

Enhanced Object Detection for Mobile Robot

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This paper presents an enhanced object detection (OD) method based on a combination of YOLO3 followed by a classification engine. Our research was conducted using computational experiments and modeling techniques. Combination of classical OD and classification results in an increase of overall intersection over union (IoU) metric more than 8%. The results were discussed and interpreted.

Today it is difficult to imagine our lives without scientific and technical achievements that make our lives easier by taking control of some of the tasks that have become routine, constantly taking away precious time that can be spent on more important things. The use of Artificial Intelligence is a great example of these advances, which helps to detect various objects more accurately, which in some cases is important, for example, to identify objects on the road. The OD is a computer technology whose main purpose is to recognize objects by processing images and highlight them with bounding boxes according to a certain classification. Unusual photos (image size, different viewpoints, mixing the object with the background), real-time detection rate, limited data, and class imbalance can cause significant problems for OD.

Today, many classical OD algorithms are used in various fields of human activity. Algorithms such as YOLO, Fast R-CNN and HOG are considered among the best. Everyone has their own advantages, for example YOLO is considered one of the best OD algorithms due to its speed. The processing speed of the image in real time reaches 45 frames per second and newer modifications of the algorithm can process about 155 frames per second. But everyone is united by one important thing - Image Classification. Image Classification is the process of analyzing the definition of an object by certain characteristics.

Our research was triggered by the impressions of the use cases of artificial intelligence in various applications, presented at scientific conferences and challenges. That is why we set ourselves the goal of creating a simple but efficient neural network.

Participating in the special scientific competition "Roborace" is a great way to test the efficiency and correctness of the neural network, because due to constant movement we get a blurred image, which can cause problems with recognition and classification of the object. Therefore, we proposed to use the classification head after the OD stage. Because by selecting objects in the constraint frame, we can filter out erroneous results by selecting a confidence threshold.

The result of our work is the detection and identification of objects with an IoU metric increased by 8%.

We achieved this result by using a classifier head after OD, which helped reduce the number of false positives. The use of our method is limited by the hardware of mobile robots.

In the future, the direction of research will be aimed at improving the detection quality of and reducing the learning time and computational complexity of the model.

In this paper we proposed the enhanced method for OD for mobile robotics. It is based on the stack of OD and classification heads implemented using an artificial neural network with the open-source library TensorFlow 2. This framework is designed specifically for deep machine learning. A feature of this network is a simple but effective concept that demonstrates the accuracy of object identification with a high level of performance.

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