB, Python, Spyder, Pycharm, Visual Studio

Publications

- **Yilun Zhao**, Zhenming Yu, Zhiquan Wan, Shaohua Hu, Liang Shu, Jing Zhang, and Kun Xu, "Low complexity OSNR monitoring and modulation format identification based on binarized neural networks," IEEE Journal of Lightwave Technology. (Under review)
- Zhiquan Wan, Zhenming Yu, Liang Shu, **Yilun Zhao**, Haojie Zhang, and Kun Xu, "Intelligent optical performance monitor using multi-task learning based artificial neural network," Opt. Express 27,11281-11291 (2019)

Research Experience

Intern Algorithm Researcher, *Automatic Speech Recognition*, VIPKID — **Jul. 2019 - Present**

(VIPKID is an online platform providing kids with one-to-one English teaching by foreign teachers)

Project 1: Optimization of the triphone state tying module in Kaldi (a speech recognition toolkit developed by C++)

- Studied on papers regarding state tying of triphones
- Adjusted the maximum value of split leaves of decision tree clustering in Kaldi and the clustering method of generating question set, and a good state tying decision tree was obtained initially
- Grasped HMM (Hidden Markov Model), statistics and decision tree in Kaldi, derived the statistics of each triphone and proportion of tying PDF (probability distribution function), and conducted visualization analysis on off-line data
- Integrated the questions set of HTK (a speech recognition toolkit) into the question set of Kaldi
- Integrated each question in HTK into Kaldi, calculated the improvement of maximum likelihood in splitting process of decision tree, chose questions with positive effect and reintegrated them into Kaldi
- Derived the PDF and triphone gained from decision tree state tying, defined triphone templates according to the context, generated feature vector of each template based on PDF, and generated new questions through clustering
- Achievements: optimized the triphone state tying method, which reduces the complexity of acoustic model. The number of PDF has been reduced by 15% and the WER of model has been reduced by 3%

Project 2: Developing a text normalization tool

- Studied on papers regarding text normalization (TN)
- Developed a text normalization tool based on *sparrowhawk* (an open source library from google)
- Developed the interface of text normalization and inverse normalization using C++
- Developed a tool to display dynamic subtitles of the audio, which use TN and inverse TN to restore non-standard words

Graduate Research, *Application of Machine Learning in Optical Communication*, BUPT — **Jul. 2018 - Present**

Project 1: The simulation of binary optical receiver through Python and Keras (Jul. 2018 - Sept. 2018)

- Studied on papers regarding Binary Neural Network (BNN) and reproduced the BNN model in paper based on Python and Keras
- Applied Matlab and Python to implement digital signal processing algorithm of coherent optical fiber communication receiver
- Adopted the simulated binary optical receiver for QPSK signals
- Achievement: contributed to a paper in *IEEE Journal of Selected Topics in Quantum Electronics*

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Project 2: Realization of an algorithm for channel equalization in complex domain (Sept. 2018 - Dec. 2018)

- Probed into the nonlinear equalization algorithm in receiver of optical fiber communication system
- Used Python and Keras to realize a kind of neural network model which could directly calculate complex number
- Integrated the algorithm into the digital signal processing algorithm to verify its nonlinear compensation capability

Project 3: Proposing an optical performance monitoring solution based on Binarized-CNN (Dec. 2018 - Mar. 2019)

- Adopted Python to realize a Binarized-CNN (Binarized Convolutional Neural Network) and verified its effect in MNIST (a handwritten digit database)
- Selected the constellation diagrams of coherent Optical communication signals after polarization demultiplexing, converted it into grayscale diagrams to construct a constellation diagram data set with different transmitting power, transmission distance and Optical Signal to Noise Ratio (OSNR), and divided the data set into training set and test set according to the proportion of 70% and 30%
- Carried out training on the data set by Binarized-CNN, and performed modulation format recognition and OSNR estimation
- Achievements:
  - ✓ The precision of modulation pattern recognition is 100%, and the precision of OSNR reaches over 95%
  - ✓ Finished a paper as the first author and submitted the paper on *IEEE Journal of Lightwave Technology*, which is under review

Project 4: Proposing a low complexity and stable performance polarization demultiplexing algorithm through Matlab simulation modeling (Apr. 2019 - Jul. 2019)

- Applied Matlab to reproduce an algorithm of polarization demultiplexing by mapping signals to stokes space
- Integrated stokes algorithm and constant modulus algorithm to realize a polarization demultiplexing and equalization algorithm
- Used the above algorithm to perform polarization demultiplexing and linear equalization towards the dual polarization 16QAM and QPSK signals obtained by the experiment, and tested its performance
- Achievement: Completed a paper and submitted to the *Optical Networking and Communication Conference*

Research Assistant, Lab of Advanced Communication Research, Peking University Jan. 2019 - Jun. 2019

Project: Application research of polar code in future communication scenarios

- Researched the application scenarios of polar code in 5G and B5G communication system
- Reorganized the papers and technical standards about existing short packet communication protocol
- Used Matlab for modeling and simulation and tested the effectiveness of polar code in MIMO-OFDM system
- Analyzed how to design the channel parameters in MIMO-OFDM system to eliminate the gap between the polar code and the channel capacity with finite length bound

Undergraduate Research, National Engineering Lab for Next Generation Internet, HUST Nov. 2017 - Jun. 2018

Graduation thesis: The nonlinearity compensation algorithm based on neural networks for IM/DD system

- Studied on the principle and research progress of IMDD (Intensity Modulated & Direct Detected) system and nonlinear equalization algorithm based on neural network
- Used Python and Matlab for simulation modeling, and adopted Python and tensorflow to realize a neural network equalization algorithm, integrated this algorithm into the IMDD digital signal processing algorithm, and tested its function

Leader, Innovation and Entrepreneurship Training Project of College Students, HUST Apr. 2017 - Nov. 2017

Project: Design of a driving circuit with hardware and software combined

- Applied Matlab to design a graphical user interface to perform serial communications with microcontrollers so as to control the circuit to send the drive voltage to the chip

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Work Experience

Intern C++ software engineer, Shenzhen Excelsecu Data Technology Co., Ltd. **Jul. 2018 - Sept. 2018**

- Developed the middleware of the encryption hardware (USB key) based on APDU instructions.
- Optimized the script parsing function of the instruction testing tool

Honors & Awards

- Outstanding graduate of Huazhong University of Science and Technology Jun. 2018
- Second place of National Collegiate Basketball Challenge Sept. 2017