README

This project implements face verification using the ArcFace model on a ResNet101 backbone, focusing on robust data augmentation and hyperparameter settings for improved accuracy.

Model Architecture

- **Backbone**: ResNet101 pretrained on ImageNet (IMAGENET1K_V1) is used as the feature extractor. The fully connected (FC) layer of ResNet101 is removed, and ArcFace is applied to enforce a cosine-based margin.
- **ArcFace**: The ArcMarginProduct module adds a cosine margin for better discrimination, using settings of:
    - s = 64.0: Scaling factor to adjust the output.
    - m = 0.9: Margin parameter that enhances feature separation.

Data Augmentation

- **Train Transformations**:
    - Resize(112): Resizes images to 112x112.
    - RandAugment(): Applies random transformations, increasing data diversity.
    - ToTensor() and Normalize(mean=[0.5, 0.5, 0.5], std=[0.5, 0.5, 0.5]): Standardize images to have a mean and standard deviation of 0.5 across each channel.
- **Verification Dataset Transformations**:
    - CenterCrop(112): Crops the center portion of each image for consistent verification input size.
    - ToTensor() and Normalize(mean=[0.5, 0.5, 0.5], std=[0.5, 0.5, 0.5]): Ensures normalized inputs for testing as well.
- **Additional Techniques**:
    - **Mixup**: Combines two images and labels in a batch to prevent overfitting and enhance robustness.
    - **CutMix**: Mixes random regions of one image with another for improved model generalization.

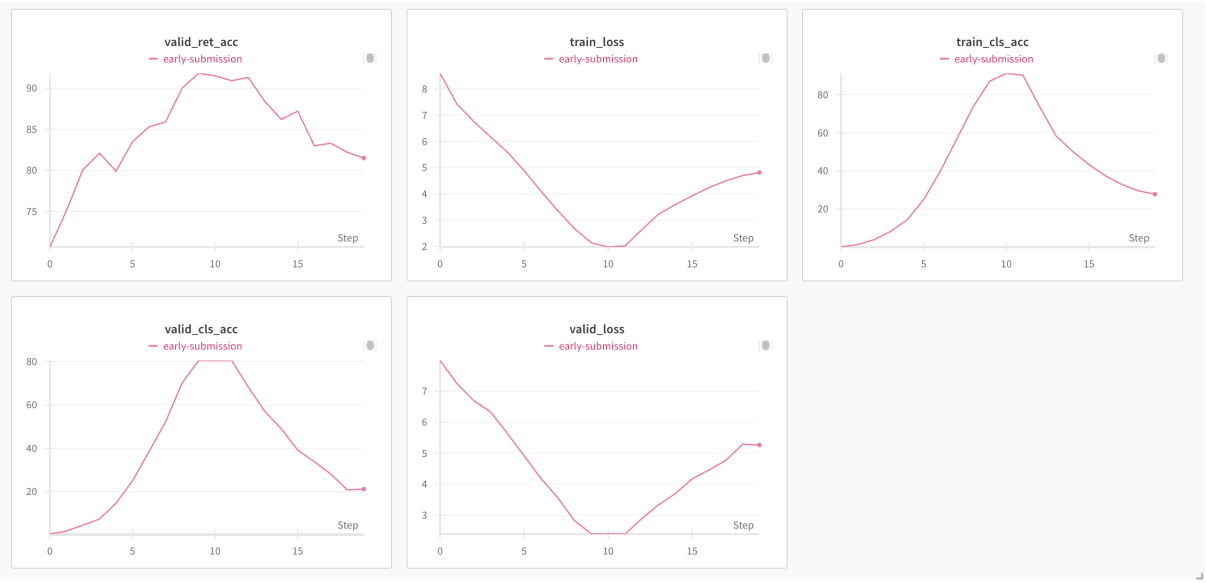
Hyperparameters

- **Batch Size**: 64, selected for a balance between computational efficiency and performance.
- **Learning Rate**: 0.001, using Adam optimizer.
- **Loss Function**: Cross-entropy with label smoothing of 0.1.
- **Scheduler**: CosineAnnealingLR with T_max = 20, decays the learning rate smoothly over epochs.

Ensemble

After training, the top-3 performing models based on validation accuracy are selected for ensemble. These models' predictions are averaged for the final test results, ensuring robustness in face verification.

WandB logs



Training and Validation Logs

The training and validation logs, visualized via Weights & Biases (wandb), illustrate performance trends over epochs:

- **Training Accuracy (train_cls_acc)** and **Validation Accuracy (valid_cls_acc)** initially increase, peaking around the middle epochs, and then start to decline. This trend suggests that overfitting occurs in the later epochs, as the model's generalization ability decreases.
- **Training Loss (train_loss)** and **Validation Loss (valid_loss)** decrease steadily at first, reaching a minimum in the mid-epochs, but then begin to rise again, which also indicates signs of overfitting.
- **Verification Accuracy (valid_ret_acc)** shows initial growth and then stabilizes, highlighting the model's verification capability.

To mitigate overfitting and maximize verification performance, we performed an **ensemble** using the top 3 models based on validation accuracy. By averaging the predictions of each selected model, the ensemble improves robustness and stability in the final test results.