

Technical Summary: COMSYS 5 Competition

Task A: Gender Classification

Objective: Classify facial images into male or female categories under significant class imbalance.

Data Exploration

- Strong class imbalance: Male >> Female.

Preprocessing

- Resize to 224x224
- Random Horizontal Flip
- Random Rotation ($\pm 10^\circ$)
- Color Jittering: brightness, contrast, saturation
- Normalization with ImageNet mean and std

Model Architecture

- Backbone: Pretrained ResNet18
- Final FC layer modified for binary classification

Training Setup

- Loss: CrossEntropyLoss
- Optimizer: Adam (lr = 0.0003)
- Scheduler: StepLR
- Class Balancing: WeightedRandomSampler based on training targets

Evaluation Metrics

| Metric | Value |
|-----------|-------|
| Accuracy | 94.5% |
| Precision | 0.94 |
| Recall | 0.94 |
| F1-Score | 0.94 |

Detailed report via `sklearn.metrics.classification_report`

Tools and Libraries

- PyTorch
- torchvision
- numpy
- scikit-learn
- tqdm

Task B: Face Recognition Under Distorted Conditions

Objective: Build a face recognition model that performs accurately under distortions (blur, fog, lowlight, noise, etc.).

Dataset Structure

```
Task_B/  
  train/  
    person_1/  
      distortion/  
  val/  
    person_1/  
      distortion/  
  test/
```

Model Architecture

- Backbone: ResNet18
- Embedding Dimension: 512
- Losses:
 - ArcFace Loss for angular margin separation
 - Contrastive Loss using triplet sampling

Training Strategy

- Normalized 512-d embeddings
- ArcFace and Contrastive Loss combined for robust training

Evaluation Results

| Distortion Type | Accuracy | F1 Score |
|-----------------|----------|----------|
| Clean | 97.2% | 0.965 |
| Blur | 95.6% | 0.950 |
| Fog | 93.1% | 0.925 |
| Lowlight | 92.4% | 0.915 |
| Noise | 94.3% | 0.935 |
| Sunny (Hard) | 86.1% | 0.855 |

Tools and Libraries

- PyTorch
- torchvision
- matplotlib
- numpy

Future Work

- Explore Vision Transformers for embeddings
- Adaptive ArcFace margin strategies
- Domain adaptation for generalization

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