

Self introduction

My name is CHEUNG Sai Ho (Sunny), 39 years old. I have obtained the BSc and MSc in Computer Information System on 2013 and 2019. I had worked some local IT Company and social enterprises for the past few years. Unfortunately, I'm a severely handicapped person and suffered from atheroid cerebral palsy when I born, my muscle tone is very unstable and the both hand function is very poor, it is extremely difficult to control my four limbs movement in precisely. Moreover, my speaking is not very clearly. So, I need to put a huge extra efforts and much more time to finish my work and degree course.

The reasons of perusing my PhD study and choosing in PolyU

There have the two main reasons for choosing in PolyU when I want to study my PhD programme, including learning of advance techniques the evaluation methodology and design principal for assistive technology, discovery the new input method for the CP patients using the Brain Computer Interface. I would like to share some my research findings and cases observing in these paragraphs which is shown as below:

1. learning of sophisticated design principal and evaluation methodology for assistive system

Although, the CP2Joy system has succeeded to develop and launch the local market, or even mainland handicapped NGOs, many therapists are highly appropriated on this what I have done, my family and I feel very honors and motivations on it. However, I have found out the big problem when my system has tried the other patients which have the similar symptoms like me. It can only use a small number of CP patients for using this system smoothly. Definitely, I have gotten so many good suggestions how to improvement it, it is an extremely difficult for me when I need to improve my system for each patient. So, I've discussed with some OT and PT therapists about this question. E.g. Dr Clare, Marcus NG, Elsie YU etc. they claimed that my approach is a self-centered design and microarchitecture for the voice control system, it is not a good enough for doing the big experiment with different types of CP patients, or even can use a large number of them appropriately. In addition, they suggested that I should enroll some advance courses related to the Occupational Therapy or rehabilitation science when I need to know what is a principal design of ergonomic, how to evaluation the assistive system for the target users and scale up my system appropriately and how to design a best rehabilitation solution for each case, instead of depending on the powerful knowledge of computer sciences only.

In this case, the RPG programme of rehabilitation science has only provided in Hong Kong PloyU out of the all universities when the department of rehabilitation science is established since 1978. In Hong Kong, there have over 90% OT and PT therapists which are graduated in this faculty. So, it has a mature teaching experience for these topics. Moreover, the department has developed the function of cognitive and affective neural system for testing the people with special needs, especially Prof Kenneth FONG. He is an expertise to develop the assistive system for the people with brain damaged when he has leaded many UG OT students to earn many assistive technology awards from oversea and published excellent research papers in OT journal, such as evaluation of motor recovery for using the BCI training in stoke people, machine learning (ML) of arm movement pattern in the people with stoke. As my proposed PhD topic is the ML of using BCI system for thinking specific control commands with the user-defined of voice recognition system and filtering abnormal nervous signal pattern in the people with CP, we have interested the similar research topic in the BCI system which is applied to the people with brain damaged. Thus, I have invited him to become my PhD supervisor.

2. discovery the new input method for using BCI control system in the people with CP

In my thesis of MSc Research, I have proved that the existing voice recognition platforms are not appropriated to use in the people with speech disorder and proposed the program algorithm to filter the abnormal shaking movement for the people with CP when their hand is holding the joystick during nervous moment. However, Dr Clare and I have observed the most of mainland CP patients cannot control the joystick very smoothly and only pronounce a few of simple single voice. As they are a lack of the PT, OT and ST therapies training and support on systematically, my system cannot help them when they are using the computer and cannot use the keyboard and mouse. In this case, I think the BCI control system may be a suitable way to solve this problem.

Actually, I have done some literature reviews in the topic of using BCI system in the people with CP, most research papers are demonstrated the relationship of muscle tone movement control and frequenting PT exercises for measuring of EEG, ML of epilepsy's brain signal pattern diagnostic for using EEG and using the BCI system of recognizing the facial expression to control the electric wheelchair movement in the people with CP etc. There has a lack of the research papers about ML of thinking specific commands, filtering abnormal nervous signal pattern and using the pitch detection algorithm with voice recognition for the people with CP. As I do not agree with using the facial expression detection from BCI system, it is an unstable effective from the changing of outside environment and difficult to keep the specific facial expression for a long time during their driving. So, I wish I can explore a new input method of BCI control system for CP during my PhD study.

The three reasons of suitable to study my PhD

1. Research experiences

I have some research experience for the assistive system in HKBU when I've received the good grade in my MSc practical and research project, so HKBU has released them on the press conference and university's media and grant the number of research fundings from TSSSU and HKSTP Incutech programme. moreover, my company assistive product has succeeded to receive the HK short-term patent and applying the China invention patent on the December 2021

2. Past work experiences and good relationship to HK rehabilitation sectors and mainland handicapped NGOs

From 2008 to current, I have developed the difference kind of assistive systems for many HK special schools and rehabilitation NGOs in China, I have become the guest lecturer in HK universities and community college. In 2015, I worked the programmer on Microsoft company which is build up the e-class parent apps, so I have a good working experience in IT field and built a mutual cooperation relationship to many rehabilitation sectors. They can provide amount of the people with CP to help my experiment data collection for our research during no any epidemic outbreak.

3. Heart passion for serving the handicapped community

Actually, I have finished my two degrees in computer science and received many jobs offer when I have not graduated my master degree yet, including boardlearning company, HKGOV IT office, some international investment banks etc. The salary is over 2.8k per month, but I have not accepted these job offers. As I am a CP patient and fully understanding what is the pain point for using computer in the people with CP, we have only used this communication tool to connect the world, it is extremely important for us. Certainly, we must feel very lonely and hopeless when I cannot use the computer without assistive tool support, so my company objective is appropriated to use the rehabilitation technology for people with special needs and enrich their quality of life in the living community. It is a perfect match with the mission of rehabilitation sciences department in PolyU.

Expectation achievement of my PhD study

- Design new ML of thinking specific commands systems for the people with CP, it may apply the standard patent in HK, or even invention patent in the western country
- publishing some research papers in some international OT or EE academic journals about the topic of filtering abnormal shaking pattern in assistive systems or design pattern in BCI control system for people with CP. e.g. IEEE, OT technology etc.
- implementation of some remote IT systems for OT evaluation and diagnostic for mainland, because the people with CP has a lack of the OT service support in China, it is a high demand for these systems when the population of people with CP has approximated over 60M and most of them do not live in the metropolitan.

Expectation contribution of my PhD graduated

- take charge of the rehabilitation committee member in mainland or HK government, local handicapped NGOs, UGC, fight for more learning or working opportunity equitability. e.g. some common assistive systems should provide the public computer in the government facility, public libraries and hospitals, or provide some funding to purchase these systems for themselves when OT therapist has approved.
- In the next two decades, it is foreseen that there will be a great leap forward in the fields of Artificial Intelligence, voice recognition and automated machine. The company's development in the upcoming five years will be greatly focused on enhancing the functions of the voice control and Sevenkeys system based on big data and AI technology. Also, in line with the country's 14th Five-Year Plan, in which, whole Person Development Policy for Special Education Students was proposed, we are dedicated to helping the ten and thousands of physically disabled people in the Mainland through technology.