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Discussion:

Real-time hand gesture recognition based on deep learning models has critical roles in many applications due to being one of the most advanced domains, in which the computer vision and artificial intelligence methods have helped to improve communication with deaf people, but also to support the gesture-based signaling systems. In this study, we experimented with hand gesture recognition using YOLOv3 and DarkNet-53 deep learning network models. The dataset, which we used, was collected, labeled, and trained by ourselves. We compared the performance of YOLOv3 with several other state-of-the-art algorithms, which can be seen in Table 5. The achieved results were good, as YOLOv3 achieved better results when compared to other state-of-the art algorithms. However, our proposed approach was not tested on the YOLO-LITE model. The YOLOv3 model was trained on a YOLO-labeled dataset with DarkNet-53. YOLOv3 has more tightness when it comes to bounding boxes and generally is more accurate than YOLO-LITE.

Moreover, the aim of our study was not to apply real-time hand gestures on limited computing power devices, since we collected hand images of different size and used different angles for diversity. Hence, we focused only on performance criteria rather than YOLO-LITE criteria to recognize hand gestures of speed. Complex applications such as communication with deaf people, gesture-based signaling systems, sign language recognition, special signal languages used in sports, human action recognition, posture detection, physical exercise monitoring, and controlling smart homes for assisted living, are where GPUs could perform better through YOLOv3.

In future work we can apply mixed YOLOv3–LITE on our datasets and new datasets of 1–10 numbers for all kind of applications for GPU and non-GPU based computers to achieve real-time object detection precisely and quickly. Furthermore, we can have enhanced our images through oversampling and real-time augmentation as well. The major contribution is that there is no such dataset available in YOLO-labeled format and the research on, specifically, YOLOv3 and onwards requires the YOLO-labeled dataset so by our contribution that dataset will be readily available for future research and improvement as the domain of hand gesture recognition is very much wide there is a need of dataset that should be readily available in the YOLO format also.

Moves:

1. **Background Information**

Real-time hand gesture recognition based on deep learning models has critical roles in many applications due to being one of the most advanced domains, in which the computer vision and artificial intelligence methods have helped to improve communication with deaf people, but also to support the gesture-based signaling systems. In this study, we experimented with hand gesture recognition using YOLOv3 and DarkNet-53 deep learning network models (Mujahid *et al.*, 2021).

2. **Summarizing and reporting key results**

In this study, we experimented with hand gesture recognition using YOLOv3 and DarkNet-53 deep learning network models. The dataset, which we used, was collected, labeled, and trained by ourselves. We compared the performance of YOLOv3 with several other state-of-the-art algorithms, which can be seen in Table 5. The achieved results were good, as YOLOv3 achieved better results when compared to other state-of-the art algorithms. However, our proposed approach was not tested on the YOLO-LITE model. The YOLOv3 model was trained on a YOLO-labeled dataset with DarkNet-53. YOLOv3 has more tightness when it comes to bounding boxes and generally is more accurate than YOLO-LITE (Mujahid *et al.*, 2021).

3. **Commenting on the key results**

The major contribution is that there is no such dataset available in YOLO-labeled format and the research on, specifically, YOLOv3 and onwards requires the YOLO-labeled dataset so by our contribution that dataset will be readily available for future research and improvement as the domain of hand gesture recognition is very much wide there is a need of dataset that should be readily available in the YOLO format also (Mujahid *et al.*, 2021).

4. **Stating the limitations of the study**

Moreover, the aim of our study was not to apply real-time hand gestures on limited computing power devices, since we collected hand images of different size and used different angles for diversity. Hence, we focused only on performance criteria rather than YOLO-LITE criteria to recognize hand gestures of speed (Mujahid *et al.*, 2021).

5. **Making recommendations**

In future work we can apply mixed YOLOv3–LITE on our datasets and new datasets of 1–10 numbers for all kind of applications for GPU and non-GPU based computers to achieve real-time object detection precisely and quickly. Furthermore, we can have enhanced our images through oversampling and real-time augmentation as well (Mujahid *et al.*, 2021).

DAFTAR PUSTAKA

Mujahid, A. *et al.* (2021) 'Real-time hand gesture recognition based on deep learning YOLOv3 model', *Applied Sciences (Switzerland)*, 11(9). doi: 10.3390/app11094164.