論　文　要　旨
Thesis Abstract

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主論文題名　　（Title）

Study on Object Detection using Computer Vision by Artificial Neural Network

内容の要旨　　（Abstract）

A collision avoidance system, which is an automobile safety system designed to reduce the severity of a collision, namely to detect objects and obstacle avoidance. In the actual vehicle driving situation on the road, it is desirable to be able to recognize the preceding obstacles. In order to prevent a collision of the vehicles and the obstacles - of which we do not know the exact shape, size or color- it uses various sensors to detect the obstacles, such as optical sensors, RADAR, SONAR, LIDAR, and camera. The camera is a master of classification and texture interpretation, which has the lowest price. As a result, The author would like to reduce the cost of the detector and improve the performance of the vehicle by making the vehicle has the ability to see and recognize the obstacles like human beings by computer vision system.

Such real-time obstacle detection by computer vision was crucial in that we often found fake obstacles such as a text, sign, or painting on the road. Thus, one of the most important obstacle avoidance is the vehicle has to be able to detect, recognize and classify the obstacles that are real obstacles or fake obstacles. So far, have been developed using computer vision with ANN applied to obstacles recognition and classification, which ANN is mathematical model for a computer that can imitate the function of human brain. Hence, it can improve the performance of the vehicle has the ability to see and recognize like a human, which is an important task in an automotive safety application.

The main objectives of this research is to study on object detection using computer vision by ANN as well as to design algorithm to feature extraction, object recognition and classification, from the actual video images taken by an on-board camera. Due to this, TDNN was used in object classification and detection, where TDNN has the potential to work on sequential data.

In this dissertation, the author proposes a novel general object detection system by computer vision with ANN, which only one camera is used. Whereas the previous work,

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stereo vision is widely used in advanced driver assistance systems (ADAS). This is to reduce the number of cameras, but still be able to detect objects. To obtain the effective object detection, the author also introduce several systems: object analysis, feature extraction and identification based on histogram of oriented gradients (HOG) descriptor, object classification, and TDNN. After their processes were completed, this system can effectively detect general objects, which can classify the obstacles that are real obstacles or fake obstacles.

All systems had been tested and presented results, including new findings. The results showed that the performance of each system proposed in this dissertation was highly effective. It can detect general objects, and is not restricted to vehicles, objects or pedestrians - which most of the previous work was to detect specific types of objects such as pedestrians, cars, trucks, etc. It has provided good results along with high accuracy and reliability. Therefore, this system can be applied to provide a warning to the driver when there is an imminent collision in order to prevent an accident and reduce the severity of a collision.

In my future research, the author intend to concentrate on improving the systems to detect the obstacles in bad weather such as fog or rain by deep learning. Along with the principle of deep learning neural networks to be design the algorithm to improve the detection of objects. In particular, a detection of moving objects is available to realize safer path planning, a form of informative support for the driver. The author expect this research will lead to more control over vehicles to avoid oncoming obstacles automatically and efficiently.

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