Using Artificial Intelligence to Improve Camera’s Recognition Function on Mobile Phone

Zefeng Wang 1,*

1School of Art, Design & Architecture, Monash University, Melbourne, Australia

*Corresponding author e-mail: zefengwang0802@qq.com

Abstract. There is a rising trend in the numbers of Artificial Intelligence (AI) applications in different fields include interaction design and mobile phone. In addition, mobile devices have been tools that people interact with every day. Thus, applying the combination of AI and interaction design to camera’s recognition of mobile devices is the central concern of this research. This report includes the discussion around two aspects towards mobile phones which are holography and augmented reality (AR). Within these two aspects, machine-learning-based technologies such as image recognition and face recognition have been applied to improve the user experience and interactions. In order to build a new bridge for the interactions between people and mobile phones, the proposal of this research is to design an AR-based 3D hologram system on mobile phones. This proposal will also include technologies of computer vision and eye tracking. Importantly, this combination will allow users to create their own new ways to connect virtual objects in the real world through mobile phones. To design this product, some methods such as concept mapping, case studies and prototyping will be used in the process. Moreover, this product may change the way between human and machine and take the interaction to a new degree.

1. Introduction

In recent years, Artificial Intelligence has an influence in different industries and it can play an important role in the mobile phones industry. With the development of mobile phones, cameras’ functions are richer and more powerful than before. Additionally, some complicated applications relying on cameras such as AR applications begin to draw the attention of people by using AI technologies. Those technologies include image recognition and face recognition. As for the holographic projection, it is now mostly still being used in some large occasions such as stage shows because this technology may be not mature enough on mobile devices. Nevertheless, there is a probability that allowing this technology to create a new relationship for human and mobile phones in the future. So, this report will attempt to explore the key connection between AR technology and holography.

Artificial Intelligence (AI) consists of many parts such as deep learning, machine learning, artificial neural network (ANN), physiology and psychology [1]. He states that Artificial Intelligence is interrelated to various fields such as the medical industry and smart home. Also, its development needs the effort and contribution of people in different fields so that it can provide better interactions and services with people.
2. Related works

A great number of people use mobile phones to take photos thus a satisfactory picture is important to user experience in photographing. Image composition is one of the key elements that affect photo quality. However, the relevant skills to have good image composition may be too professional for amateurs. So, Wu and Fahn [2] propose a real-time image composition analysis system to help them take better photographs. Camera users who use this system can receive image composition guidance while taking photos in real time, which improves user experience between photographing and users and it may be implemented to smart electronic devices especially smartphones.

Also, Face recognition has begun to be applied to the smartphone in recent years and it has a wide application prospect. However, it is challenging to be efficient for machine recognition of human faces which contains such a huge data [3]. Thus, the author proposes an intelligent system for face recognition. This intelligent system incorporates deep learning which makes recognition tasks easy. The deep learning is based on artificial neural network (ANN) which is a set of algorithms attempting to mimic the biological brain. Implementing face recognition to photographing promotes the photography on mobile devices. A research by Kim, Jeon, Lee, Rhee and Chung [4] argue that face recognition based on the genetic algorithm (GA) can be used for intelligent digital photography on smart devices. The genetic algorithm is a branch of machine learning, which generates solutions for optimization by simulating natural evolution.

Furthermore, The Mobile phone has been developed as one of augmented reality platforms today. Mobile augmented reality (MAR) applications, and machine learning can be incorporated into those applications. Santos, Araújo, Chagas, Neto and Meiguins [5] present a proposal that helps users to easily find the Points of Interest (POI) during navigation in the real world. This proposal is combining computer vision based on machine learning with AR applications on mobile devices. The exploiting of machine learning improves the accuracy and efficiency of image recognition so that users can navigate to a more precise target place which is better than relying on geolocation data only. They also present a process for image recognition includes filter selection, feature detection, feature extraction and classification.

In addition, Lee, Chen, and Chang [6] conduct a research that is combining augmented reality technology with three-dimensional holography for older adults. Holography is a three-dimensional light technology that allows people to watch 3D objects in the real world without wearing any equipment. It is the scientific definition that refers to the practice of making hologram by using light wave interference effects so that it can display 3D objects [7]. The author also points out that a hologram only includes all the information about a certain scene. If a hologram contains too much information, people’s eyes will never perceive all the contents, which means the holographic rendering process should be simplified. Lee, Chen, and Chang stress that a hologram can allow users to watch 3D objects without any equipment and it presents a visual display that draws attention from people in public. So, they intend to design an AR-based 3D hologram (AR-3DH) system as the training device. Comparing to traditional AR technology, the advantage of their proposal is users can view all the virtual contents with the naked eyes. Importantly, this AR-3DH training system is effective for users to focus more on the 3D models and help them improve the mental rotation ability. Also, this system illustrates the superiority of applying the holographic technology to AR applications.

3. Methods

3.1. Concept mapping

This method will allow designers to construct the framework for core elements and ideas and produce new concepts and ideas. Also, it can explain the relationship clearly for every component. Through this method, the relationship between Artificial Intelligence and camera's recognition of mobile phone will be made.

Furthermore, the basic design principles for the product will be visualised by this method. AR applications on mobile phones rely on camera’s recognition includes image recognition and face recognition whose efficiency can be boosted by machine learning. This will therefore reduce user
waiting time and improve user experience. Additionally, with holography incorporated into mobile phones, users can watch stereoscopic objects with the naked eyes.

![Diagram of Artificial Intelligence, Machine Learning, Camera's Recognition of Mobile Phone, AR Applications on Mobile Phone, Holography, AR-based 3D Hologram system on Mobile Phone](image)

**Figure 1.** Storyline flowchart and command sequence

3.2. Questionnaires

Questionnaires are survey tools that help to collect information from target people. This information contains their feelings, thoughts, behaviours, or attitudes. Thus, implementing the method will provide the intended design with different aspects of suggestions, feedback and opinions, which will be useful for the future iteration and improvement. There are some core elements will be considered in these questionnaires. The first is do they know AR and hologram and how do they think of AR and hologram. The second is to collect AR and hologram applications that impress them. Third, their advice and opinions toward combining AR with holography are also important. To conduct these questionnaires, they will be constructed and distributed online so that the process will be more efficient and effective.

3.3. Prototype

This method will be helpful to formulate the working principles and preliminary design for the products and it also can be tested so that designers can receive feedback for the iteration of their designs. By using this method in this research, the working principles of AR-based 3D hologram system will be outlined and visualised by graphics editor such as Adobe Illustrator. In the prototyping process, the collaboration of rear camera and holographic projector will be illustrated so that people can clearly know how the system works. Finally, when the initial prototype is finished, its design styles, colours, functions, principles or structure will be tested by target users, which is in preparation for iteration and improvement.

4. Conclusion

The original intention of this research is to apply Artificial Intelligence to improve camera’s recognition on mobile phone. As AR relies on cameras, machine learning can be used to boost camera’s recognition and then improve AR experience. Currently, AR technology and applications are
gradually known to more people through smartphones. With the popularity of AR, the proposed design is to combine AR technology with holography attempting to find a new interaction way for people and mobile devices. The potential of this design is allowing users to view virtual objects with the naked eyes while experiencing AR. However, there are some limitations in this proposal. The first is the holography technology is not mature enough to be used on mobile phones. In addition, the relevant hardware for holography is still high cost. So, the future is continuing to find more viable ways to promote and improve the product.

5. Acknowledgments
Throughout this project, there are many problems and challenges from the beginning. Despite I have encountered many difficulties, I can solve those problems step by step with the support and assistance of Wilkie Tan. So, I would like to appreciate him for helping me develop and improve the project.

References
[1] Norris, Donald J. "Introduction to Artificial Intelligence." (2017).
[2] Wu, Meng Luen, and C. S. Fahn. "A Real-Time Professional Photographing Guiding System Through Image Composition Analysis." International Conference on Virtual Springer, Cham, 2017.
[3] Tripathi, and K. B. "On the complex domain deep machine learning for face recognition." Applied Intelligence (2017).
[4] Kim, Dong Sun, et al. "Embedded face recognition based on fast genetic algorithm for intelligent digital photography." IEEE Transactions on Consumer Electronics 52.3(2006):726-734.
[5] Santos, Carlos G.R. G, Tiago D.O. D Araújo, Paulo R. R. Chagas, Nelson C.S. C Neto, and Bianchi S. S. Meiguins. "Recognizing and Exploring Azulejos on Historic Buildings' Facades by Combining Computer Vision and Geolocation in Mobile Augmented Reality Applications." Journal of Mobile Multimedia 13, no. 1-2 (2017): 57-74.
[6] Lee, I Jui, C. H. Chen, and K. P. Chang. "Augmented reality technology combined with three-dimensional holography to train the mental rotation ability of older adults." Computers in Human Behavior 65(2016):488-500.
[7] Marina Krakovsky. "Bringing holography to light." Communications of the ACM 59.10(2016):13-15.