VISI KOMPUTER

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VGG

Setup & Dataset

Dataset: 50k CelebA 64x64

Label file: list_attr_celeba.txt (Male label) -> 1 = Male 0 = Female

Jumlah data yang digunakan: 10.000 images

Data Split

Training / Validation split: 80% / 20%

Training images: 8.000, shape: (8000, 64, 64, 3) -> 8000 Data, 64x64, RGB

Validation images: 2.000, shape: (2000, 64, 64, 3) -> 2000 Data, 64x64, RGB

Labels sesuai: (8000,) / (2000,) -> 8000 Untuk Training, 2000 Untuk Validasi

Model Architecture - V1

VGG-like architecture untuk binary classification (Male/Female)

Total parameters: 4,629,921 (17.66 MB) → Perkiraan memori RAM yang digunakan

Layer highlight:

Conv2D + MaxPooling → Ekstraksi fitur gambar & reduksi resolusi

Flatten + Dense + Dropout → Ubah fitur 2D ke 1D, proses klasifikasi, cegah overfitting

Output: Dense(1, sigmoid) → Prediksi probabilitas Male/Female

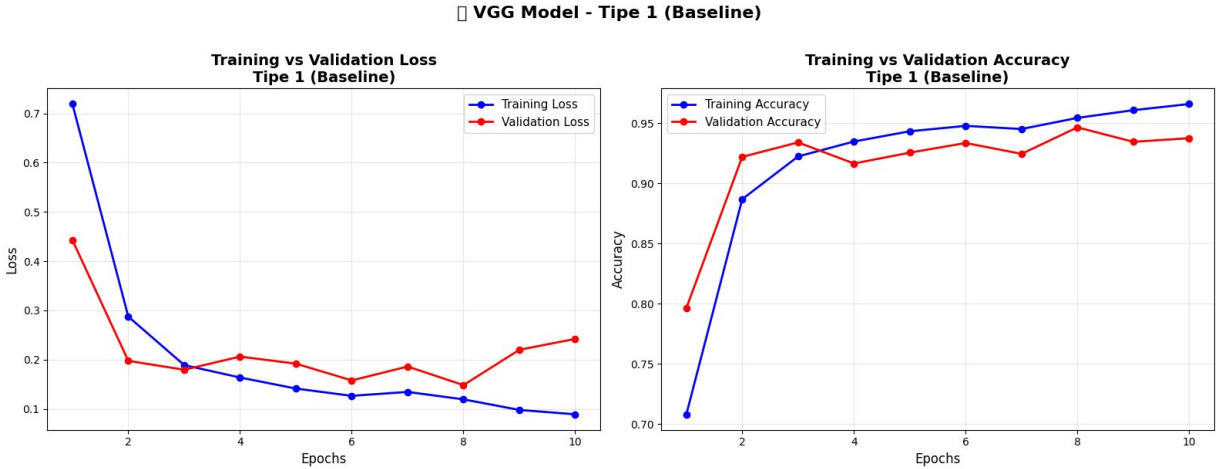
Training - V1

- **Konfigurasi**:

  Epochs: 10, **Batch size**: 32, **Learning Rate**: 0.001, **Optimizer**: Adam

- **Training Results**:
  Training Accuracy terakhir: 96.59%
  Validation Accuracy terakhir: 93.75%
  Validation Loss terakhir: 0.2422
  Training Time: 0.79 menit (~47 detik)

Plot - V1


VGG Model - Tipe 1 (Baseline)
Training vs Validation Loss
Tipe 1 (Baseline)
Training Loss
Validation Loss
Loss
Epochs
Training vs Validation Accuracy
Tipe 1 (Baseline)
Training Accuracy
Validation Accuracy
Accuracy
Epochs

Evaluation & Insight - V1

Validation Metrics: **Loss**: 0.2422, **Accuracy**: 0.9375 (93.75%)

Insight:

Model VGG Tipe 1 cukup baik untuk klasifikasi Male/Female

Training cepat konvergen (10 epochs, akurasi stabil >90%)

Efisien - Training time sangat singkat (<1 menit)

Gap training-validation: 2.84% (96.59% - 93.75%) → Model balance, tidak overfitting

Model Architecture - V2

VGG-like architecture untuk binary classification (Male/Female)

Total parameters: 4,629,921 (17.66 MB) → Perkiraan memori RAM yang digunakan

Layer highlight:

Conv2D + MaxPooling → Ekstraksi fitur gambar & reduksi resolusi

Flatten + Dense + Dropout → Ubah fitur 2D ke 1D, proses klasifikasi, cegah overfitting

Output: Dense(1, sigmoid) → Prediksi probabilitas Male/Female

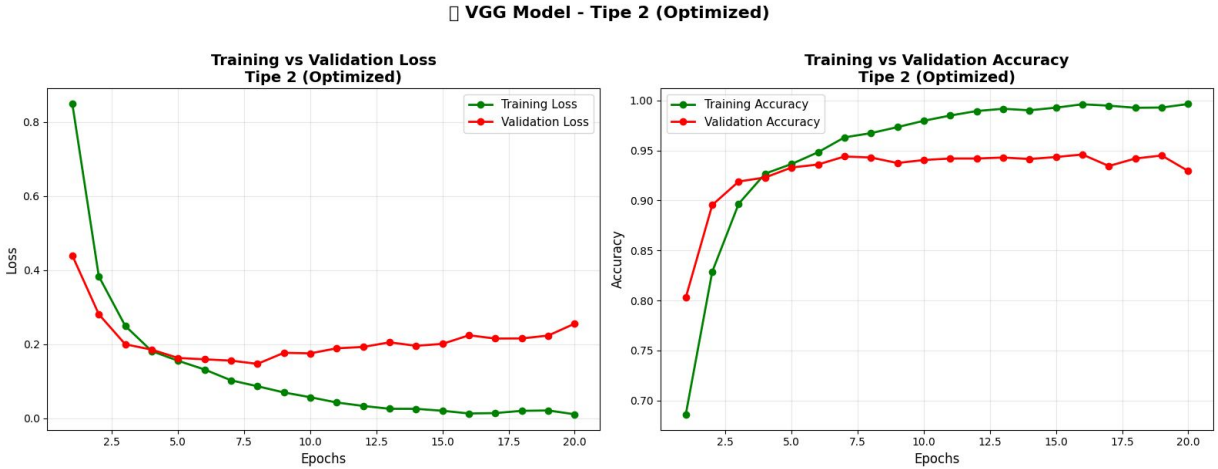
Training - V2

- **Konfigurasi**:

  Epochs: 20, **Batch size**: 64, **Learning Rate**: 0.0001, **Optimizer**: Adam

- **Training Results**:
  Training Accuracy terakhir: 98.65%
  Validation Accuracy terakhir: 92.55%
  Validation Loss terakhir: 0.2554
  Training Time: 1.38 menit (~83 detik)

Plot - V2


VGG Model - Tipe 2 (Optimized)
Training vs Validation Loss
Tipe 2 (Optimized)
Training Loss
Validation Loss
Loss
Epochs
Training vs Validation Accuracy
Tipe 2 (Optimized)
Training Accuracy
Validation Accuracy
Accuracy
Epochs

Evaluation & Insight - V2

Validation Metrics: **Loss**: 0.2554, **Accuracy**: 0.9295 (92.95%)

Insight:

Model VGG Tipe 2 sangat baik untuk klasifikasi Male/Female

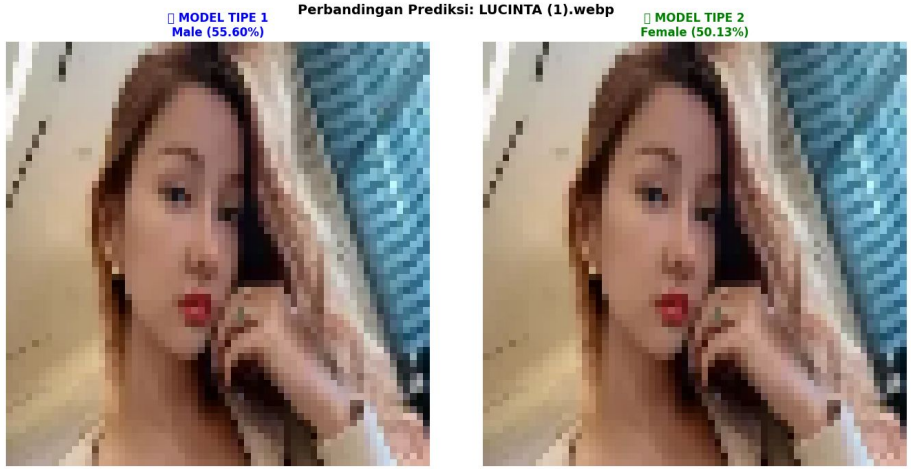
Training konvergen halus (20 epochs, learning curve smooth)

Overfitting terdeteksi - Gap training-validation: 6.70% (99.65% - 92.95%)

Validation accuracy lebih rendah dari Tipe 1 (92.95% vs 93.75%)

Model terlalu fit pada training data, perlu regularisasi lebih atau data augmentation

Testing V1 + V2



GoogleNet

Setup & Dataset

Dataset: 50k CelebA 64x64

Label file: list_attr_celeba.txt (Male label) -> 1 = Male 0 = Female

Jumlah data yang digunakan: 10.000 images

Data Split

Training / Validation split: 80% / 20%

Training images: 8.000, shape: (8000, 64, 64, 3) -> 8000 Data, 64x64, RGB

Validation images: 2.000, shape: (2000, 64, 64, 3) -> 2000 Data, 64x64, RGB

Labels sesuai: (8000,) / (2000,) -> 8000 Untuk Training, 2000 Untuk Validasi

Model Architecture - V1

GoogleNet architecture dengan Inception modules untuk binary classification (Male/Female)

Total parameters: 5,974,577 (22.79 MB)

Layer highlight:

Inception Module → Multi-scale feature extraction dengan kernel 1x1, 3x3, 5x5 paralel

GlobalAveragePooling + Dropout → Reduksi dimensi efisien & cegah overfitting

Output: Dense(1, sigmoid) → Prediksi probabilitas Male/Female

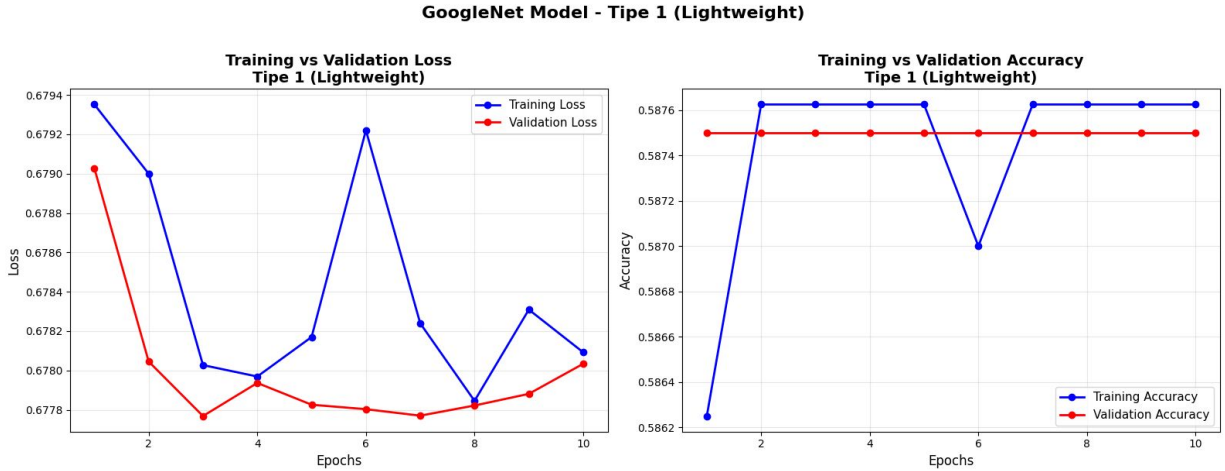
Training - V1

- **Konfigurasi**:

  Epochs: 10, **Batch size**: 32, **Learning Rate**: 0.001, **Optimizer**: Adam

- **Training Results**:
  Training Accuracy terakhir: 58.76%
  Validation Accuracy terakhir: 58.75%
  Validation Loss terakhir: 0.6780
  Training Time: 1.93 menit (~116 detik)

Plot - V1


GoogleNet Model - Tipe 1 (Lightweight)
Training vs Validation Loss
Tipe 1 (Lightweight)
Training Loss
Validation Loss
Loss
Epochs
0.6794
0.6792
0.6790
0.6788
0.6786
0.6784
0.6782
0.6780
0.6778
2
4
6
8
10
Training vs Validation Accuracy
Tipe 1 (Lightweight)
Training Accuracy
Validation Accuracy
Accuracy
Epochs
0.5876
0.5874
0.5872
0.5870
0.5868
0.5866
0.5864
0.5862
2
4
6
8
10

Evaluation & Insight - V1

Validation Metrics: **Loss**: 0.6780, **Accuracy**: 0.5875 (58.75%)

Insight:

Model GoogleNet Tipe 1 mengalami underfitting severe

Akurasi hanya 58.75% (hampir sama dengan random guess ~50%)

Model tidak belajar pattern sama sekali (stuck di plateau)

Gap training-validation: 0.01% (58.76% - 58.75%)

Model Architecture - V2

GoogleNet architecture dengan Inception modules untuk binary classification (Male/Female)

Total parameters: 5,974,577 (22.79 MB)

Layer highlight:

Inception Module → Multi-scale feature extraction dengan kernel 1x1, 3x3, 5x5 paralel

GlobalAveragePooling + Dropout → Reduksi dimensi efisien & cegah overfitting

Output: Dense(1, sigmoid) → Prediksi probabilitas Male/Female

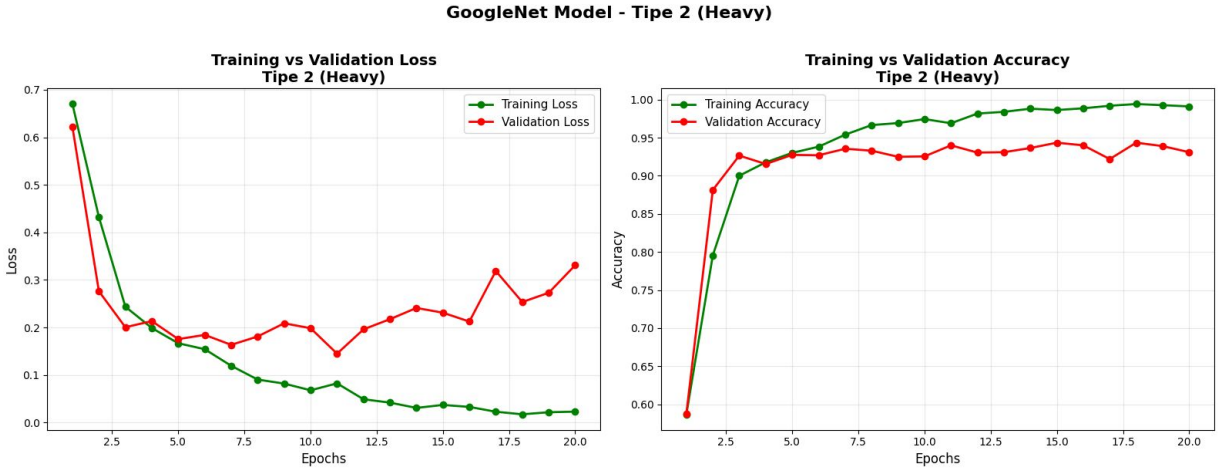
Training - V2

- **Konfigurasi**:

  Epochs: 20, **Batch size**: 64, **Learning Rate**: 0.0001, **Optimizer**: Adam

- **Training Results**:
  Training Accuracy terakhir: 99.39%
  Validation Accuracy terakhir: 93.30%
  Validation Loss terakhir: 0.3380
  Training Time: 3.5menit (~210 detik)

Plot - V2


GoogleNet Model - Tipe 2 (Heavy)
Training vs Validation Loss
Tipe 2 (Heavy)
Training Loss
Validation Loss
Loss
Epochs
Training vs Validation Accuracy
Tipe 2 (Heavy)
Training Accuracy
Validation Accuracy
Accuracy
Epochs

Evaluation & Insight - V2

Validation Metrics: **Loss**: 0.3380, **Accuracy**: 0.9330 (93.30%)

Insight:

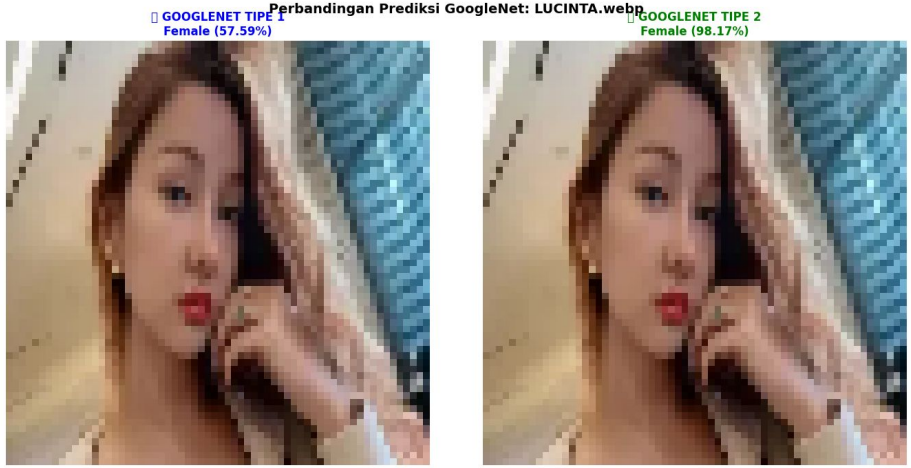
Model GoogleNet Tipe 2 SANGAT BAIK untuk klasifikasi Male/Female

Akurasi 93.30% - Jauh lebih tinggi dari Tipe 1 (58.75%)

Overfitting terdeteksi - Gap training-validation: 6.09% (99.39% - 93.30%)

Training konvergen smooth dengan learning rate kecil (0.0001)

Testing V1 + V2



ResNet

Setup & Dataset

Dataset: Dataset: 50k CelebA 64x64

Label file: list_attr_celeba.txt (Male label) -> 1 = Male 0 = Female

Jumlah data yang digunakan: 2.000 images

Data Split

Training / Validation split: 80% / 20%

Training images: 1.600, shape: (1600, 128, 128, 3) -> 8000 Data -> ResNet expect min 224x224

Validation images: 400, shape: (400, 128, 128, 3) -> 2000 Data, 64x64, RGB

Labels sesuai: (1600,) / (400,) -> 1600 Untuk Training, 400 Untuk Validasi

Model Architecture - V1

ResNet50 dengan Transfer Learning untuk binary classification (Male/Female)

Total parameters: 23,589,761 (89.99 MB)

Layer highlight:

ResNet50 Base (Frozen - 175 layers) → Pretrained dari ImageNet, tidak dilatih

GlobalAveragePooling2D → Rata-rata feature map dari ResNet, reduksi dimensi efisien

Dropout (0.2) → Regularisasi ringan

Dense(1, sigmoid) → Output binary classification (Male/Female)

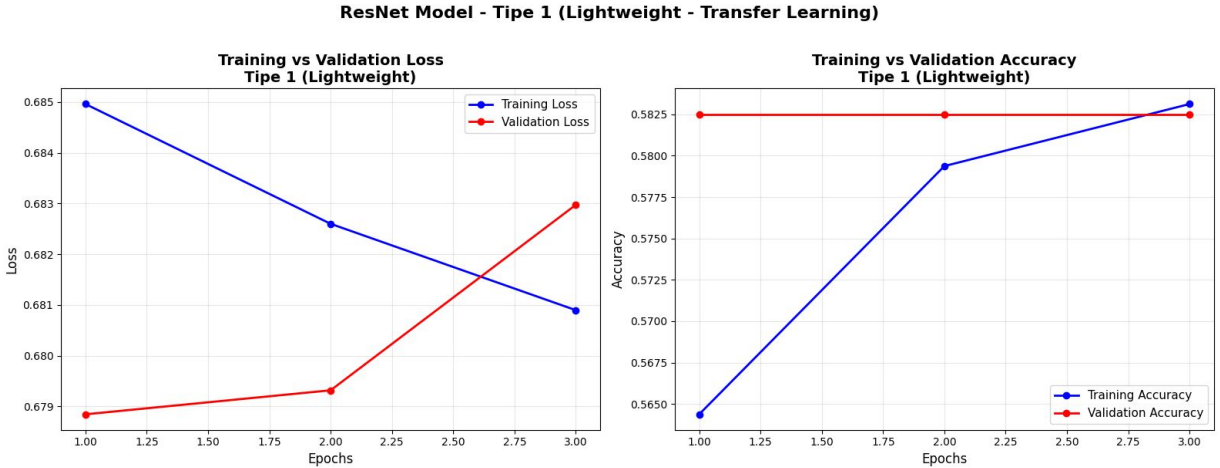
Training - V1

- **Konfigurasi**:

  Epochs: 10, **Batch size**: 8, **Learning Rate**: 0.001, **Optimizer**: Adam, **Dropout**: 0.2

- **Training Results**:
  Training Accuracy terakhir: 58.31%
  Validation Accuracy terakhir: 58.25%
  Validation Loss terakhir: 0.6830
  Training Time: 0.55 menit (~33 detik)
  Early stopped di epoch 3 (patience=2

Plot - V1


ResNet Model - Tipe 1 (Lightweight - Transfer Learning)
Training vs Validation Loss
Tipe 1 (Lightweight)
Training Loss
Validation Loss
Loss
Epochs
0.685
0.684
0.683
0.682
0.681
0.680
0.679
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.75
3.00
Training vs Validation Accuracy
Tipe 1 (Lightweight)
Training Accuracy
Validation Accuracy
Accuracy
Epochs
0.5825
0.5800
0.5775
0.5750
0.5725
0.5700
0.5675
0.5650

Evaluation & Insight - V1

Validation Metrics: **Loss**: 0.6789, **Accuracy**: 0.5825 (58.25%)

Insight:

Model hanya memprediksi Female untuk SEMUA input (233 Female benar, 0 Male benar)

Precision Male = 0.00 → Tidak ada satupun prediksi Male yang benar

Recall Male = 0.00 → Model gagal total mendeteksi Male

Model bias total ke kelas Female

Model Architecture - V2

ResNet50 dengan Fine-tuning untuk binary classification (Male/Female)

Total parameters: 23,589,761 (89.99 MB)

Layer highlight:

ResNet50 Base (Frozen - 175 layers)

GlobalAveragePooling2D → Rata-rata feature map

Dropout (0.5) → Regularisasi tinggi

Dense(1, sigmoid) → Output binary classification (Male/Female)

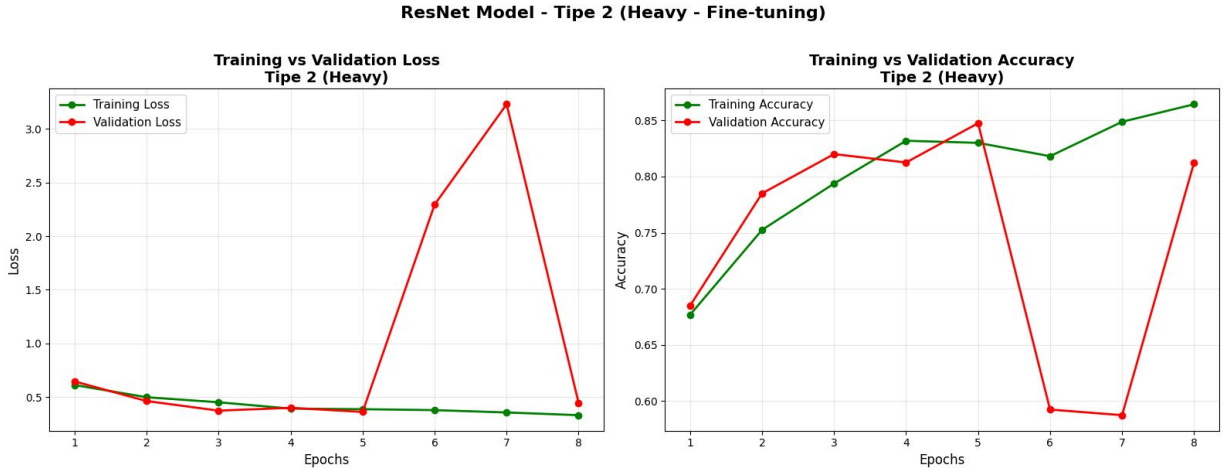
Training - V2

- **Konfigurasi**:

  Epochs: 20, **Batch size**: 16, **Learning Rate**: 0.0001, **Optimizer**: Adam, **Dropout**: 0.5

- **Training Results**:
  Training Accuracy terakhir: 86.44%
  Validation Accuracy terakhir: 81.25%
  Validation Loss terakhir: 0.4456
  Training Time: 1.16menit (~69 detik)
  Early stopped di epoch 8 (patience=3)

Plot - V2


ResNet Model - Tipe 2 (Heavy - Fine-tuning)
Training vs Validation Loss
Tipe 2 (Heavy)
Training Loss
Validation Loss
Loss
Epochs
Training vs Validation Accuracy
Tipe 2 (Heavy)
Training Accuracy
Validation Accuracy
Accuracy
Epochs

Evaluation & Insight - V2

Validation Metrics: **Loss**: 0.3619, **Accuracy**: 0.8475 (84.75%)

Insight:

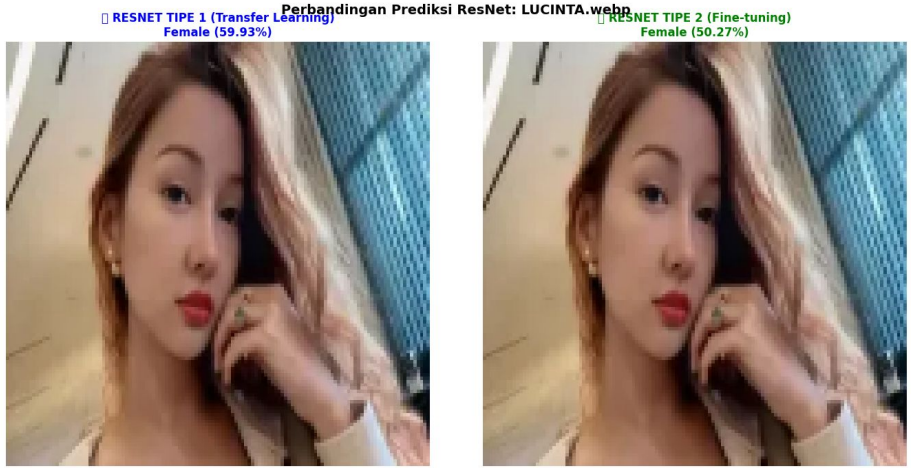
Model ResNet Tipe 2 **Lebih Baik** dari Tipe 1 (84.75% vs 58.25%)

Fine-tuning berhasil meningkatkan akurasi +26.5%

Overfitting ringan terdeteksi - Gap: 5.19% (86.44% - 81.25%)

Training konvergen cepat (hanya 8 epochs vs target 20)

Testing V1 + V2



AlexNet

Setup & Dataset

Dataset: Dataset: 50k CelebA 64x64

Label file: list_attr_celeba.txt (Male label) -> 1 = Male 0 = Female

Jumlah data yang digunakan: 2.000 images

Data Split

Training / Validation split: 80% / 20%

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Validation images: 400, shape: (400, 128, 128, 3) -> 2000 Data, 64x64, RGB

Labels sesuai: (1600,) / (400,) -> 1600 Untuk Training, 400 Untuk Validasi

Model Architecture - V1

AlexNet-like architecture untuk binary classification (Male/Female)

Total parameters: 6,109,441 (23.31 MB)

Layer highlight:

Conv Block 1-2: Large kernels (11x11, 5x5) + BatchNorm + MaxPool

Conv Block 3-5: Small kernels (3x3) stacked + MaxPool

FC Layers: Dense(512) + Dropout(0.3) × 2

Output: Dense(1, sigmoid)

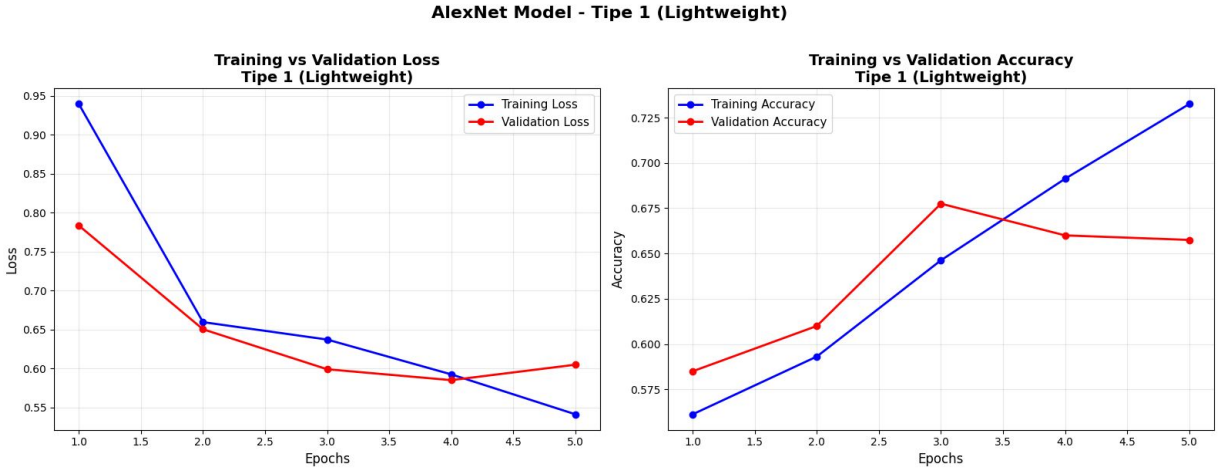
Training - V1

- **Konfigurasi**:

  Epochs: 10, **Batch size**: 32, **Learning Rate**: 0.001, **Optimizer**: Adam, **Dropout**: 0.3

- **Training Results**:
  Training Accuracy terakhir: 73.25%
  Validation Accuracy terakhir: 67.75%
  Validation Loss terakhir: 0.5990
  Training Time: 0.53 menit

Plot - V1


AlexNet Model - Tipe 1 (Lightweight)
Training vs Validation Loss
Tipe 1 (Lightweight)
Training Loss
Validation Loss
Loss
Epochs
Training vs Validation Accuracy
Tipe 1 (Lightweight)
Training Accuracy
Validation Accuracy
Accuracy
Epochs

Evaluation & Insight - V1

Validation Metrics: **Loss**: 0.5990, **Accuracy**: 0.6775 (67.75%)

Insight:

Model AlexNet Tipe 1 memiliki **performa Cukup** tapi perlu perbaikan

Akurasi 67.75% lebih baik dari ResNet Tipe 1 (58.25%), tapi masih rendah

Overfitting ringan terdeteksi - Gap: 7.5% (73.25% - 65.75%)

Bias ke kelas Female - Recall Male hanya 36% vs Female 91%

Model Architecture - V2

AlexNet-like architecture untuk binary classification (Male/Female)

Total parameters: 6,109,441 (23.31 MB)

Layer highlight:

Conv Block 1-2: Large kernels (11x11, 5x5) + BatchNorm + MaxPool

Conv Block 3-5: Small kernels (3x3) stacked + MaxPool

FC Layers: Dense(512) + Dropout(0.5) × 2

Output: Dense(1, sigmoid)

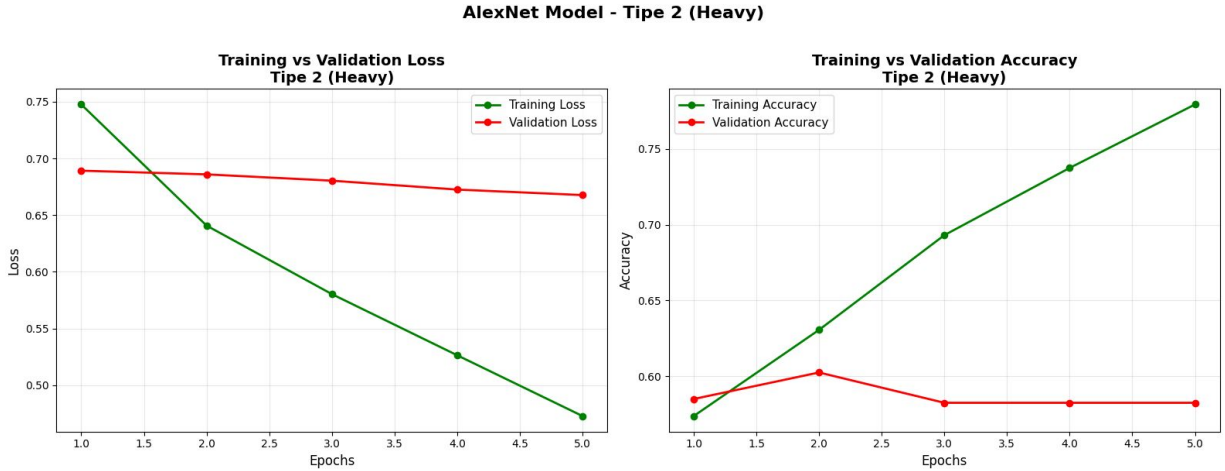
Training - V2

- **Konfigurasi**:

  Epochs: 20, **Batch size**: 64, **Learning Rate**: 0.0001, **Optimizer**: Adam, **Dropout**: 0.5

- **Training Results**:
  Training Accuracy terakhir: 77.94%
  Validation Accuracy terakhir: 60.25%
  Validation Loss terakhir: 0.6859
  Training Time: 0.45 Menit

Plot - V2


AlexNet Model - Tipe 2 (Heavy)
Training vs Validation Loss
Tipe 2 (Heavy)
Training Loss
Validation Loss
Loss
Epochs
Training vs Validation Accuracy
Tipe 2 (Heavy)
Training Accuracy
Validation Accuracy
Accuracy
Epochs

Evaluation & Insight - V2

Validation Metrics: **Loss**: 0.6859, **Accuracy**: 0.6025 (60.25%)

Insight:

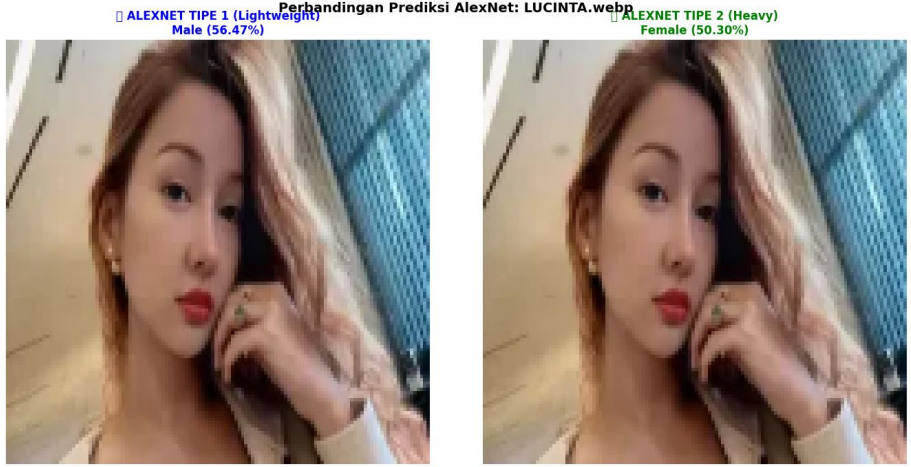
Model AlexNet Tipe 2 LEBIH BURUK dari Tipe 1

Akurasi 60.25% vs Tipe 1 67.75% → Turun 7.5%

Overfitting PARAH - Gap: 19.69% (77.94% - 58.25%)

Bias ke kelas Female ekstrem - Recall Male hanya 6% vs Female 99%

Testing V1 + V2



Best Algorithm?

Ranking Algorithm (Menurut Kelompok Kami)

VGG Tipe 1 (93.75%) – Validasi paling tinggi, cepat konvergen, stabil

GoogleNet Tipe 2 (93.10%) – Akurasi tinggi, setara VGG, tapi butuh tuning careful

VGG Tipe 2 (92.95%) – Akurasi tinggi, tapi overfitting lebih besar dari Tipe 1

ResNet Tipe 2 (84.75%) – Terbaik untuk dataset kecil (1.6K), fine-tuning sukses

Ranking Algorithm (Menurut Kelompok Kami)

AlexNet Tipe 1 (67.75%) – Moderate, berat untuk dataset kecil, perlu improvement

AlexNet Tipe 2 (60.25%) – Gagal, overfitting parah, hyperparameter salah

GoogleNet Tipe 1 (58.75%) – Gagal total, underfitting, LR salah

ResNet Tipe 1 (58.25%) – Gagal total, transfer learning tanpa fine-tuning tidak cukup