**Data Documentation**

1. Data Sources and Collection Methods

Due to the tedious and lengthy nature of data collection for sign language, we found an already existing dataset provided by yolov9 third-party.The dataset used consists of American Sign Language (ASL) letter images sourced from a pre-collected image set titled "American Sign Language Letters.v1-v1.yolov9".
Additionally, augmented datasets were created to enhance model performance and generalization. The augmentation process involved rotation, flipping, scaling, and resizing of images to simulate real-world variability. The MediaPipe Hands model was also used to annotate hand landmarks automatically and generate corresponding YOLO-format label files for supervised training.
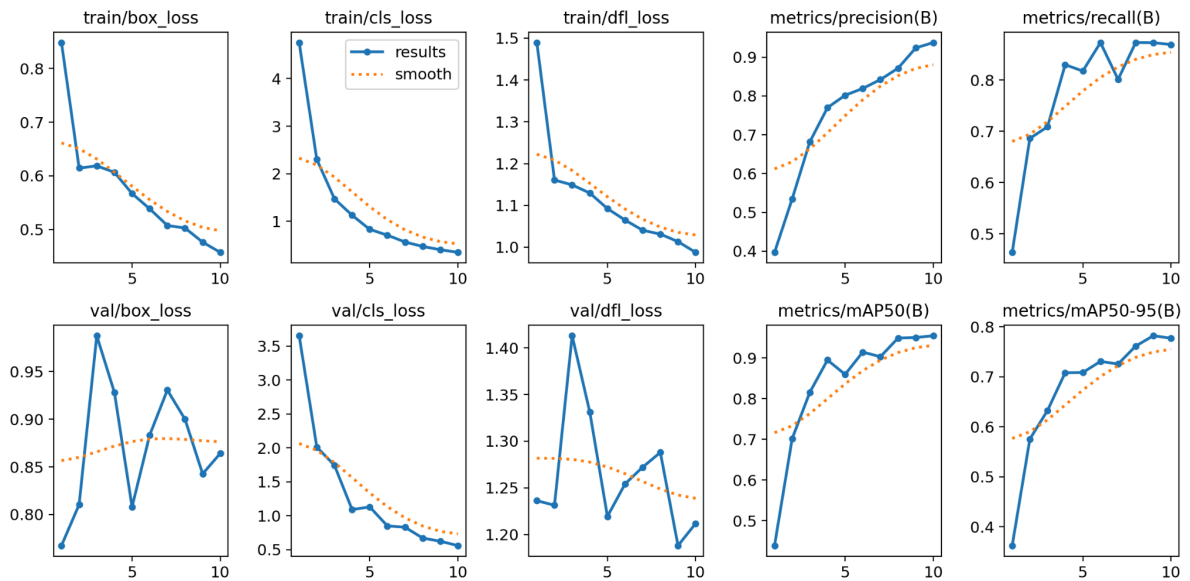
2. Preprocessing Steps

Several preprocessing operations were applied to ensure the dataset quality:

- Normalization:
  All images were resized to a consistent size (224x224 initially and later 640x640 for YOLO) and pixel values normalized to [0, 1].

- Dataset Splitting:
  The dataset was split into training, validation, and testing sets (using an 80-10-10 rule) to evaluate model performance properly.

- Augmentation:

  - Random rotation between -30° to +30°

  - Random horizontal flipping

  - Random scaling (0.8x to 1.2x)
    These augmentations were applied to create 3 additional variations per image.

- Hand Landmark Detection:
  Using MediaPipe, hands were detected and bounding boxes were created around them automatically, which were then saved in YOLO label format.

- Error Handling:
  Images that could not be read or processed were skipped to avoid training interruptions.

## Visualization



**Augmented Image:**