**Project Report: YOLOv8 Segmentation Model**

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**1. Introduction**

This project aims to develop a custom segmentation model using YOLOv8 to identify and segment objects in images from the DeepBee dataset. The process involved downloading images, annotating them, and training a YOLOv8 model for segmentation tasks.

**2. Background**

YOLOv8 is an advanced object detection and segmentation model, offering high accuracy and efficiency. This project uses YOLOv8 to leverage its capabilities in segmenting objects from the DeepBee dataset, which provides a valuable testbed for such applications.

**3. Objectives**

* **Dataset Acquisition:** Download images from provided links.
* **Annotation:** Annotate images using Roboflow in YOLOv8 format.
* **Model Training:** Train a YOLOv8 model for object segmentation.
* **Validation and Evaluation:** Assess model performance and accuracy.

**4. Dataset**

* **Source:** DeepBee dataset
* **Files:**
  + images.csv: Contains image names and download links.
  + labels.csv: Contains image annotations.
* **Process:**
  1. Download images using links from images.csv.
  2. Annotate images using Roboflow.

**5. Data Preparation**

1. **Image Download:** Images were downloaded from the URLs provided in images.csv.
2. **Annotation:** Images were annotated in YOLOv8 format using Roboflow.
3. **Dataset Split:** The dataset was divided into training and validation sets.

**6. Model Training**

* **Model:** YOLOv8 segmentation
* **Training Procedure:**
  + **Configuration:** Custom configuration settings for YOLOv8.
  + **Hyperparameters:** Tuned learning rates, batch sizes, etc.

**7. Validation and Evaluation**

* **Validation Metrics:** Precision, Recall, F1 Score, and mAP (mean Average Precision).
* **Evaluation Results:** Performance metrics on the validation set were used to gauge accuracy and model effectiveness.

**8. Challenges and Solutions**

* **Challenge 1:** Downloading and managing a large number of images.
  + **Solution:** Utilized automated scripts to streamline the download process.
* **Challenge 2:** Annotating a large dataset efficiently.
  + **Solution:** Used Roboflow for automated annotation and quality checks.

**9. Outcomes and Impact**

The YOLOv8 model effectively segmented objects in the DeepBee dataset, demonstrating high accuracy and potential for practical applications in various domains.

**10. Team Collaboration**

The project was divided among team members as follows:

* **Data Preprocessing:** 2 members focused on cleaning and augmenting the dataset.
* **Model Implementation:** 2 members were responsible for implementing and training the segmentation model.
* **Performance Evaluation:** One member handled the evaluation and optimization of the model.

**11. Team Collaboration**

The model’s performance was evaluated using mAP and F1-score. The results were as follows:

* The **mAP50 values** for both classes (B and M) are 0.9950, indicating very high precision at an IoU threshold of 0.5.
* The **mAP50-95 values** are slightly lower but still very high (0.9520 for B and 0.9669 for M), showing good performance across a range of IoU thresholds.
* **F1-Score (B):** ~0.9996
* **F1-Score (M):** ~0.9996

The results indicated that the model performed well in isolating the bee regions from other elements in the frames. However, further optimization could improve these metrics.

**12. Conclusion**

The project successfully developed a YOLOv8 segmentation model, trained it on the DeepBee dataset, and validated its performance. Future work may involve further fine-tuning and exploring additional data augmentation techniques.

**13. References**

* YOLOv8 Documentation
* DeepBee Dataset