Bachelor Project Proposal: Open-Ended Three-Dimensional Object Recognition using OrthographicNet and Color Constancy

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Nowadays, accurate object recognition is crucial to improve the performance of self-driving vehicles and service robots. Most approaches to object recognition focus on either shape features or color features. The OrthographicNet has recently proven to be a more reliable solution than many competing approaches for 3D object recognition in open-ended domains [2]. While the network currently only uses shape features to classify objects, it has already been found that color related features such as color constancy and the use of specific color spaces can improve the likelihood of correct classification [1]. The aim of this bachelor project is therefore to investigate the expected performance gain of the OrthographicNet when it is extended with color encoding layers.

Firstly, in a literature review of related research insights regarding the extension of the OrthographicNet are searched for. The form in which the color features can be encoded in the network under the use of which color space will be priorities of the literature review. Based on these findings the OrtographicNet will be extended to meet the requirements for this research project. Several architectures appear viable at the moment, differing in how separated shape and color information are evaluated.

After the implementation of relevant code is finished, several experiments will be conducted. First, different color spaces will be evaluated to find the most successful for further experimentation. The aim is to compare the five popular color spaces in contemporary use: CIE, RGB, YUV, HSL/HSV, and CMYK. In a second experiment, the performance of the extended OrthographicNet will be compared with the original OrthographicNet as well as other state-of-the-art 3D object recognition algorithms. The evaluation shall be done on at least the *MobileNet-v2, VGG16-fc1* and the *ResNet50* data set. If the time constraints of the Bachelor project allow, in a series of real-time system demonstrations, it will be displayed how the extension of the OrthographicNet performs superior in scenarios including objects that can only be differentiated by color features but share the same shape.

To give a brief overview of the stages that make up the research, the literature review shall be finished in mid-March, followed by a implementation phase until early May. The remaining time is reserved for the testing of the algorithm and reporting of findings in the Bachelor thesis.

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References

[1] H. S. Kasaei et al. Investigating the importance of shape features, color constancy, color spaces and similarity measures in open-ended 3d object recognition. 2020.

[2] H. S. Kasaei. Orthographicnet: A deep transfer learning approach for 3d object recognition in open-ended domains. 2020.