THE EDUCATION UNIVERSITY OF HONG KONG
FACULTY OF LIBERAL ARTS AND SOCIAL SCIENCES

Research Output/Impact/Knowledge Transfer Prize
for the Dean's Research Fund 2018-19

Brief Introduction of Awardee's
Research/KT Publication/Study/Output and Future Research/KT Development

Awardee (Dept):	Dr. Xie Haoran, Assistant Professor (MIT)
Publication Title/KT project:	On the Effectiveness of Least Squares Generative Adversarial Networks

A. *Briefly introduce your research/KT publication/study/output for which you have received the prize.*

Generative adversarial networks (GAN) is one of cutting-edge research areas in artificial intelligence. Unsupervised learning with generative adversarial networks (GAN) has proven hugely successful. Regular GANs hypothesize the discriminator as a classifier with the sigmoid cross entropy loss function. However, this loss function may lead to the vanishing gradients problem during the learning process. To overcome such a problem, Dr. Xie and his collaborators propose the Least Squares Generative Adversarial Networks (LSGAN) which adopt the least squares loss function for the discriminator. The following two papers are related to LSGAN:

[1] Xudong Mao, Qing Li, **Haoran Xie***, Raymond YK Lau, Zhen Wang and Stephen Smolley, On the Effectiveness of Least Squares Generative Adversarial Networks. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, DOI: 10.1109/TPAMI.2018.2872043, 2018 [SCI, IF = **17.730**, 5-Year IF = **16.887**, *****Corresponding Author, **Rank 2 out of 133 Journals in the area of Artificial Intelligence in SCI, RDO Presumable Rank = A***].

[2] Xudong Mao, Qing Li, **Haoran Xie**, Raymond Y.K. Lau, Zhen Wang and Stephen Smolley, Least Squares Generative Adversarial Networks, In Proceedings of the International Conference on Computer Vision 2017 (ICCV), Venice, Italy, October 22-27, pp. 2794-2802, 2017 (**Google Citations > 600 times**).

Dr. Xie's research outputs about LSGAN have been recognized by *Stanford University, National Taiwan University* and *Google*.

The CS231n "Convolutional Neural Networks for Visual Recognition" 2017 Spring in Stanford University has included LSGAN in Lecture.

- The course "Machine Learning and having it Deep and Structured" 2018 Spring in National Taiwan University has included LSGAN in Lecture "Generative Adversarial Network.
- LSGAN has been implemented and included in the TFGAN by TensorFlow, which is a set of open machine learning software tools developed by *Google*.

B. *How you used/will use your prize and perhaps its usefulness to your research/KT development?*

Some relevant devices have been purchased by using this prize for my further research of this

study. By exploiting these devices, the study related to LSGAN will be further exploited in the following three aspects:

(1) Data Augmentation. As the LSGAN can generate high-quality images and learn distribution from the real image samples, the generated images can be used to further enhance the training of the machine learning models like SVM or Neural Networks for more accurate and effective classifiers.

(2) Domain Adaptation. LSGAN is currently only for the single-domain training and cannot be used in various domain adaption. To address this limitation, I plan to continue to develop domain adaptive LSGAN for the style transferring for the images or change the style of some components in the images (e.g., change eye style in a face image).

(3) Image Clustering. The third potential application of LSGAN is that the output can be possibly employed in the image clustering. As LSGAN can generate many images, the features for image generation can also be used for better clustering of images by using unsupervised learning methods.

C. Expected research/KT outcomes/outputs/impacts arising from this prize.

The expected outputs and impacts arising from this prize is related the to above three aspects:

(1) Data Augmentation. A journal article entitled "A Deep Data Augmentation Framework based on Generative Adversarial Networks" by Qiping Wang, Ling Luo, Haoran Xie, Yanghui Rao, Raymond Lau, Detian Zhang has been submitted and under review of a top-tier journal.

(2) Domain Adaptation. A conference paper entitled "Cross-domain Beauty Item Retrieval via Unsupervised Embedding Learning" by Zehang Lin, Haoran Xie, Peipei Kang, Zhenguo Yang, Wenyin Liu and Qing Li has been accepted by ACM Multimedia 2019 Conference and has won the ***2nd Prize Winner in Multimedia Grand Challenges*** in the track of "AI Meets Beauty" in ACM Multimedia 2019 Conference.

(3) Image Clustering. A presentation entitled "An Enhanced DeepCluster Model for Image Clustering via Convolutationary Neural Network" has been made in Asia Pacific Society for Computing and Information Technology. Due to the high-quality of this research study and my personal research achievement, I have received the "***Outstanding Research Achievement Award from Asia Pacific Society for Computing and Information Technology***".