Summary for Overseas Travel
WENDI 2018-2019

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Grade	First year of the PhD Program
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Travel period	2019/3/10~2019/3/24
UN agencies / International organization visited	WHO
Theme of overseas travel	3D structured light based face recognition and its application

Outline of the activities (4 pages including photos, figures, etc.)

(1) Global leadership

I spent two weeks at Tsinghua University. During that period, I communicated with professors and students at Tsinghua University, not only discussed on academics, but also exchanged some information about the learning pace and postgraduate system of domestic and foreign universities. Their fast-paced postgraduate life has given me some pressure, however, it has also given me more motivation to keep improving. I am very grateful to professor Zhang. We discussed on some academic ideas, and I was taught about a way of thinking. If I want to achieve a goal, not only the original purpose and blueprint of it is very important, but also the means to achieve it is significant. Maybe there exists so many things that sound wonderful, ideal, and deserves to realize. However, a solution that can be implemented and popularized has "cost" as well as implementability as a primary consideration. This "cost" may include hardware costs, development costs, operational complexity, market demand, and so on. If one just want to do academic research, regardless of economic output, that's not a problem. These problems cannot be avoided if the results are looking forward to being applied as quickly as possible.

On March 22nd, 2019, I visited an officer in WHO China with a senior. We conducted an hour-long interview and received a number of pamphlets introducing the works and achievements of WHO. In constant contact with the WHO, I gradually found that my previous ideas are immature. I thought that international organizations need people

with strong professional qualities, that is to say, if one's quality is good, they can always find a suitable position in international organizations. Now I realize that every step and every project of the international organization is planned and targeted. When and where to do what, what kind of talent is required and so on are constantly changing, the important thing is to have the right interests. It's almost impossible to get an international organization to accommodate an individual. Usually, the organization sets the plan and the project and the individual goes to work to make it come true. Therefore, in addition to strong professionalism, international organizations expect their employees to be people with experience in cooperation, well-connected people, people who can accept different cultures without discrimination, people who can coordinate the interests of different parties…… Not only as an employee of an international organization, but also as an international leader, I think, in addition to strong personal qualities, there is also a need for leadership and organizational skills, as well as the ability to coordinate the interests of all parties.

Some aspirations may sound great, important, and noble, but that doesn't mean that it is in line with what other people think, and there is no reason for anyone else who has the ability to help you achieve your goals to devote limited resources to your cause. A person with global leadership qualities should be able to balance the interests of interested investors and "sponsors", find common ground, and form mutually beneficial relationships between members so that they can achieve their own goals while achieving the leader's own goals. After all, "win-win" is always more acceptable than "one-sided disbursement".

(2) Scientific significance

During my two weeks at Tsinghua University, I focused on the application of 3D structured light in face recognition, especially in the field of face anti-spoofing. Face detection and recognition is a classical problem in machine vision. With the development of artificial intelligence, such as deep learning, and the support of huge 2D face database, the face recognition accuracy in 2D domain has reached a quite high level. Face recognition is more and more widely used in business, security, financial port and other fields. This puts forward a higher request to the recognition accuracy.

One of the key issues of face recognition is Face Anti-Spoofing. Face Anti-Spoofing means that the algorithm needs to determine whether the object being examined is a

"person", whether it is a live human face, and other objects such as plaster casts, masks, and photographs should be rejected. Static image recognition is easy to be broken by photo, video and other methods, and is greatly affected by lighting. In order to deal with this kind of attack, an interactive motion anti-spoofing method which requires the tested object to complete the specified action is proposed. Because 3D face recognition can detect the depth information of the measured object, it is very effective to prevent "plane attack". However, 3D face recognition is vulnerable to stereoscopic attacks such as stereoscopic masks and plaster casts. Therefore, though making it much more difficult to fake, there is no guarantee that what is in front of the camera is a real human being without "disguise". Thus, it is necessary to combine the anti-spoofing with 3D face recognition to achieve attack prevention.

There are two kinds of 3D face recognition technology: 3D structured light and Time Of Flight (TOF). At present, 3D face recognition is mainly realized by 3D structured light technology in the market. Therefore, the 3D structured light technique is used in this study. 3D structured light determines depth information by reflecting light from the surface of the measured object. The whole system consists of structured light (generally infrared) projection equipment, (infrared) camera, image acquisition and processing system. It is a type of active light equipment. The process is as follows: the projection equipment emits light with certain structure to the measured object, the camera captures the three-dimensional light pattern formed on the measured object, and the acquired image is processed by the acquisition and processing system to obtain the surface data of the measured object. The basic principle is that when the relative position of the camera and the projection equipment is fixed, the light distortion projected on the surface of the measured object depends on the depth of the object surface. Therefore, the depth information can be resolved by calculation. [1]

(3) Originality/Universality

After some investigation, different surfaces for the light reflectance, scattering rate, reflection model, scattering model is different. The face surfaces can be distinguished from other surfaces by the illumination model difference between different surfaces to

realize 3D face anti-spoofing.

There are already a number of methods to perform face anti-spoofing based on 2D images. Shape from shading, for example, uses 2D images to separate the shape, light, and reflectance (material) information of the subject. The technology has been proposed for a long time (about a thousand years ago), and new solutions and improvements are being proposed constantly. More widely used solution in recent years is the approach proposed by Barron et al. in 2015 [2]. This method may be used to calculate the influence of ambient light on the intensity of infrared light produced by the active projection, so as to eliminate the weakening effect of the external environment and improve the experiment precision.

(4) Reasons and motivations for visiting UN agencies / International organizations

WHO China's priorities include health system reform; tobacco control and NCDs; infectious diseases control - including TB, HIV and hepatitis; immunization; improving regulation of food and drugs; strengthening health services and outcomes in China's western provinces; and building a movement for health across China's many cities, as the country's population becomes increasingly urbanized. [3]

I am participating in a project about secondary Hypertension since last year. It seems that WHO China is paying attention to the health effects of lifestyle habits. It calls for people to develop good habits of smoking less, lower salt, which is probably to reduce the probability of hypertension and other diseases. I thought there is a deep connection to our project. And I think it is important to actually visit international institutions, to explore the core of their work, to interview people who are working there about what their requirements toward candidates are, to get a lot of information that I cannot get through websites and reports. This makes it easier to successfully apply for an internship or career in the future.

Reference

[1] Z. Li, 12 May 2017. [Online]. Available: http://mobile.zol.com.cn/669/6691049.html. [Accessed 28 March 2019].

[2] J. T. Barron and J. Malik, "Shape, Illumination, and Reflectance from Shading," *IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE,* Vols. 37, No. 8,

pp. 1670-1687, 2015.

[3] United Nations in China, 2018.