Deep Learning Final Project Progress Update
Group 5

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- **Current Progress**

1. **Olympics Dataset**

We have successfully completed the collection of our Olympics image dataset. The comprehensive dataset encompasses 15 sports categories: athletics, boxing, basketball, badminton, breakdance, football, gymnastics, handball, judo, rugby, swimming, table tennis, tennis, water polo, and weightlifting. We have collected 150 images for each category, resulting in a total of 2250 images in the dataset. These images were sourced through various channels, including web image search engines, sports news media coverage photographs, and key frame captures from competition video footage. After completing the dataset, we discovered some corrupted images during our initial training process. Our current approach is to remove these damaged images from the dataset. As the project develops, we will evaluate whether it is necessary to either replace the missing images or further expand the dataset.

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a. List of Corrupted Images

2. **Adjustments in Model Selection and Training Strategy**

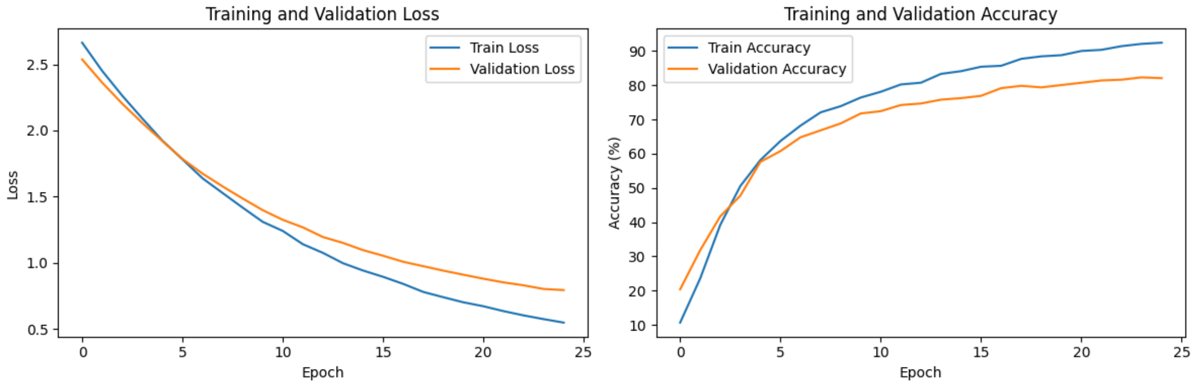
During our initial attempt to train a custom MLP model for Olympics sports classification, we encountered significant challenges. The training process was not only time-consuming but also yielded suboptimal results, with the best accuracy reaching only **24%**. Based on this experience, we decided to pivot our research focus towards evaluating various pre-trained models not explored in the original paper, while also investigating the effectiveness of different data augmentation techniques. Currently, we have completed the training and testing phases for both ResNet18, ShuffleNet V2, EfficientNet, MobileNet models, with results as follows.

Model Training Configuration:

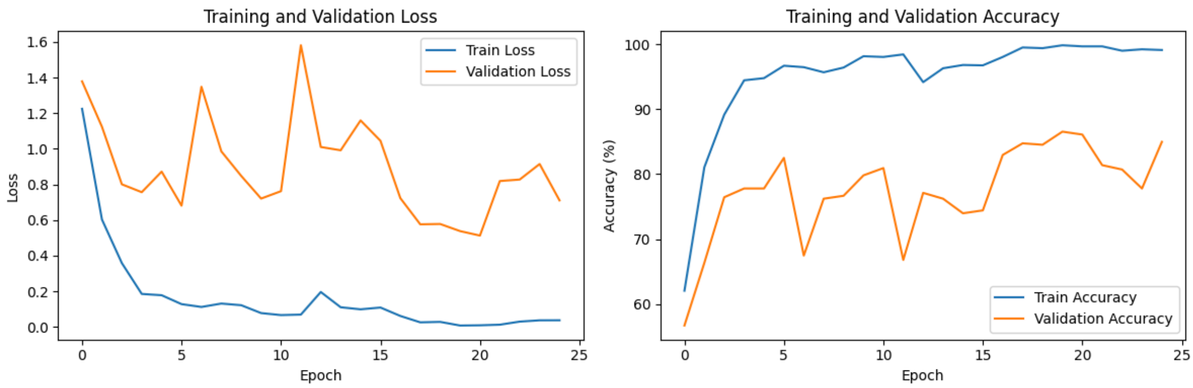
- Optimizor : SGD / Adam / AdamW
- Epoch : 25 / 30
- Batch Size : 32

In our transfer learning process, we initially implemented standard image preprocessing steps, which included resizing all images to a uniform dimension of 224×224 pixels and performing standard normalization procedures. Below are the training results obtained from our experiments with various pre-trained models.

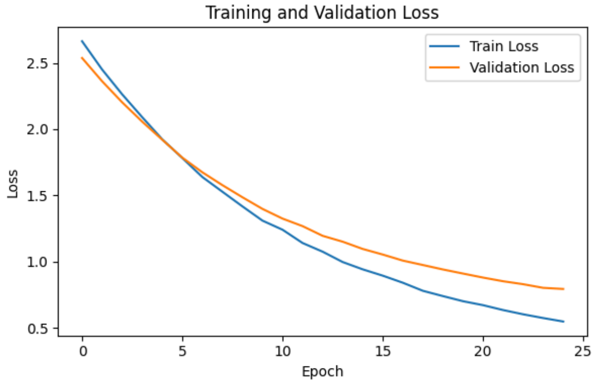
- ResNet18 (SGD)
  Best Validation Accuracy: 82.29%
  Total training time: 1612.57 seconds (26.88 minutes)

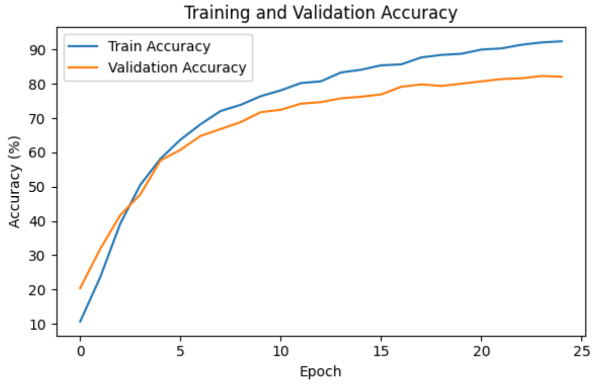


- ResNet18 (Adam)
  Result :
  Best Validation Accuracy: 86.55%
  Total training time: 2332.24 seconds (38.87 minutes)

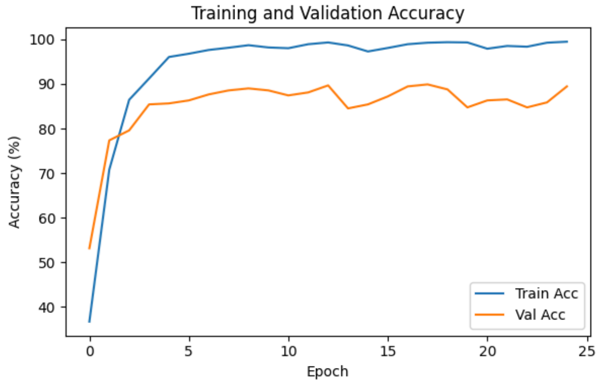


- ResNet18 (AdamW)
  Result :
  Best Validation Accuracy: 88.12%
  Total training time: 36.46 minutes

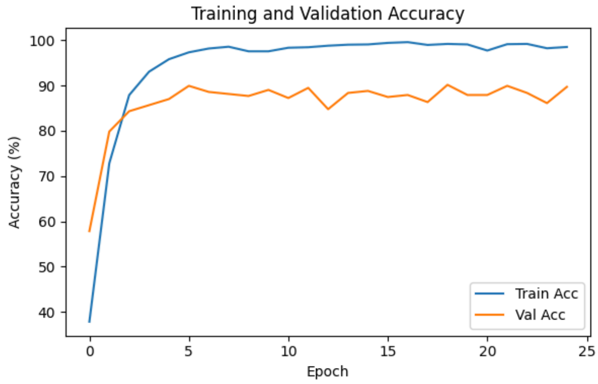




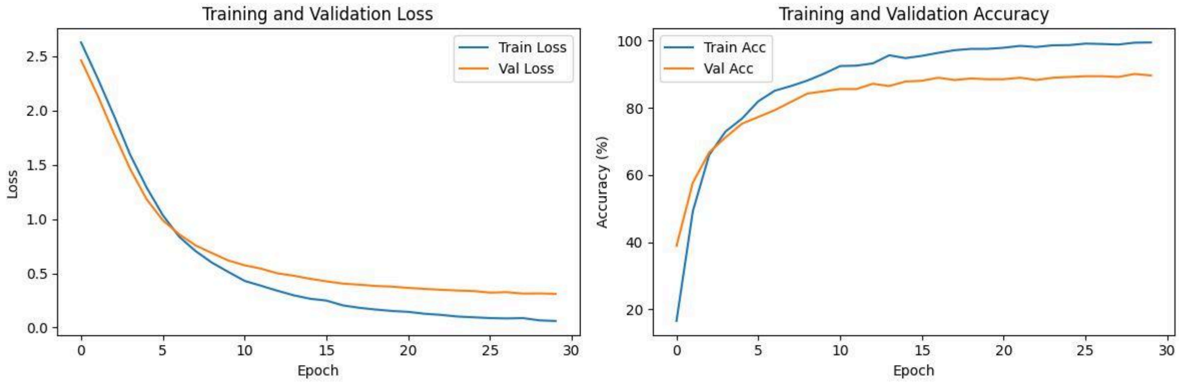
- ShuffleNet V2 (Adam)
  Result :
  Best Validation Accuracy: 89.91%
  Total training time: 30 minutes and 47 seconds



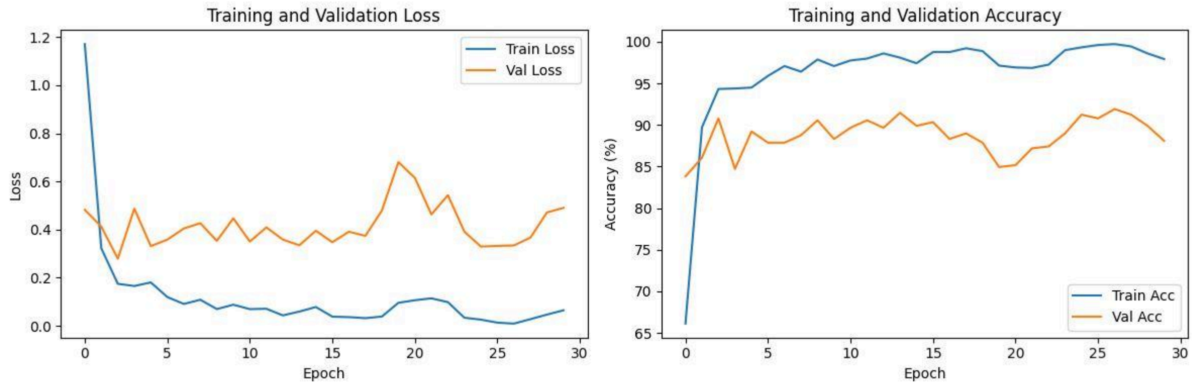
- ShuffleNet V2 (AdamW)
  Result :
  Best Validation Accuracy: 90.13%
  Total training time: 23 minutes and 10 seconds



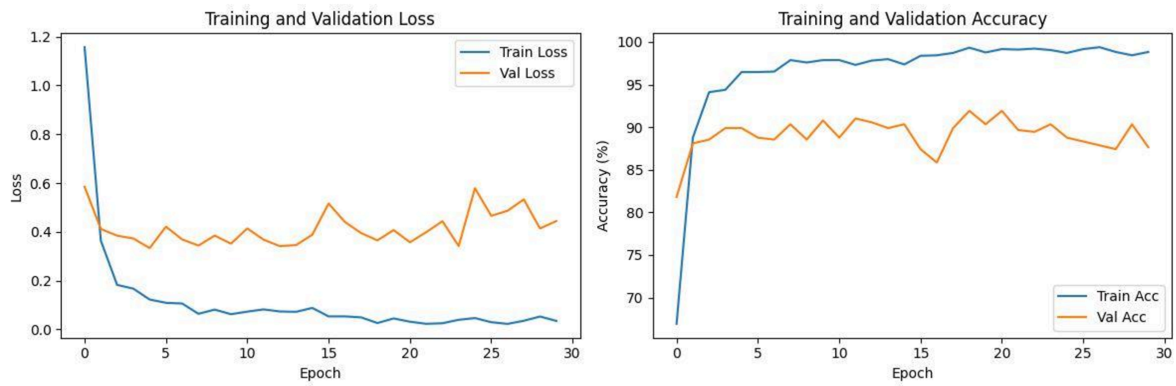
- EfficientNet (SGD)
  Result :
  Best Validation Accuracy: 90.11%
  Total training time: 29 minutes and 51 seconds



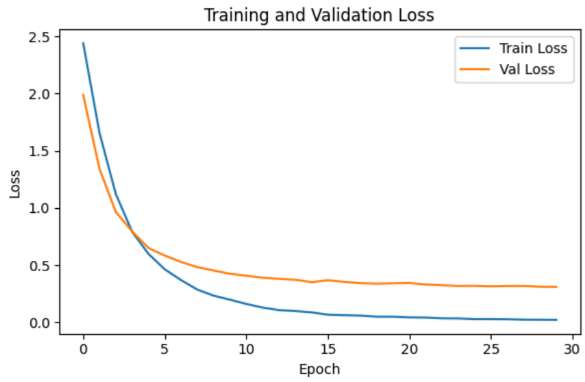
- EfficientNet (Adam)
  Result :
  Best Validation Accuracy: 91.91%, <u>this is currently our best model</u>
  Total training time: 31 minutes and 7 seconds

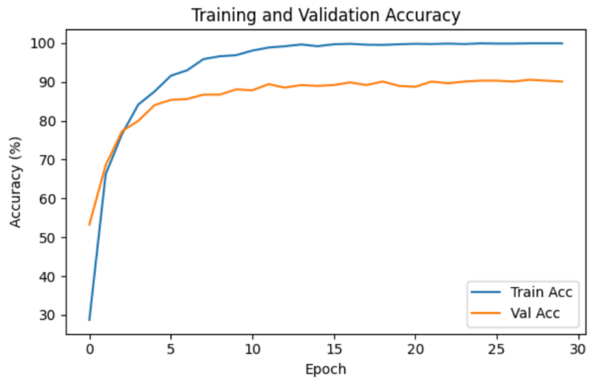


- EfficientNet (AdamW)
  Result :
  Best Validation Accuracy: 91.91%
  Total training time: 30 minutes and 54 seconds

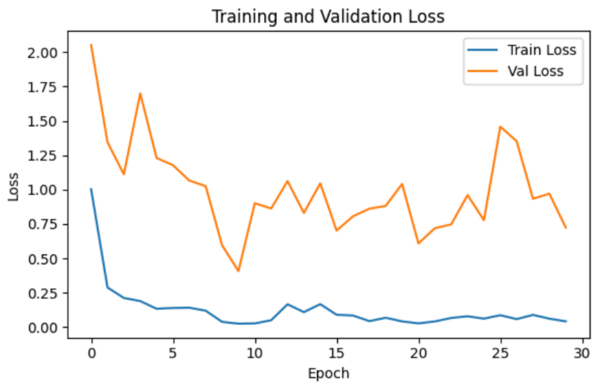


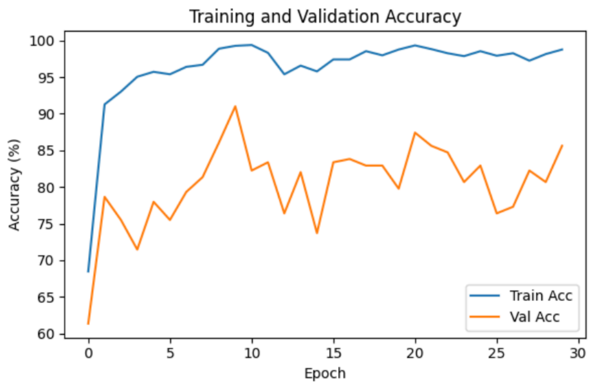
- MobileNet (SGD)
  Result :
  Best Validation Accuracy: 90.56%
  Total training time: 40 minutes and 44 seconds



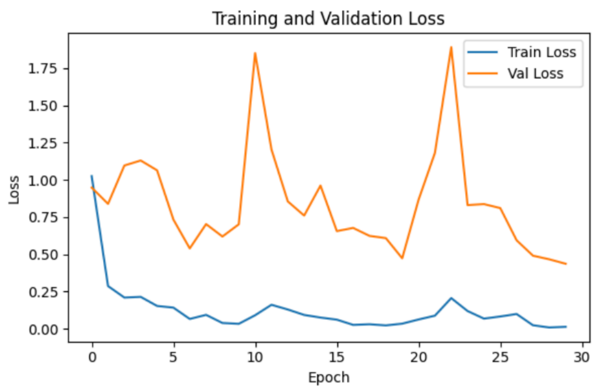


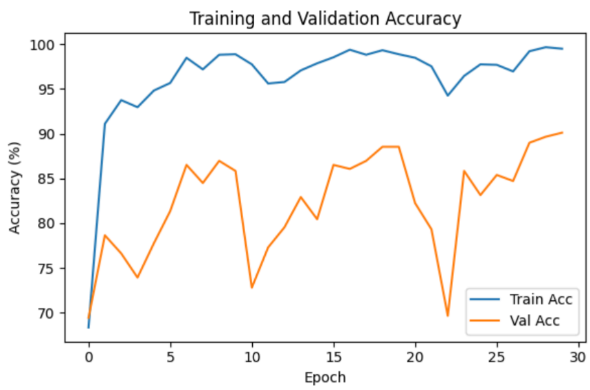
- MobileNet (Adam)
  Result :
  Best Validation Accuracy: 91.01%
  Total training time: 32 minutes and 41 seconds





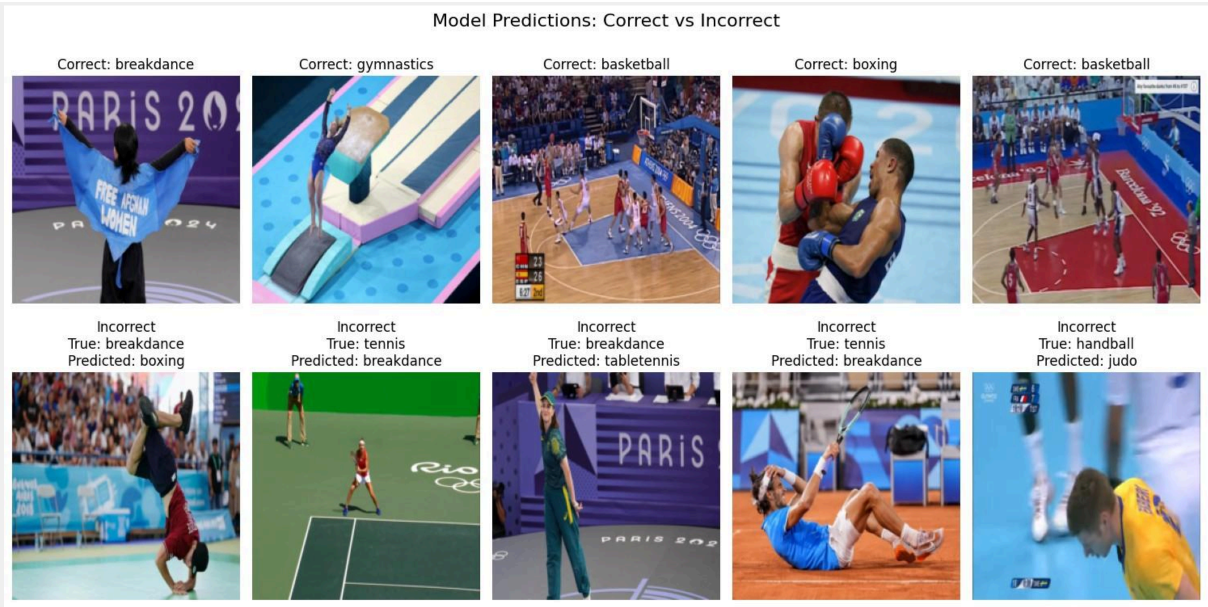
- MobileNet (AdamW)
  Result :
  Best Validation Accuracy: 90.11%
  Total training time: 38 minutes and 0 seconds





The prediction results are shown below. We can see that some incorrect predictions are understandable. For example, in **Result 1,** basketball was misclassified as handball, likely because both sports involve using hands to grab the ball. Similarly, rugby was predicted as football, possibly because the fields are very similar. In **Result 2,** breakdance was identified as table tennis, and this may be caused by the similar raised hand gesture. In addition, tennis was predicted as breakdance, possibly for the same reason. In our final phase, we aim to avoid these mis-predictions by adding different data augmentation methods or expanding our dataset if necessary.

Result 1



Result 2

- **Next Step**：

1. **Implementation of Data Augmentation Strategies**

Moving forward, we will apply these data augmentation techniques to our implemented pre-trained models. The augmentation methods include:

1. Geometric Data Augmentation: Rotation, Translation, Shearing, Horizontal flipping
2. Random Erasing Augmentation: Strategic removal and replacement of random image patches
3. Advanced Color Augmentation: Color jittering, Color dropping
4. AutoAugment: Automated augmentation policy search
5. Imgaug Library: Advanced transformation combinations

Through the systematic application and evaluation of these augmentation techniques, we aim to conduct a thorough comparative analysis of their impact on model accuracy. This investigation will provide valuable insights into the effectiveness of different augmentation strategies in the context of Olympic sports classification.

2. **Optimal Model Selection and Fine-tuning Strategy**

Based on our comprehensive evaluation of various pre-trained models integrated with data augmentation techniques, we will pick a pretrained model with the highest accuracy as our final model decision and further adjust its hyperparameters to optimize performance. This process will involve systematic fine-tuning of key parameters such as learning rate, batch size, and optimization algorithms. Additionally, we will implement cross-validation techniques to ensure the model's robustness and generalizability across different data splits. The fine-tuning process will be guided by both quantitative metrics (accuracy, precision, recall) and qualitative analysis of model predictions to achieve optimal performance in Olympic sports classification.