Age and Gender Prediction – Final Model Report

Objective: Predict age (regression) and gender (binary classification) from facial images using deep learning architectures.

Model Comparisons

Model	Epochs	Age Norm	Fine-Tuning	Score	Kagglehub model name
CNN Baseline	10	No	None	0.471	age-gender-cnn
EfficientNet-B0	10	No	Gradual unfreeze	0.589	age-gender-pre-trained-cnn
ConvNextV2-Tiny	5	Yes	Gradual unfreeze	0.608	age-gender-fb-trained-model
ConvNextV2-Tiny	12	Yes	Gradual unfreeze	0.611	age-12gender-con-trained-model
ConvNextV2-Tiny	12	No	Gradual unfreeze	**0.798**	age-12gender_wn-con-trained-model
ResNet-50	10	Yes	Gradual unfreeze	0.594	resnet50-age-gender
ResNet-50	10	No	Frozen backbone	0.575	resnet50-v2age-gender

Scratch CNN Architecture

- Two convolutional layers (`Conv2d → ReLU → BatchNorm2d → MaxPool2d`)
- Flatten → Fully Connected (128 → 64)
- Two output heads (age, gender)
- **Loss:**
  - Age → `MSELoss()` Gender → `BCEWithLogitsLoss()`
- **Optimizer:** Adam (lr = 0.001)
- **Epochs:** 10
- **Score: 0.471**

Key Observations

- Pretrained backbones (EfficientNet, ResNet, ConvNeXt) significantly outperform the CNN baseline.
- Gradual unfreezing and regression target normalization stabilize training and improve performance.
- Surprisingly, ConvNeXt-Tiny without age normalization achieved the highest score (0.798), indicating strong backbone capacity.

Conclusion & Future Work

- ConvNeXt-Tiny is the most effective architecture for age and gender prediction.
- Optimizations like dynamic loss weighting, data augmentation, and hyperparameter tuning could further boost performance.