

MINISTRY OF EDUCATION AND TRAINING
DUY TAN UNIVERSITY

**ADAPTIVE LEARNING SOLUTION BASED ON
DEEP LEARNING FOR TRAFFIC
OBJECT RECOGNITION**

Major: Computer Science

Code: 9480101

INFORMATION OF DISSERTATION

DA NANG - 2022

INFORMATION OF DISSERTATION

Dissertation title: ADAPTIVE LEARNING SOLUTION BASED ON DEEP LEARNING FOR TRAFFIC OBJECT RECOGNITION

Major: Computer Science

Code: 9480101

PhD candidate: Tran Diem Phuc

Gender: Male

Date of Birth: 07/10/1984

Place of Birth: Quang Binh

Academic Supervisor: 1. Assoc.Prof. Hoang Van Dung
2. Dr. Vo Nguyen Son

Institution: Duy Tan University

1. Main results and new contributions of the disertation:

The research results, which are presented in each chapter of the thesis, have been proved and confirmed through research works published in domestic and international conferences and journals. The research contents have been basically completed according to the stated objectives. In particular, outstanding contributions are:

(1) Having study and generalizing the indispensable fundamental role of traditional machine learning algorithms, the recent domestic and international researches on artificial intelligence, machine learning, Deep Learning object recognition techniques and Adaptive Learning techniques as well.

(2) The basic techniques of Deep Learning are demonstrated in the Chapter 2 (Pedestrian recognition, vehicle recognition,...). Through the simulation experiments of Advanced Driver Assistance Systems (ADAS) equipment in traffic, it has shown that the CNN models' ability to recognize is great when being trained. The research results in this chapter are considered as a foundation for an overall model development of an ADAS system which is capable of self-learning and become more intelligent.

(3) The main contribution of the thesis is to propose a comprehensive model for Adaptive Learning solution. The operation of the ADAS model demonstrated that an auto robot system is capable of self-learning and recognizing by simulation of the human brain. The proposed solution, along with adaptation and automatic updating of actual data, enables the system to change and adapt to the training hyperparameter set matched with the input data. It is this combination that has generated a quite complete model for the Adaptive Learning solution of auto robot systems in the future.

(4) Through the experiments on the research contents, the author has collected and develop a dataset of many different objects such as a data set of actual pedestrians, a data set of pedestrian posture, a data set of traffic signs, and a dataset of vehicles as well. Because data for the experimental process are not available (including published famous datasets), the data sets of images stated in the thesis were in real ones which were collected directly from real movement of car on road or from internet videos.

2. Ability to apply in practice

The research of the thesis emulated the operation of ADAS in practice. Despite the fact that testing was made on only two objects (vehicle and traffic signs), they were representative and covered all possible objects of the on-the-road journey of ADAS. Moreover, the proposed model is expected to be widely applied in all intelligent systems using object recognition complexes. The proposed model matched with systems with low equipment configuration, thus lacking resources for complex or multiple object recognition. Throughout the Adaptive Learning process of the proposed model, the system was able to recognize objects with accuracy, which is equivalence and higher over time.

3. Further research:

The proposed model shows the Adaptive Learning solution of ADAS devices. However, it can be seen that further research and development in following different directions may be of potential:

- Extend objects for recognition to diversify the capabilities of the ADAS system or develop into a complete auto robot system capable to Adaptive Learning on all objects.

- Evaluate and search appropriate values replacing fixed values during training of Adaptive Learning model. Extend the search parameter range to increase the ability to select the appropriate parameters for retraining the model corresponding to the new data set. At the same time, the study will find a solution in which the complexity in the hyperparameter searching process of the proposed model is reduced with minimized time and improved processing efficiency.

- In the proposed model, the continuous adaptive learning process will enable the training dataset to rapidly increase in number. Thus, the point is to develop a lean solution with a selective training dataset in order to eliminate easy samples while prioritizing hard samples. This is expected to make the model possible to reduce training time and improve the accuracy and quality of the adaptive learning process.

- Develop a complete and large data set with a variety of different types of objects for the initial training of the Adaptive Learning model

Author's Publications

- [1] D.-P. Tran, N. G. Nhu, and V.-D. Hoang, "Pedestrian action prediction based on deep features extraction of human posture and traffic scene," in *Asian Conference on Intelligent Information and Database Systems*, 2018, pp. 563-572.
- [2] D.-P. Tran, V.-D. Hoang, T.-C. Pham, and C.-M. Luong, "Pedestrian activity prediction based on semantic segmentation and hybrid of machines," *Journal of Computer Science and Cybernetics*, vol. 34, pp. 113-125, 2018.

- [3] D.-P. Tran and V.-D. Hoang, "Vehicle Categorical Recognition for Traffic Monitoring in Intelligent Transportation Systems," in *Asian Conference on Intelligent Information and Database Systems*, 2019, pp. 670-679.
- [4] D.-P. Tran and V.-D. Hoang, "Adaptive Learning Based on Tracking and ReIdentifying Objects Using Convolutional Neural Network," *Neural Processing Letters*, vol. 50, pp. 263-282, 2019.
- [5] D.-P. Tran, N. G. Nhu, and V.-D. Hoang, "Hyperparameter Optimization for improving Recognition Efficiency of an Adaptive Learning System", *IEEE Access*, vol. 08, pp.160569 - 160580, 2020.
- [6] V.-D. Hoang, V.-D. Dang, T.-T. Nguyen, and D.-P. Tran, "A solution based on combination of RFID tags and facial recognition for monitoring systems," in *2018 5th NAFOSTED Conference on Information and Computer Science (NICS)*, 2018, pp. 384-387.
- [7] V.-H. Pham, D.-P. Tran, and V.-D. Hoang, "Personal Identification Based on Deep Learning Technique Using Facial Images for Intelligent Surveillance Systems," *International Journal of Machine Learning and Computing*, vol. 9, 2019.
- [8] Tri-Cong Pham, Chi-Mai Luong, Antoine Doucet, Van-Dung Hoang, Diem-Phuc Tran, Duc-Hau Le , "Meta-analysis of computational methods for breast cancer classification," *International Journal of Intelligent Information and Database Systems*, vol. 13, 2020.
- [9] V.-D. Hoang, D.-P. Tran, N. G. Nhu, and V.-H. Pham, "Deep Feature Extraction for Panoramic Image Stitching," in *Asian Conference on Intelligent Information and Database Systems*, 2020, pp. 141-151.

Da Nang, Jan-4, 2022

Academic Supervisors



Assoc.Prof. Hoàng Văn Dũng

PhD Candidate



Trần Diễm Phúc

