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14:43 Tuesday 29th June, 2021
Dear Professor,

I am Ziquan Wei, a second-year master student from Huazhong University of Science and Technology (HUST), China. My supervisor is Prof Shaoqun Zeng. I am willing to apply for your PhD program and very intriguing by machine learning and deep learning.

• Why I am a good fit

To start with, I have the following publications so far.

1. Shenghua Cheng, Sibo Liu, Jingya Yu, Gong Rao, Yuwei Xiao, Wei Han, Wenjie Zhu, Xiaohua Lv, Ning Li, Jing Cai, Zehua Wang, Xi Feng, Fei Yang, Xiebo Geng, Jiabo Ma, Xu Li, **Ziquan Wei** et al.: *Robust Whole Slide Image Analysis for Cervical Cancer Screening Using Deep Learning*, submitted to **Nature communications**; **IF:12.121**; PREPRINT, 2021.
2. **Ziquan Wei**, Xiuli Liu, Shenghua Cheng*, Shaoqun Zeng: *An Efficient Cervical Whole Slide Image Analysis Framework Based on Multi-scale Semantic and Spatial Features using Deep Learning*, submitted to **Medical Image Analysis**; **IF:11.148**; PRIPRINT, 2021.
3. Zhuoqian Yang, Yang Yang*, Kun Yang, **Ziquan Wei**: *Non-Rigid Image Registration With Dynamic Gaussian Component Density and Space Curvature Preservation*, **IEEE Transactions on Image Processing**; **IF:9.34**; 2018, 28:2584-2598
4. Su Zhang, Yang Yang*, Kun Yang, **Ziquan Wei**: *Non-rigid point set registration using dual-feature finite mixture model and global-local structural preservation*, **Pattern Recognition**; **IF:7.196**, 2018, 80:183-195.
5. **Ziquan Wei**, Yang Yang*, Kun Yang, Su Zhang: *Dual-feature Gaussian Mixture Model and Dual-constraint Spatial Transformation based Non-rigid Point Set Registration*, **Journal of Software**; Journal of Software is a top-level Chinese journal on Computer Science and Computer Engineering, EI index searching; 2018, 29(11):341-359.
6. **Ziquan Wei**, Yifeng Han, Mengya Li, Kun Yang*, Yang Yang*, Yi Luo*, Sim-Heng Ong: *A Small UAV Based Multi-Temporal Image Registration for Dynamic Agricultural Terrace Monitoring*, **Remote Sensing**; **IF:4.509**; 2017, 9(9).

– My research path:

I have very different research directions for my undergraduate and master lives. Point set registration and image registration are my undergraduate directions. The goal of them is to minimize the geometrical or per-pixel discrepancy of a point set or image pair, respectively. It is a classic problem with abundant downstream applications. Algorithms in this area are mostly conventional, working in an unsupervised manner without any training. Ideas/methods of this area are usually mathematically intensive, with neat implementation and perfect interpretability. It deeply intrigued me back then. I worked hard, and achieved several decent English and Chinese publications. Finally, I was lucky enough to be recommended to HUST for my master study.

Cytopathological whole slide image (WSI) analysis is the major direction for my master study. The goal is to determine the grade of infection of the WSI. Detecting the top abnormal zones then conclusively classifying them as one bag is the common way for pathologists as well as the algorithm. The most challenging problem in this area is that interested cells are sparse in the gigapixel WSI, and the various contextual cells far outnumber them. It is an important problem for the computer-aided diagnosis for cervical cancer screening. Since the high cost of data generation in this area, it is rarely developed on the WSI level but the patch level. My recent work has proven that the representability of WSI local zones is crucial.

• Why I am interested

In addition to my main direction, I am particularly intrigued in designing a strong AI. It has been a life-long interest since the first time when I read some sci-fi novel when I was a primary school student. I would definitely like to pledge my PhD life to this problem. I think there are two possible ways that worths a try.

The first solution is to uncover the deep learning black box. Interpretability is one of the sharpest differences between my bachelar and master research directions. Everything in my registration method is track-able and predictable. Therefore, it is much easier to iterate the development cycle and evolve the method. However, for deep learning, the interpretability is still a hot and on-going

research topic, or more like a stepping stone. In my opinion, the difference between a week AI and a strong AI is that, the former is similar to a machine, doing repetitive things on the perceptive level, While the latter is capable of cognitive or even emotional thinking. I believe the interpretability is one of the promising keys to the evolution.

The second solution is to uncover us human black box. Affective computing is a interdisciplinary field that involves physiological, psychological and engineering domains. We know that our sensation, perception and cognition work in two systems. Most deep neural network or deep learning methods work in System 1. However, a more complex and cognitive process usually works on System 2. How to embed the physiological/psychological mechanism into the design of neural network? Works like the SlowFast network for action recognition is one of the very interesting and inspiring attempts. Also, how to uncover the pattern among facial expression, speech, and many other physiological signals are also a good candidate to uncover the curtain.

Natural language processing (NLP), for instance, could be a typical research topic to explore the strong AI. Logic and emotion as the representation of natural language sentences are two factors of the human cognition system. Comprehending them is probably inspiring for the discovery of human thought and the physiological/psychological mechanism.

Recently I have been working on an on-going in-the-wild emotion recognition competition associated with ICCV 2021. The goal is to temporally continuously predict the emotional state of a subject, using either visual, aural, speech, or all information. Our model significantly outperform the baseline and the champion of last year. I acquired solid theoretical and engineering experience through this challenge.

Sincerely,

Wei.