A Preliminary Study on View Independent Panoptic Scene Change Detection

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Abstract—**This paper addresses the novel task of view-independent panoptic scene change detection. The task aims to detect the unknown class instances by two images captured from different viewpoints before and after the change occurred. This paper proposes methods to solve this task based on panoptic segmentation. In addition, we created a new panoptic scene change detection dataset for the challenge of images captured from different camera viewpoints. Through the experiments, we confirmed that the proposed method achieved good performance on the change detection dataset.**

I. Introduction

Deep neural networks have succeeded in many image-processing tasks, such as semantic segmentation and others. They can only identify the labeled categories that appear in training and cannot identify unknown categories not included in the training dataset. However, the open-world setup requires segmenting instances of unknown categories [1]. The proposed method detects these unknown instances based on change detection between two images before and after unknown class instances appear. Our newly created dataset included 22 object categories as unknown instances and 12 scenarios.

II. Proposed Methods

Firstly, an image of the first view without unknown class instances (background image) is segmented by Panoptic DeepLab [1], and then small patches are clipped from the region of each known class instance to build the background model for the region. In the change detection, an image containing unknown class instances from the other view is also segmented, and some small patches are clipped from the region we want to detect. Then, each small patch is evaluated to determine whether it is similar to the background model. Here, the patch region will be considered a changed region if the similarity is below a threshold. The proposed two change detection methods are described below.

1. Pearson correlation coefficient of RGB histograms extracted from two patches.
2. Deep metric learning based similarity. Here, we used an idea that patch pairs from the same object should be similar and patch pairs from images within different object should be dissimilar. The projection of the original sample space to the new space is learned to find the appropriate similarity metric.

Table 1. Results of two proposed methods

Methods	PA	mIoU
$histogram_{sofa}$	78.9	42.1
$deepmetric_{sofa}$	94.7	64.8
$histogram_{all}$	85.3	54.4
$deepmetric_{all}$	89.9	69.2

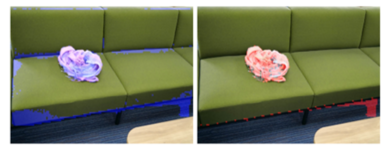

Figure 1. Results of different evaluation metrics. **Left**: Pearson correlation coefficient. **Right**: Cosine similarity of deep metric learning features.

III. Results

We used two evaluation metrics, pixel accuracy (PA) and mIoU. Fig.1 shows the results and Table 1 shows the data about these two methods. Deep metric learning-based method has better accuracy than histogram-based method.

IV. Conclusion

In this paper, we proposed an idea to solve the panoptic scene change detection, as well as list two methods to solve this task. And a new dataset is created for this idea. Future works will include work improving the deep metric learning network and learning more appropriate feature space transformations to improve the accuracy.

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