Face Mask Detection

Group Members:-

Dhrumil Buch

Sharad Parmar

Jani Miya Shaik

Dipsy

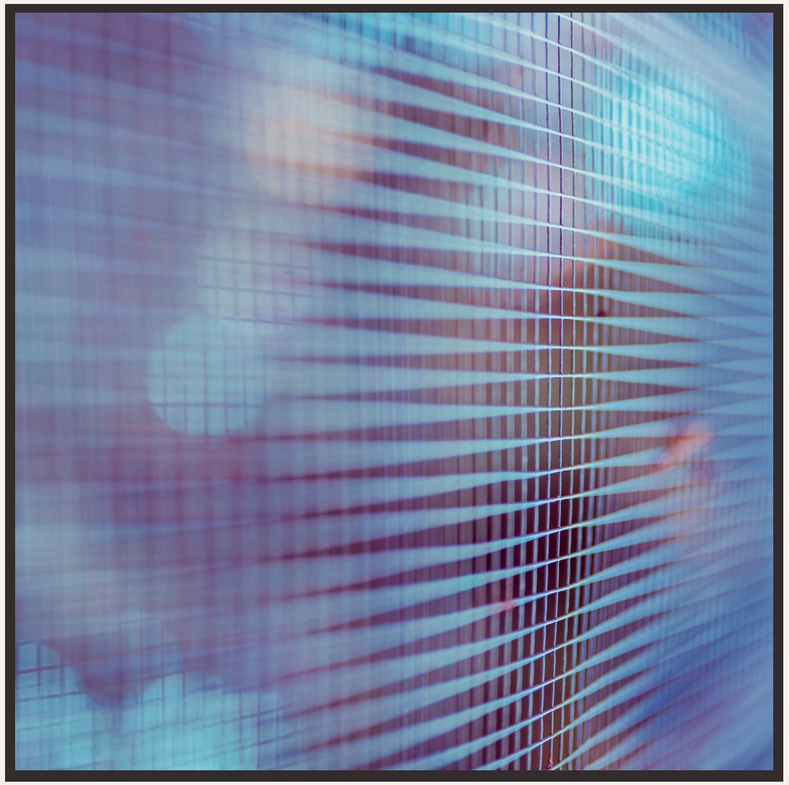
Aditya Desale

The Problem

- During the COVID-19 pandemic, non-compliance with mask mandates in public spaces posed significant health risks.
- Manual monitoring proved to be error-prone and inefficient.
- This created a demand for automated and scalable solutions to improve compliance and reduce transmission.

The Vision

- Develop a deep learning-based real-time mask detection system using advanced models.
- Ensure accurate classification of individuals into "with_mask" or "without_mask" categories.
- Support efforts to reduce viral transmission and enhance public health monitoring.



About the Dataset

Dataset Source:
The dataset consists of 7553 images collected from two sources:
1776 images from Prajna Bhandary's GitHub repository.
5777 images from Google search engine results.

Dataset Structure:
3725 images of faces with masks.
3828 images of faces without masks.

Image Details: The images are in RGB format with three color channels.

Dataset Size: The total dataset size is 171 MB, divided into two labeled folders (with_mask and without_mask).

Dataset Link:
https://www.kaggle.com/datasets/omkargurav/face-mask-dataset

Methodology

Step 1: Data Acquisition & Preprocessing

- Normalization and resizing (224x224 pixels).
- Data augmentation to improve generalization (rotation, scaling, flipping).

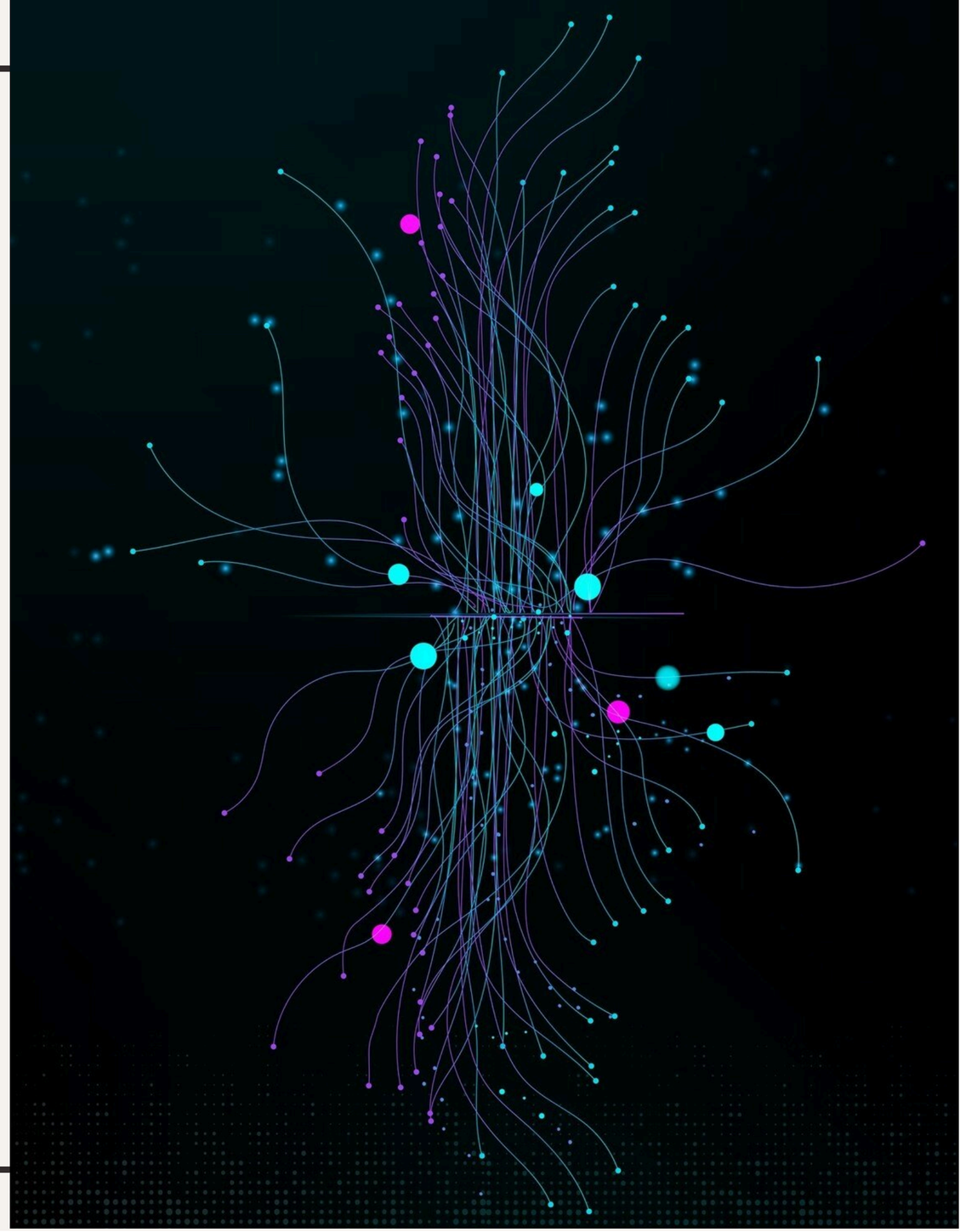
Step 2: Model Development & Training

Models Used:

Baseline CNN: Custom Convolutional Neural Network.

Pre-trained Models:

- ResNet152V2: Deep residual network for feature extraction.
- InceptionV3: Optimized for computational efficiency and accuracy.
- MobileNetV2: Lightweight architecture suitable for edge and mobile applications.

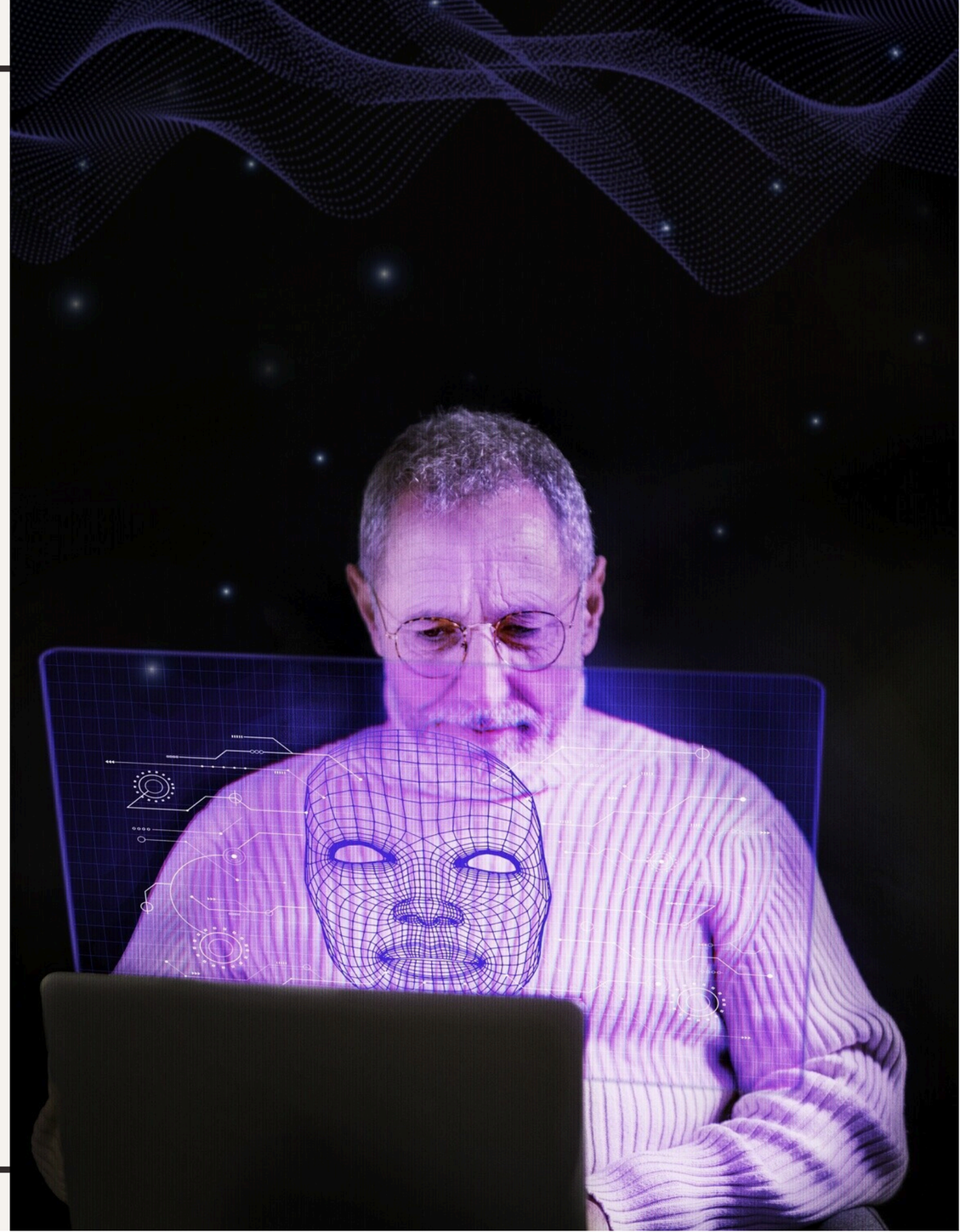


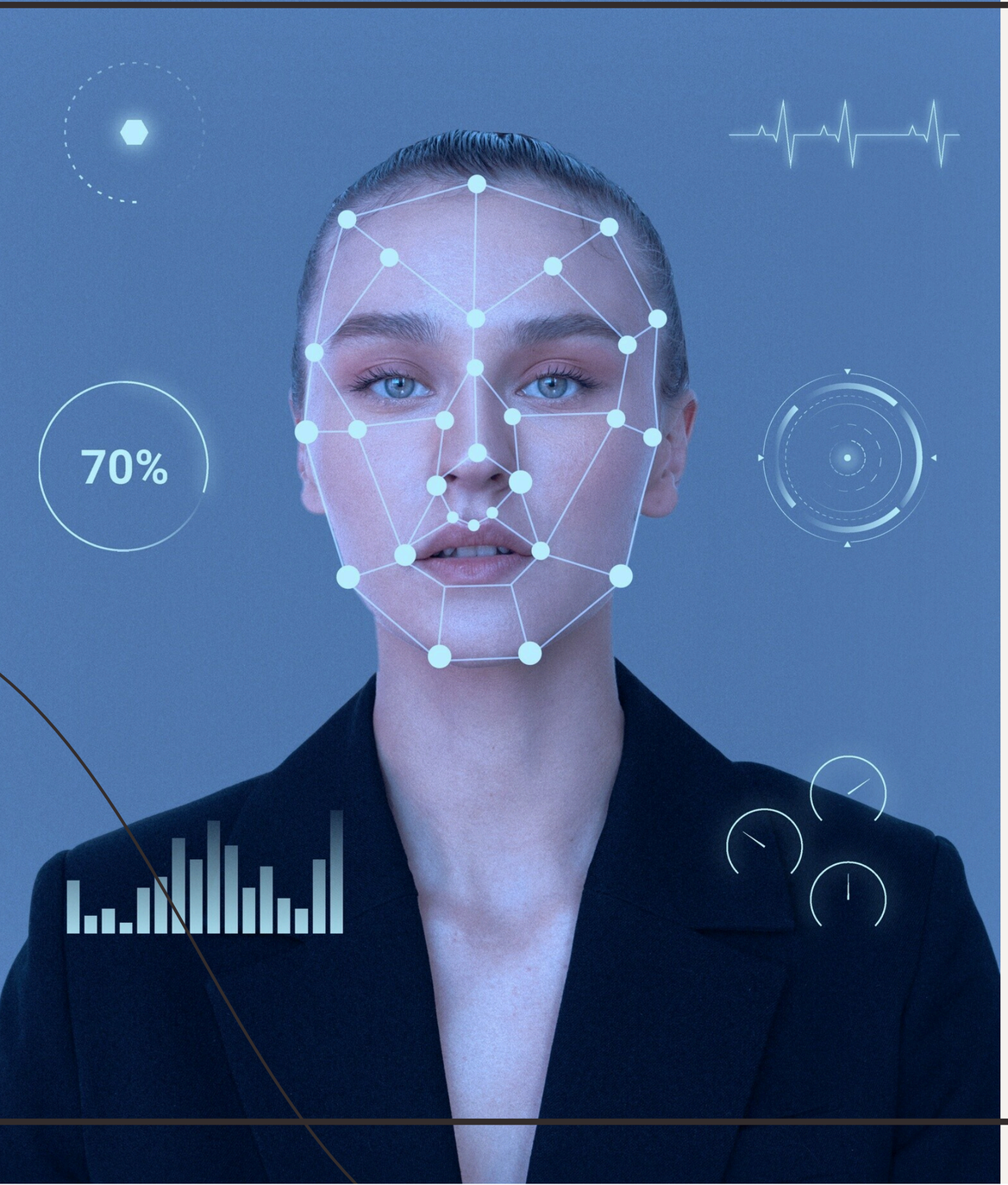
Custom Classification Layer

- Added dense layers with activation functions tailored for binary classification (with_mask vs without_mask).
- Applied Global Average Pooling to reduce spatial dimensions.
- Included Dropout Regularization (0.3) to prevent overfitting.

Training Details

- Optimizer: Adam with learning rate 0.001.
- Loss Function: Sparse Categorical Cross entropy.
- Metrics: Accuracy.
- Early Stopping: Monitored validation loss with a patience of 2 epochs.





Step 3: Model Evaluation & Comparison

Evaluation Metrics:

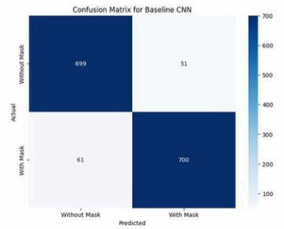
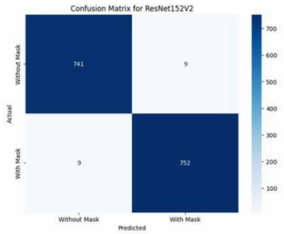
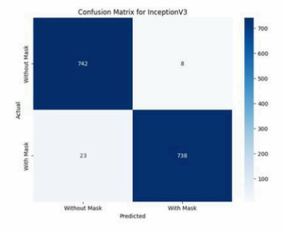
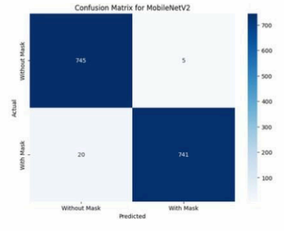
Test Accuracy: Measure of how well the model generalizes on unseen data.

Confusion Matrix: Shows performance across categories (true positives, false positives, etc.)

Model Performance:

Best Model: ResNet152V2with the highest test accuracy of 99%.

Model Comparison:

Model	Test Accuracy	Confusion Matrix
Baseline CNN	93%	
ResNet152V2	99%	
InceptionV3	98%	
MobileNetV2	98%	

Baseline CNN:

- Test Accuracy: 93%
- Final Epoch Accuracy: 98.32%
- Test Loss: 0.1941

ResNet152V2:

- Test Accuracy: 99%
- Final Epoch Accuracy: 99.70%
- Test Loss: 0.0558

InceptionV3:

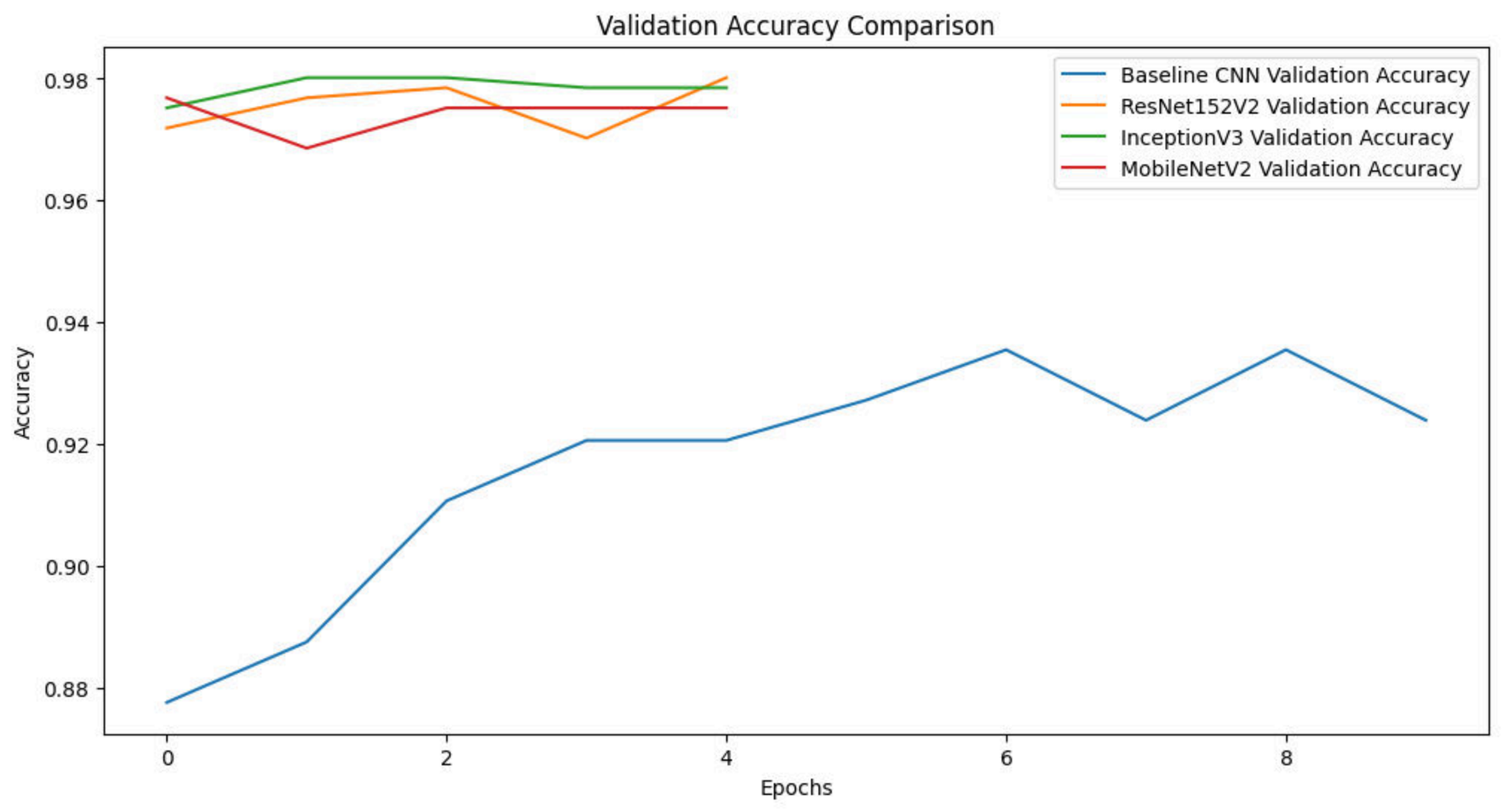
- Test Accuracy: 98%
- Final Epoch Accuracy: 99.17%
- Test Loss: 0.0671

MobileNetV2:

- Test Accuracy: 98%
- Final Epoch Accuracy: 99.58%
- Test Loss: 0.0649

Validation Accuracy Comparison

Best Model:
ResNet152V2 with
Accuracy: 0.99



Key Findings & Future Work

Results:

- ResNet152V2 is the most accurate model for mask detection, outperforming other models.

Next Steps:

- Deploy the model for real-time mask detection in video feeds.
- Explore further improvements with fine-tuning and additional data augmentation techniques.
- Integrate the model into an app or website for public use.

Thanks!

Do you have any questions?