CHENG KANG

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PROFILE

I am a Ph.D candidate at the Analysis and Interpretation of Biomedical Data Group, Department of Cybernetics, Czech Technical University in Prague, and I am supervised by doc. Ing. Daniel Novák, Ph.D. Now my research on **Artificial Intelligence and Biocybernetics** was supported in part by Research Centre for Informatics, Brain Dynamics and Student Grants from Czech Technical University in Prague. I was included in two main projects: (1) **Detecting Depression and Scoring Depressive Severity Under Brain Computer Interface (BCI)** and (2) **Psychotherapy Chatbot On Language Models**. During the Master's study, I was recruited as a research assistant in Li Ka Shing Faculty of Medicine, the University of Hong Kong, where I worked with Prof. Yong Hu who is the Director of Neural Eng. and Clin Electrophysiology Laboratory. I also visited the Knowledge Discovery and Machine Learning Lab, University of Leicester, where I was supervised by Prof. Yudong Zhang and Prof. Huiyu Zhou.

EDUCATION

PhD, Czech Technical University Prague, Czech Republic Sep 2020 ▸ Now

Department of Cybernetics, CIIRC, Faculty of Elektrotechnická

Major: Bioengineering

Courses: (1) Practical Data Mining Problems; (2) Statistical Method in Natural Language Processing; (3) Deep Learning; (4) Bioinformatics; (5) Introduction to Computer Vision.

Visiting Study, University of Leicester Leicester, United Kingdom Sep 2018 ▸ Sep 2019

School of Computing and Mathematic Sciences

Major: Medical Image Processing

Courses: (1) Distributed System; (2) Big Data and Predictive Analytics.

Visiting Study, University of Hong Kong Hong Kong Aug 2016 ▸ Aug 2017

Li Ka Shing Faculty of Medicine

Major: Biomedical Signal Processing and Machine Learning

MSc. Shenzhen University Shenzhen, China Sep 2013 ▸ Jun 2016

Department of Control Engineering and Cybernetics

Major in Engineering

B.S. Weifang University of Science and Technology Weifang, China Sep 2009 ▸ Jun 2013

Faculty of Electrical Engineering and Automatization

Major in Engineering

SKILLS

Program Language	Knowledge	Open Libraries	Software	Language
Python	Deep Learning	Pytorch	Pycharm	Chinese
C/C++	NLP and LLM	SciPy	VS C++	English
MATLAB	Machine Learning	NumPy	CMake	Czech
SQL	Computer Vision	TensorFlow	Eclipse	
Java	Statistics	...	...	

Beginner Average Pro Master Contributor

Work Experience

PhD Student, Junior Researcher

Czech Technical University · Prague — Sep 2020 ▸ Now

Psychotherapy Chatbot based on LLMs:

- Prepare large text data;
- Fine-tune and retrieval, quantization and deploying large language models to online servers;
- Develop generative language models to interact with users;
- Build strong relationships with psychologists and manage product expectations;

Contributions: We proposed (1) InA – inspired by Shunting Inhibition – to finetune LMs; (2) an Assistant Instrcution tuning method on Psychotherapy Chatbot; and (3) embedding-vector-quantized controllable diffusion language models.

Algorithm and System Engineer

Shenzhen Dymind Biotechnology Co, · Shenzhen, China — Sep 2019 ▸ Sep 2020

Hematology Analyzer (blood cells counting + CRP + SAA):

- Algorithm maintaining and developing;
- Solve bugs according to clinical data and regularly upgrade software system with a new algorithm version;
- Deploying and maintaning data system.

Algorithm Engineer

Wuhan Zoncare Bio-medical Electronics Co., Ltd., · Wuhan, China — Sep 2017 ▸ Sep 2018

Help cardiologists to diagnose heart diseases by 12-lead electrocardiograms and AI:

- Clean 12-ECG dataset, design algorithm to detect features of ECGs;
- Do advanced research on automatic disgnosis.

Research Assistant

Li Ka Shing Faculty of Medicine in University of Hong Kong, · Hong Kong — Aug 2016 ▸ Aug 2019

Develop an automatic system which can evaluate the injury level of spinal cords:

- Surgery assistance and setting electrodes to collect somatosensory evoked potentials (humans, monkeys, rats and ect.),
- Clean data, extract features and construct/train deep neural networks.

Other Projects

Detect Depression Using Brain Computer Interface System

Li Ka Shing Faculty of Medicine in University of Hong Kong, · Hong Kong Aug 2016 ▸ Aug 2019

Develop a automatic system to detect depression using Brain Computer Interface and AI:

- Analyze EEG data, construct and cluster functional brain networks;
- Statistic analysis of EEG data, such as t-test, ANOVA, PCA, correlation analysis and multivariate autoregressive;
- Use artificial neural networks to detect depression and the severity;

Contributions: We developed an automatic system to detect depression and the depressive severity using BCI.

Dynamic Design for Artificial Neural Networks

Czech Technical University · Prague Nov 2022 ▸ Now

Analyze the control system function of most ANNs (such as CNNs, GANs, VAEs, Transformer-based LMs, Diffusion Models and so on) and control them:

- Analyze and get the control system function of ANNs,
- Simulate the systematic response of ANNs on various hyperparameters,
- Develop better Optimizers (such as, why PID and Fuzzy PID) and Learning systems (such as, why Mamba Language Model) according to the control systematic response;

Contributions: We propose (1) a new standard to analyze the convergence, stability and robustness of ANNs; (2) a better optimizer (e.g., Fuzzy PID optimizer) to optimize the training process of CNNs, FFNN, GANs.

Main Publications

Brain Networks of Maintenance, Inhibition and Disinhibition During Working Memory. **Cheng Kang**; Yuezhi Li; Daniel Novak; Yudong Zhang; Qinghua Zhou and Yong Hu. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 2020. Code; PDF

InA: Inhibition Adaption On Pre-trained Language Models. **Cheng Kang**; Jindich Prokop; Lei Tong; Huiyu Zhou; Yong Hu; Daneil Novak. Neural Networks, 2024. Code; PDF

Quantized Embedding Vectors for Controllable Diffusion Language Models. **Cheng Kang**; Yong Hu; Daneil Novak. Under Review, 2023. Code; PDF

Domain-Specific Assistant-Instruction on Psychotherapy. **Cheng Kang**; Cheng Kang, Yuqing Cheng, Katerina Urbanovad, Yong Hu, Yudong Zhang, Daneil Novak. Under Review, 2024. Code; PDF

Based on What We Can Control Artificial Neural Networks. **Cheng Kang**; Xujing Yao. Under Review, 2023. Code; PDF

Please find more publications from my Google Scholar.

Technical Blogs

Embedding Neural Networks into Devices. Mar 2023
Fine-Tune Language Models: Instruction Tuning; Sep 2022
Medical Conversation and Diagnosis Chatbot: Conversation (A); Mar 2022
Medical Conversation and Diagnosis Chatbot: Diagnosis (B); Mar 2022
Basic Deep Learning Knowledge; Nov 2021
HRV for Sleep Scoring and Pressure Evaluating; Dec 2018