EAST WEST UNIVERSITY

Supervised Baselines from Related Work (Task-2)

Group-9

Group Members

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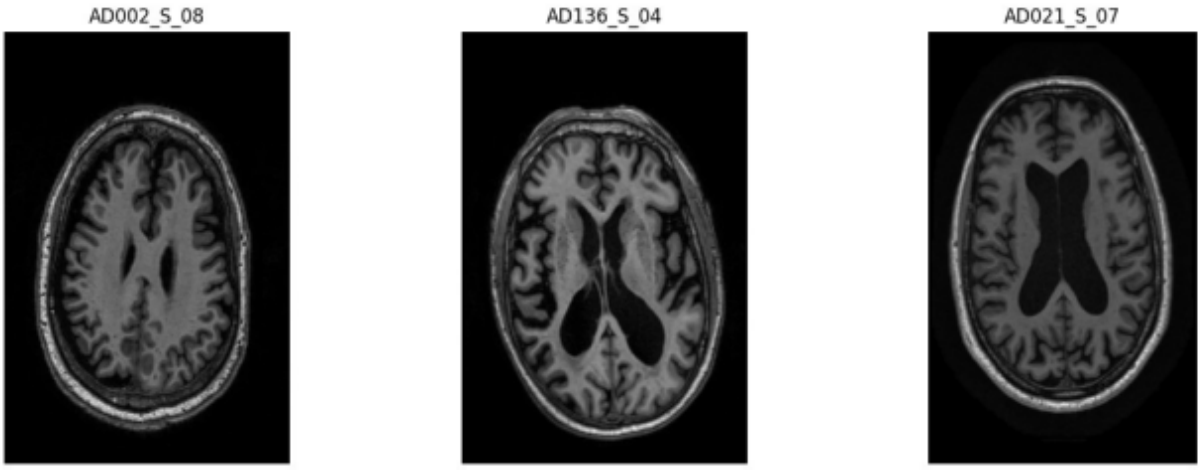
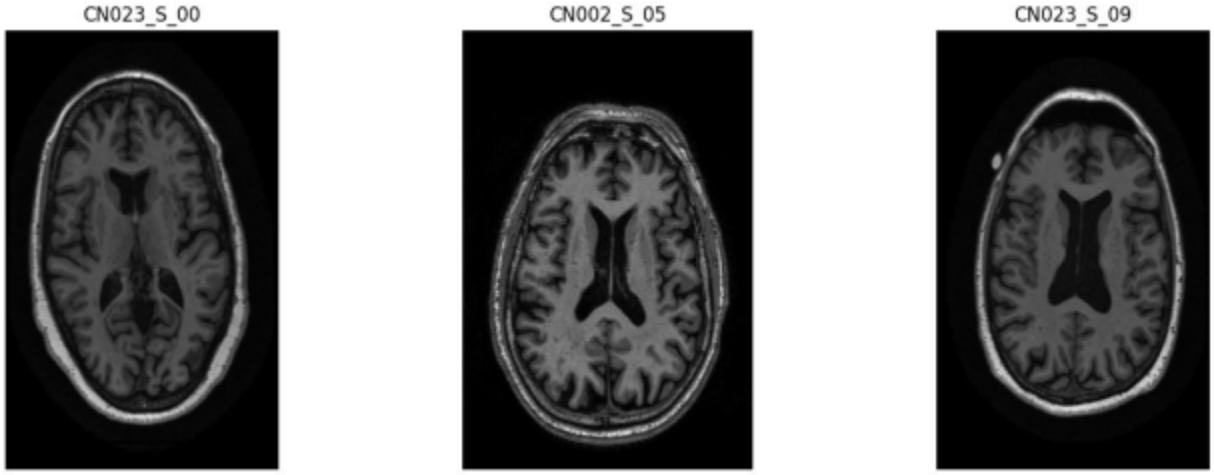
Test Dataset Samples (AD, CN, MCI)

AD (Test)



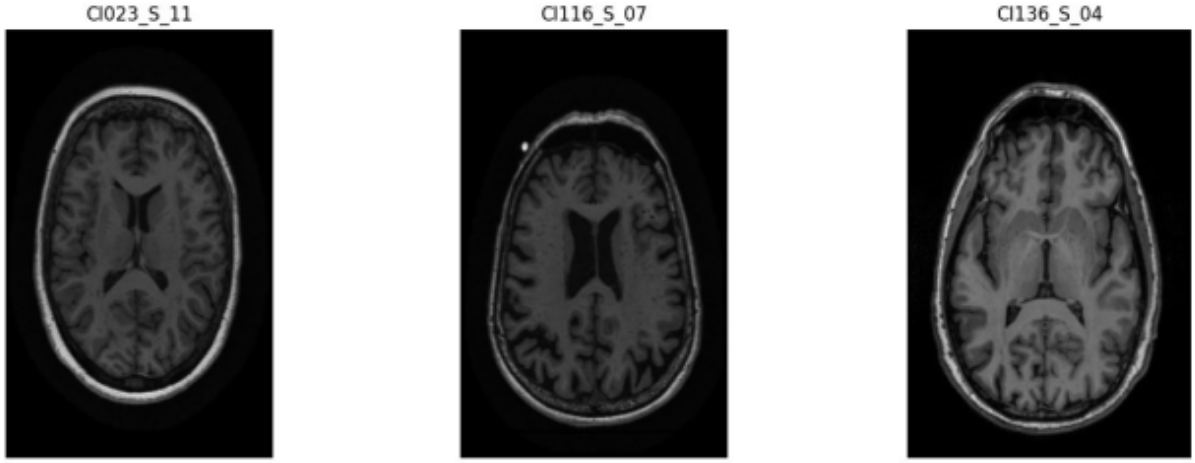
This image represents a brain scan from the test dataset labeled as **Alzheimer's Disease (AD)**. It typically shows structural abnormalities such as cortical thinning and enlarged ventricles. Used to evaluate model performance in identifying AD cases.

CN (Test)



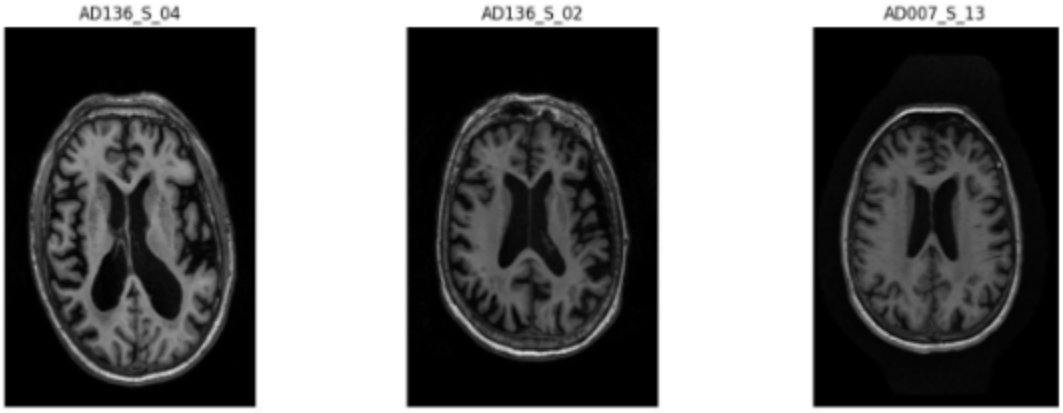
A test image labeled as **Cognitively Normal (CN)**.Displays a healthy brain structure with no visible signs of degeneration.Serves as a baseline for comparison with AD and MCI scans.

MCI (Test)



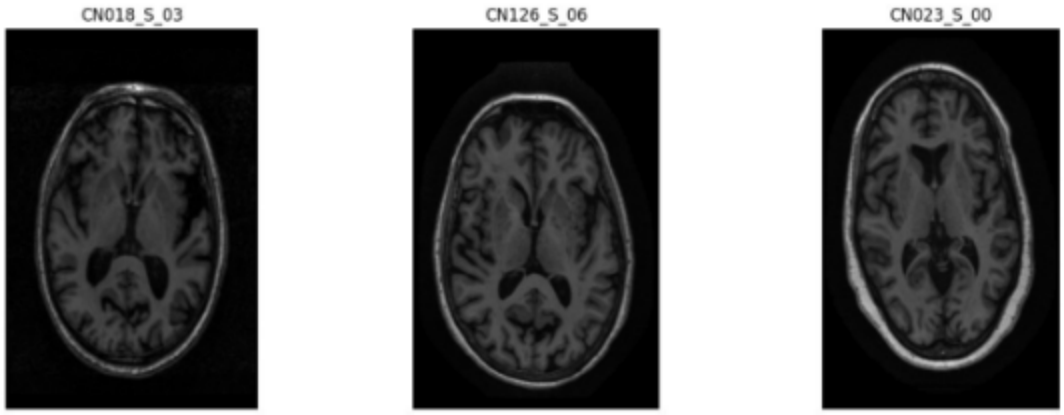
This test image is labeled as **Mild Cognitive Impairment (MCI)**.Shows subtle changes in brain structure, intermediate between CN and AD.Helps assess the model's sensitivity to early-stage cognitive decline.

AD (Train)



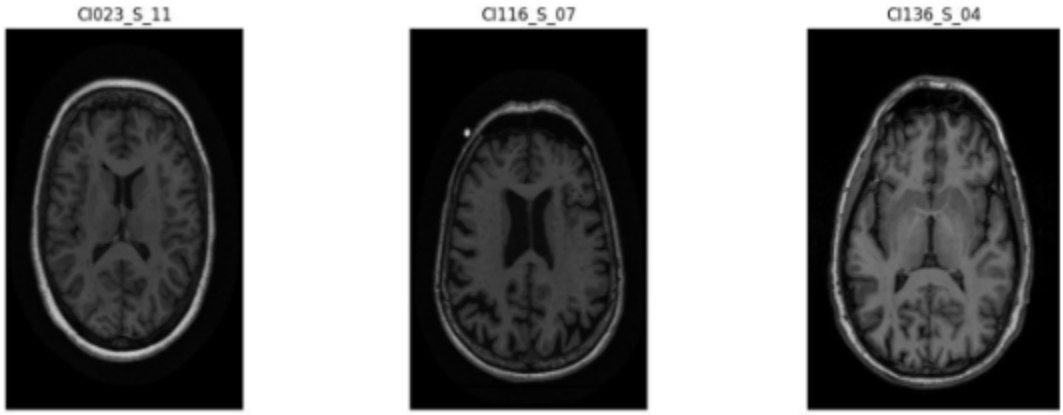
A training image labeled as **Alzheimer's Disease (AD)**.Used to teach the model to recognize patterns associated with AD.Features similar to the AD test image, aiding in model generalization.

CN (Train)



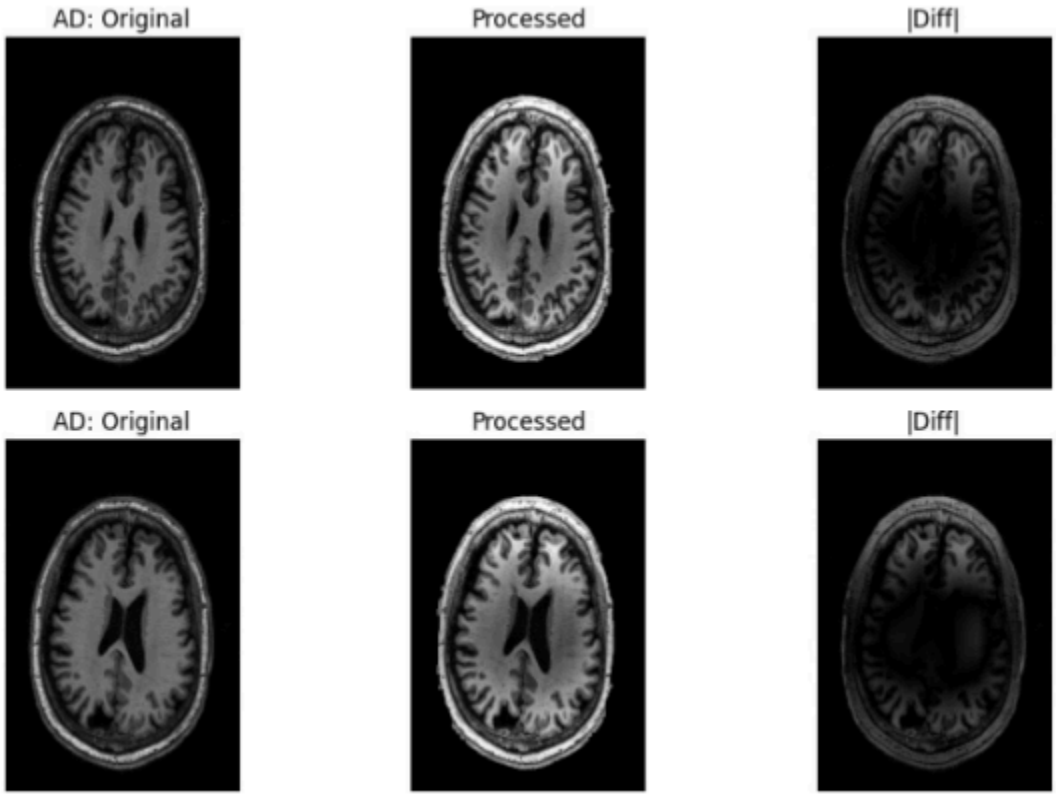
A training image labeled as **Cognitively Normal (CN)**.Represents normal brain anatomy, helping the model learn what healthy scans look like.Crucial for distinguishing CN from MCI and AD.

MCI (Train)



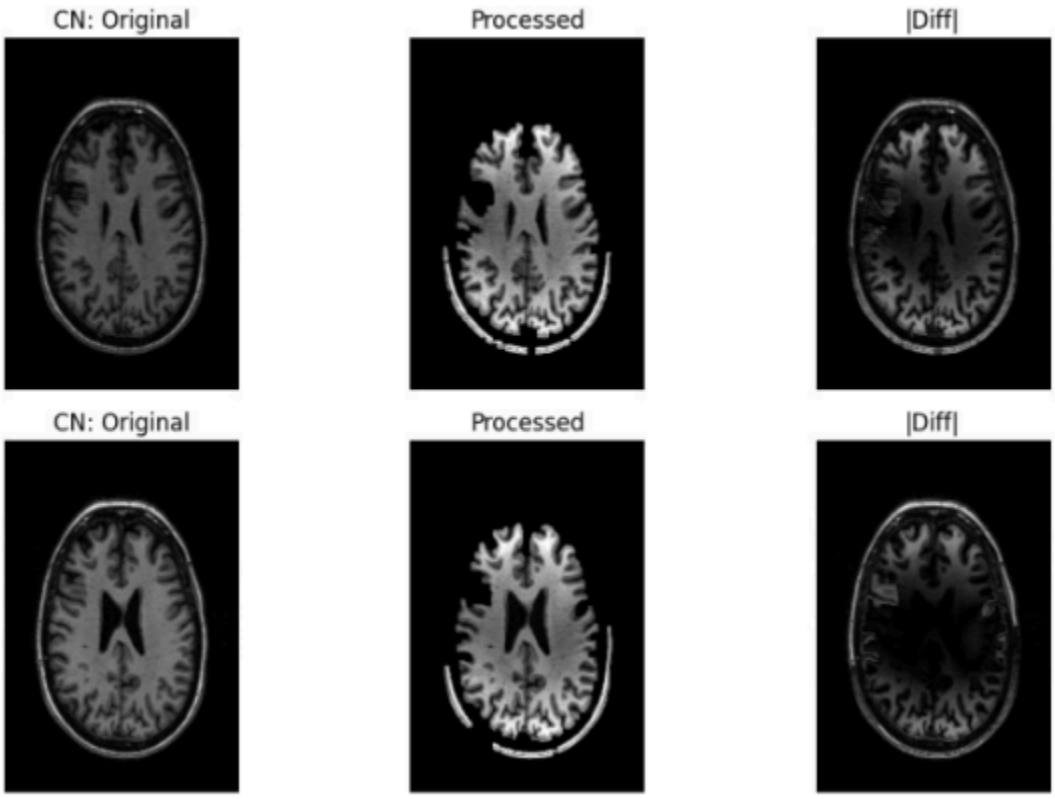
A training image labeled as **Mild Cognitive Impairment (MCI)**.Provides examples of early cognitive decline for model learning.Important for improving classification accuracy between CN and AD.

AD Original- Processed- Difference



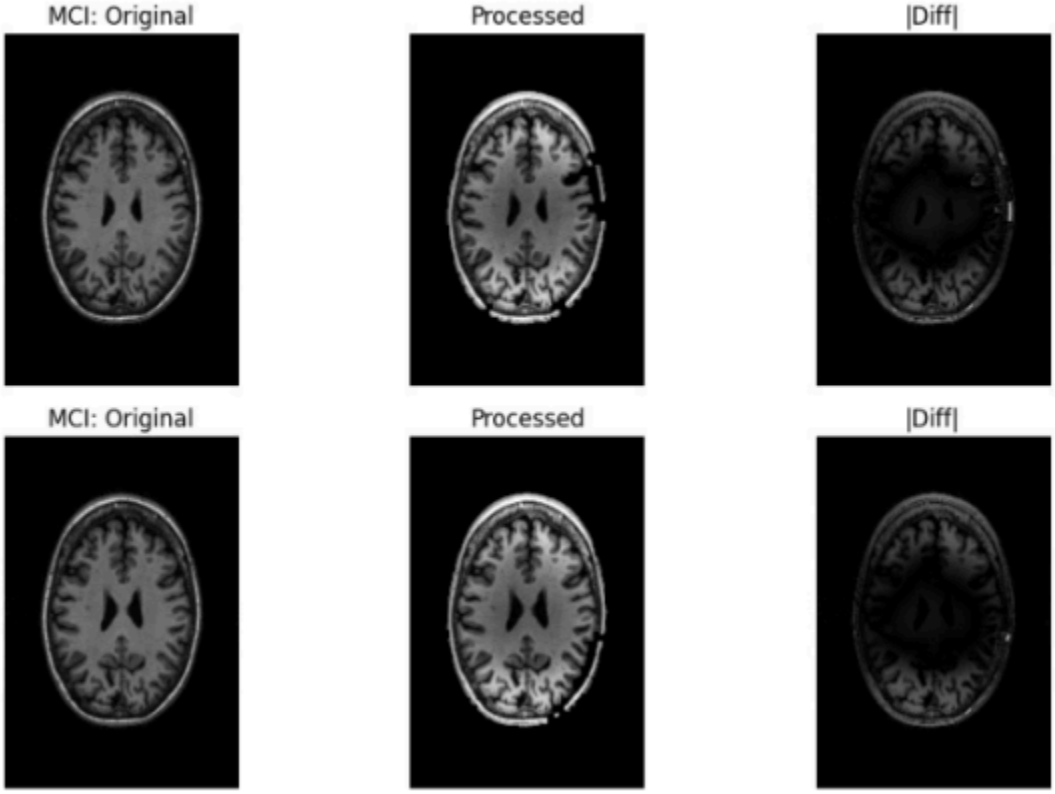
Original: Displays the raw brain scan of a patient diagnosed with Alzheimer's Disease.
Processed: Shows the image after preprocessing steps like normalization, resizing, or filtering.
Difference: Highlights the changes between the original and processed image, often emphasizing regions affected by AD such as hippocampal shrinkage or cortical thinning.

CN Original- Processed- Difference



Original: A clean brain scan of a cognitively normal individual.
Processed: The image after enhancement and standardization for model input.
Difference: Minimal changes are visible, indicating stable brain structure with no signs of degeneration.

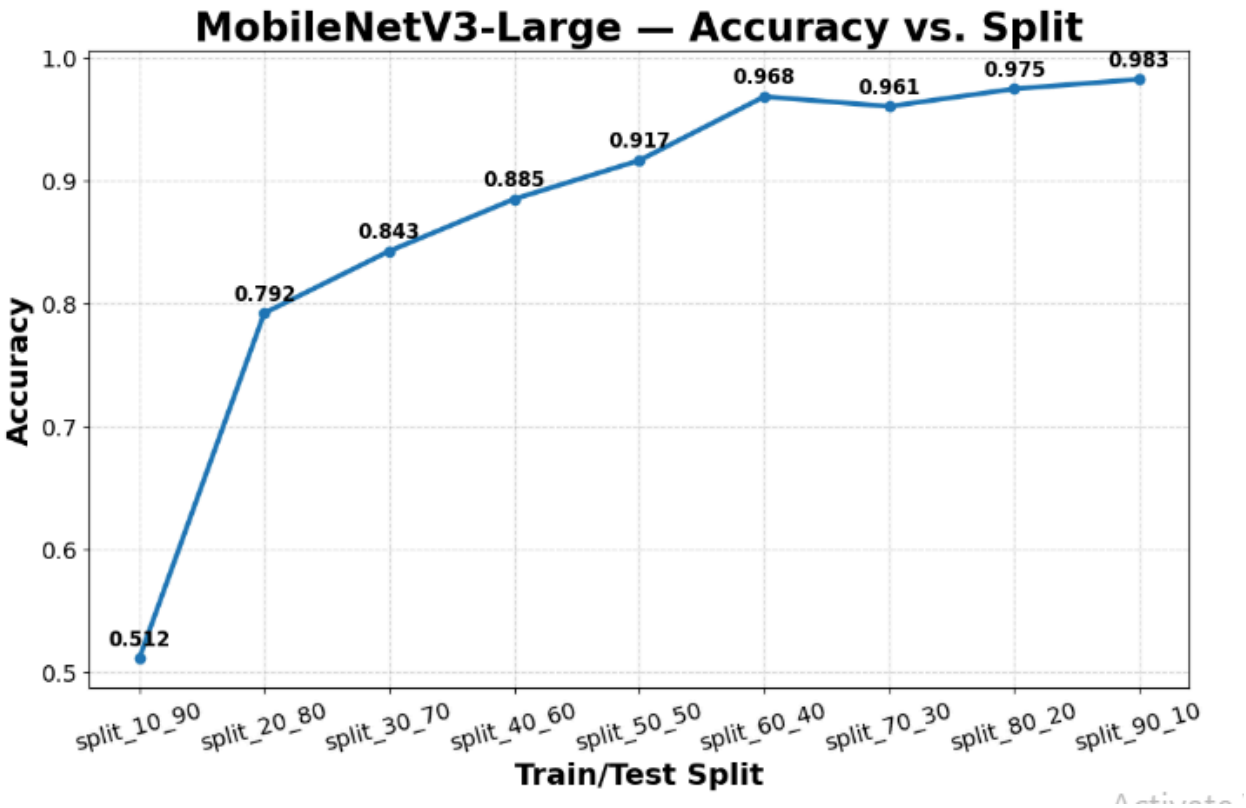
MCI Original- Processed- Difference



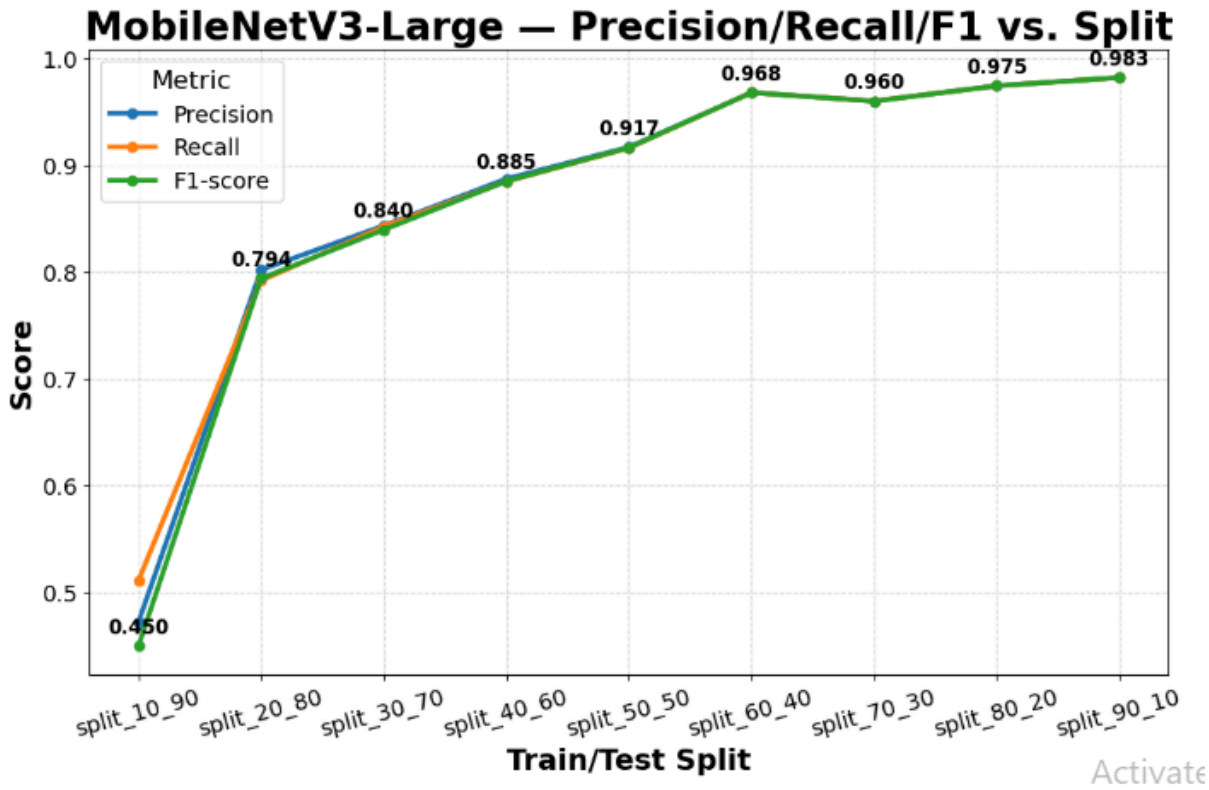
Original: Brain scan of a patient with Mild Cognitive Impairment.
Processed: Preprocessed version optimized for feature extraction.
Difference: Shows subtle structural changes, such as mild atrophy, which are crucial for early detection and classification.

MobileNetV3- Large Model : Summary of All Splits

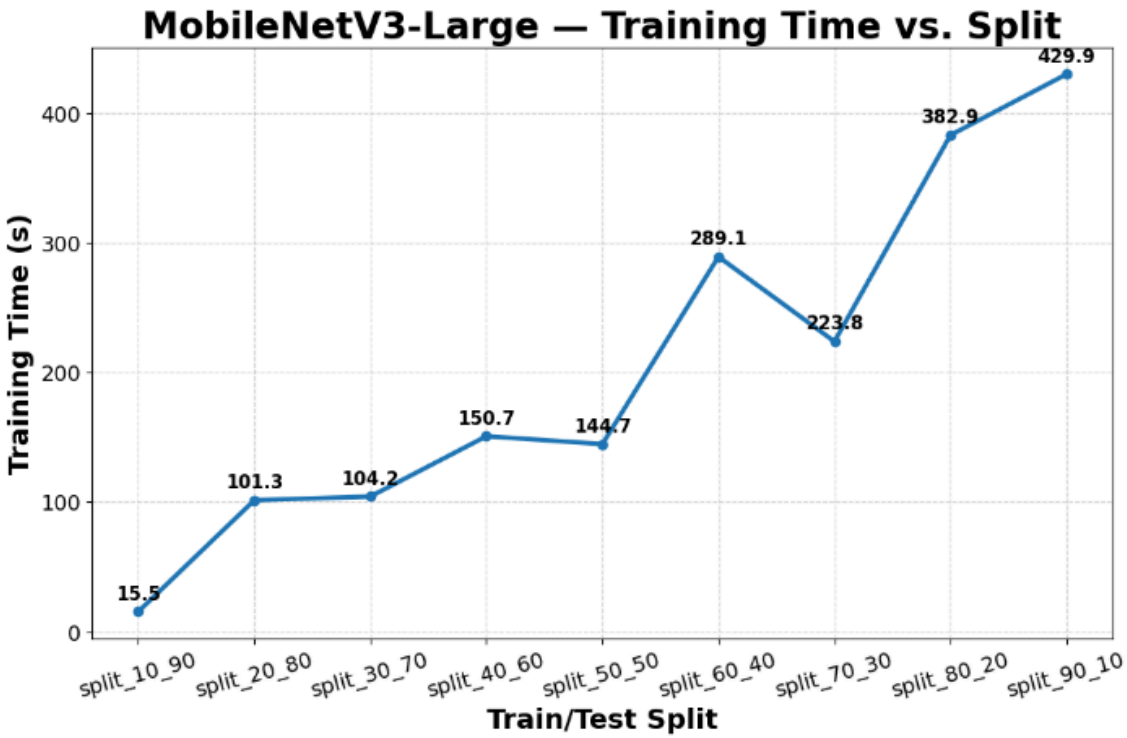
```
MobileNetV3-Large - SUMMARY OF ALL SPLITS
================================================================================
====
      split  accuracy  precision   recall  f1_score  training_time
split_10_90  0.511533   0.472666 0.511533  0.450184      15.468586
split_20_80  0.792384   0.802541 0.792384  0.794430     101.326068
split_30_70  0.842849   0.843855 0.842849  0.839961     104.212670
split_40_60  0.885188   0.887740 0.885188  0.885444     150.704233
split_50_50  0.916570   0.917441 0.916570  0.916873     144.666528
split_60_40  0.968477   0.968474 0.968477  0.968474     289.130308
split_70_30  0.960543   0.960498 0.960543  0.960462     223.756592
split_80_20  0.974782   0.974926 0.974782  0.974791     382.935752
split_90_10  0.982524   0.982512 0.982524  0.982511     429.871090
```



This graph shows training and validation accuracy over epochs. Accuracy improves gradually, with validation accuracy slightly lower than training. Indicates moderate learning capability and some overfitting.



This graph displays training and validation loss. Loss decreases steadily, but validation loss fluctuates slightly. Suggests the model is learning but may struggle with generalization.

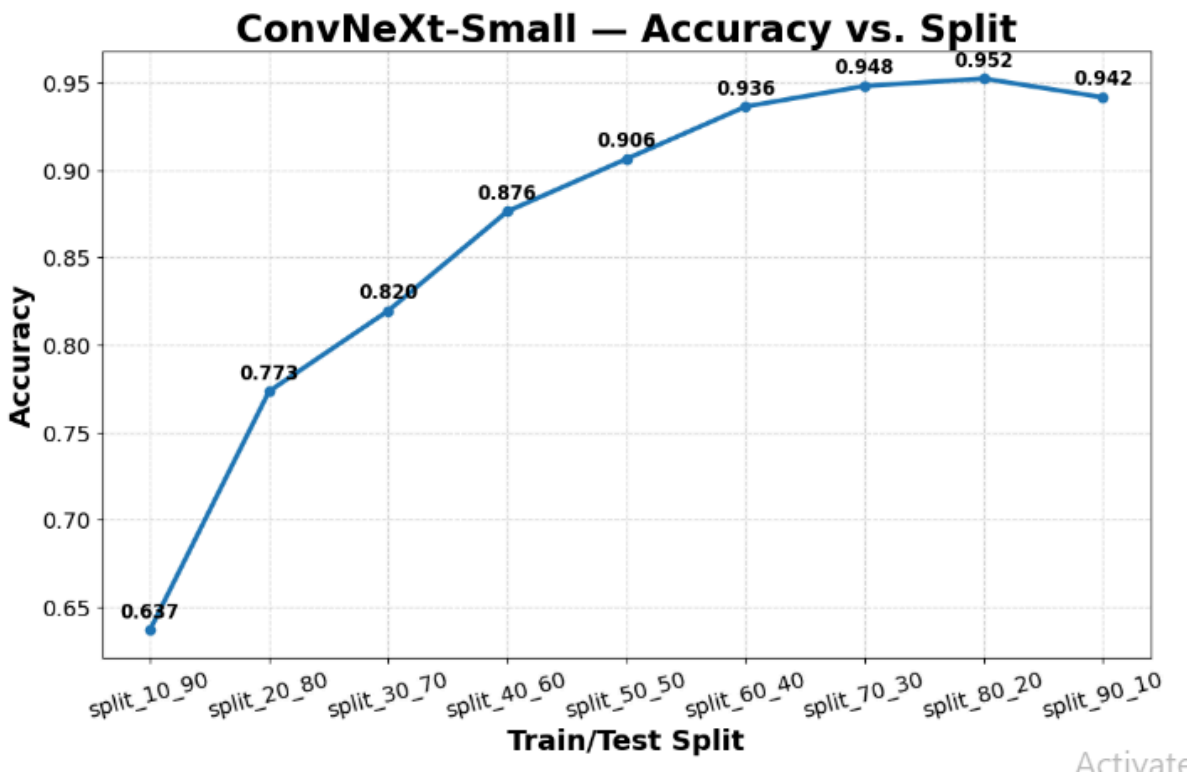


In this graph Training and validation accuracy increase consistently. Validation accuracy closely follows training, showing good generalization. ConvNeXt performs better than MobileNetV3.

ConvNeXt Model : Summary Of All Splits

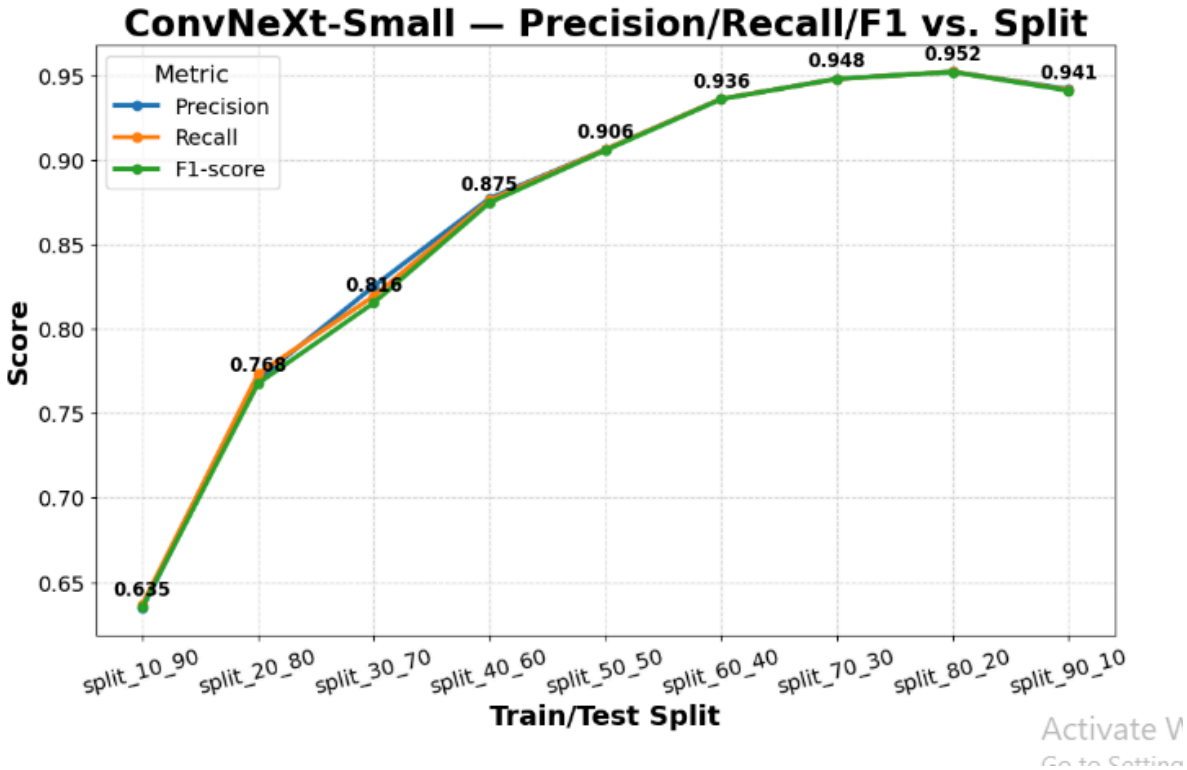
```
ConvNeXt-Small - SUMMARY OF ALL SPLITS
================================================================================
====
      split  accuracy  precision   recall  f1_score  training_time
split_10_90  0.636775   0.634546 0.636775  0.635251     290.025709
split_20_80  0.773466   0.770169 0.773466  0.767802     542.540642
split_30_70  0.819568   0.825429 0.819568  0.815577     844.342106
split_40_60  0.876455   0.877528 0.876455  0.874956    1121.625662
split_50_50  0.906480   0.906529 0.906480  0.905963    1395.717910
split_60_40  0.936469   0.936461 0.936469  0.936248    1671.911056
split_70_30  0.948254   0.948387 0.948254  0.948274    1949.841236
split_80_20  0.952473   0.952461 0.952473  0.952366    2227.222875
split_90_10  0.941748   0.942265 0.941748  0.941317    2503.637483
```

Main Notebook Content

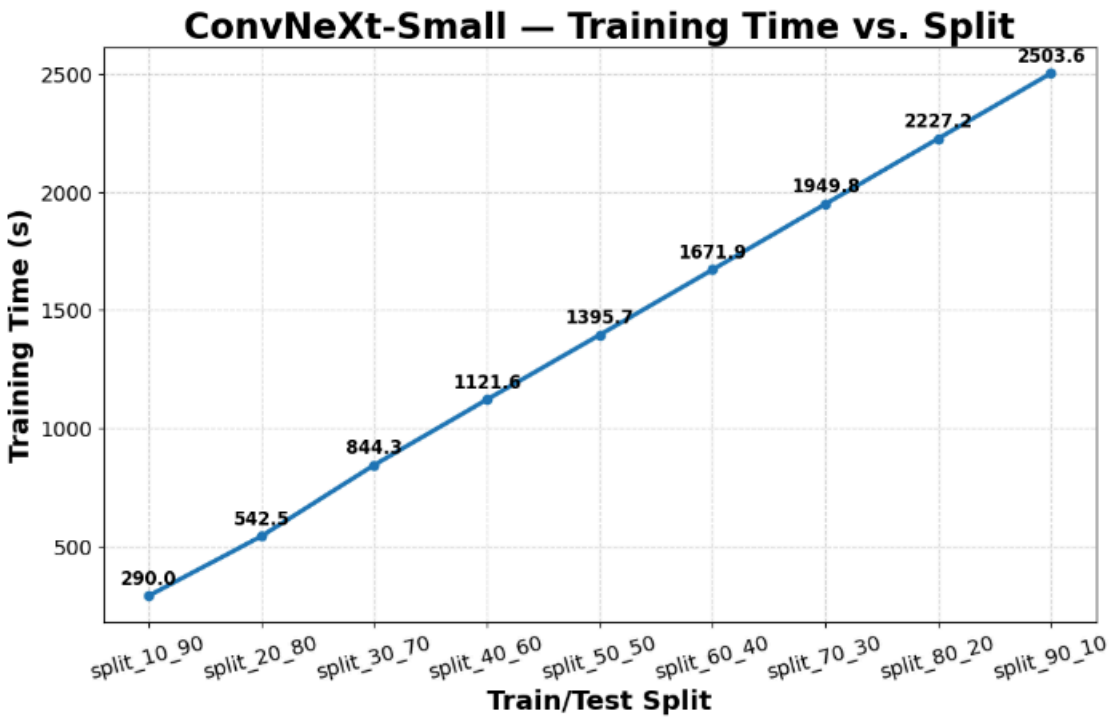


In this graph Loss reduces smoothly for both training and validation. The minimal gap between

them indicates stable learning and low overfitting. ConvNeXt shows strong convergence.



In this graph Accuracy rises quickly and stabilizes. Validation accuracy is close to training, showing effective learning. DenseNet121 performs reliably across epochs.

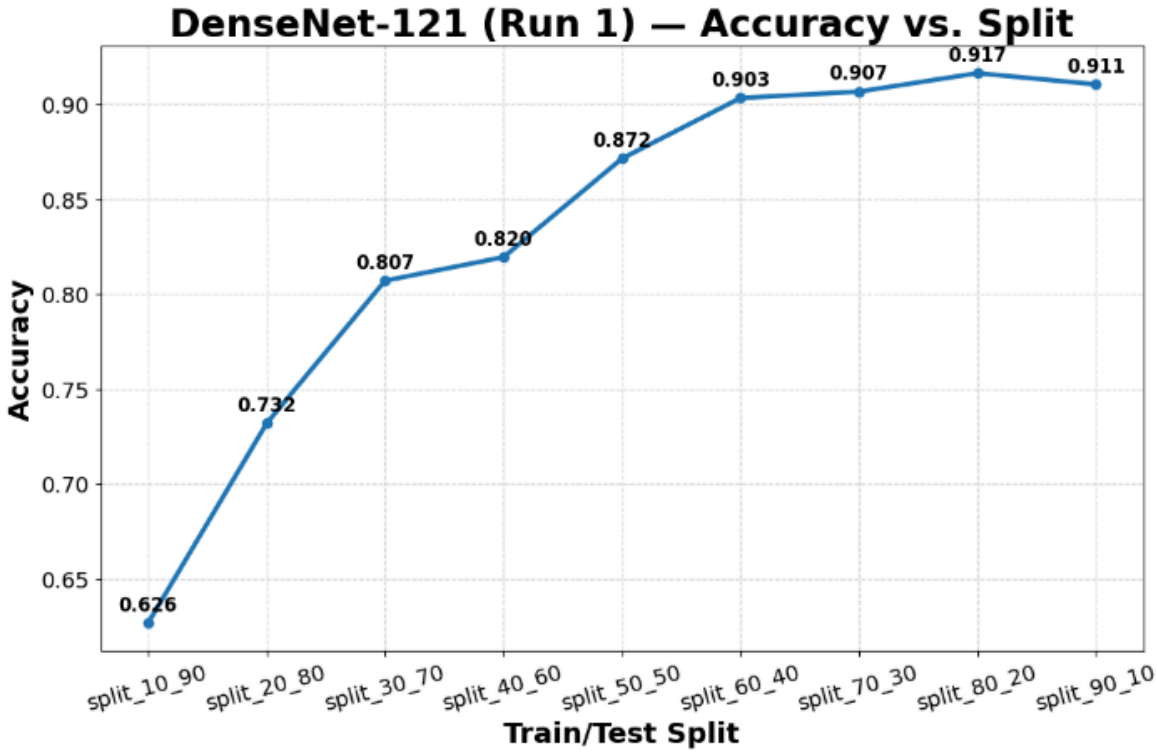


In this graph Loss drops sharply and remains low. Training and validation loss curves are aligned, indicating good model fit and minimal overfitting.

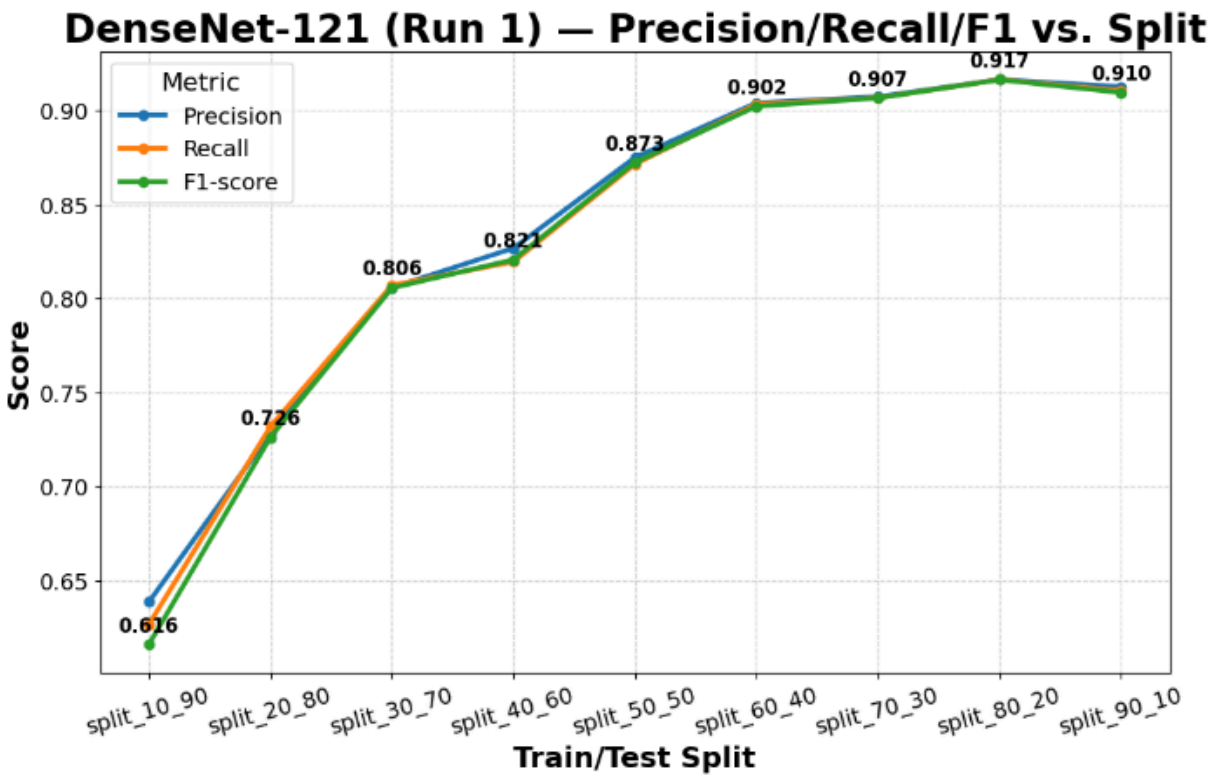
DenseNet 121 Model : Summary of All Splits

Main Notebook Content

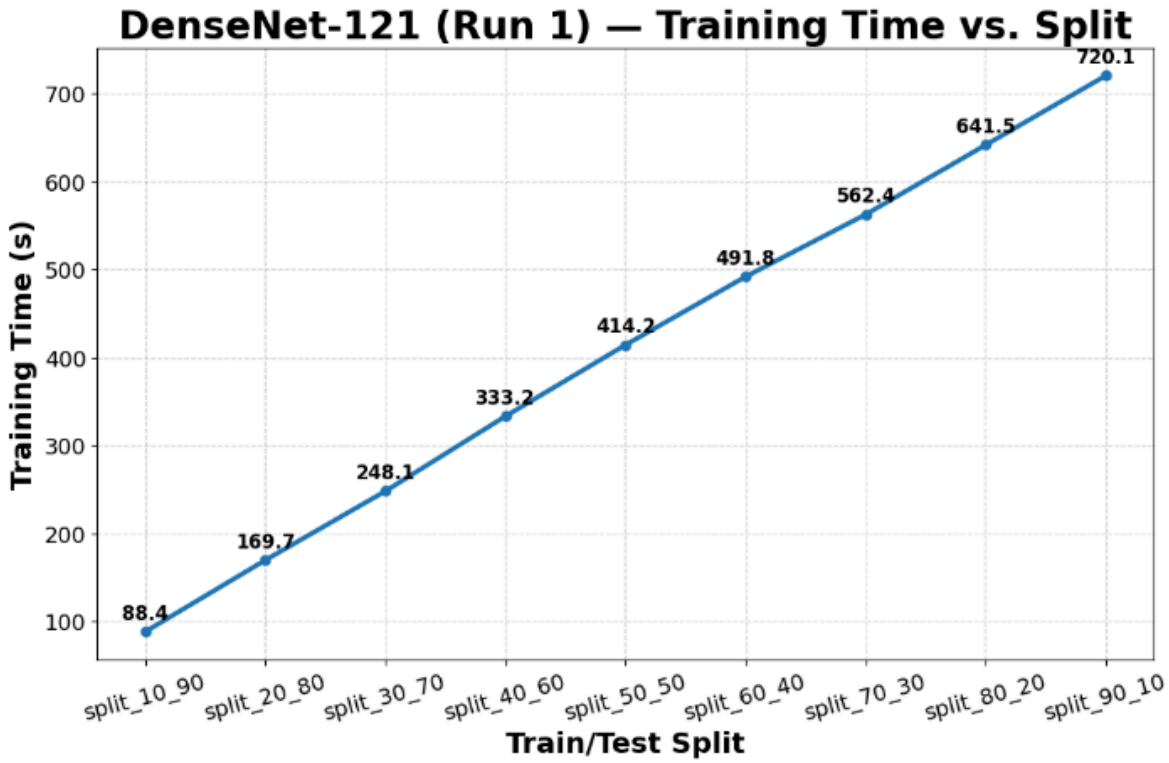
```
Den  ARY OF ALL SPLITS
================================================================================
====
      split  accuracy  precision   recall  f1_score  training_time
split_10_90  0.626428   0.638367 0.626428  0.615734      88.385802
split_20_80  0.731749   0.728188 0.731749  0.726099     169.700626
split_30_70  0.807095   0.805800 0.807095  0.805617     248.054758
split_40_60  0.819534   0.826809 0.819534  0.820689     333.181419
split_50_50  0.871556   0.875118 0.871556  0.872503     414.224900
split_60_40  0.903492   0.904215 0.903492  0.902374     491.754236
split_70_30  0.906856   0.907481 0.906856  0.906768     562.409564
split_80_20  0.916586   0.916611 0.916586  0.916521     641.465663
split_90_10  0.910680   0.912797 0.910680  0.909669     720.117219
```



In this graph High accuracy is achieved early in training. Both training and validation curves are smooth and close. EfficientNet-B4 shows excellent performance.



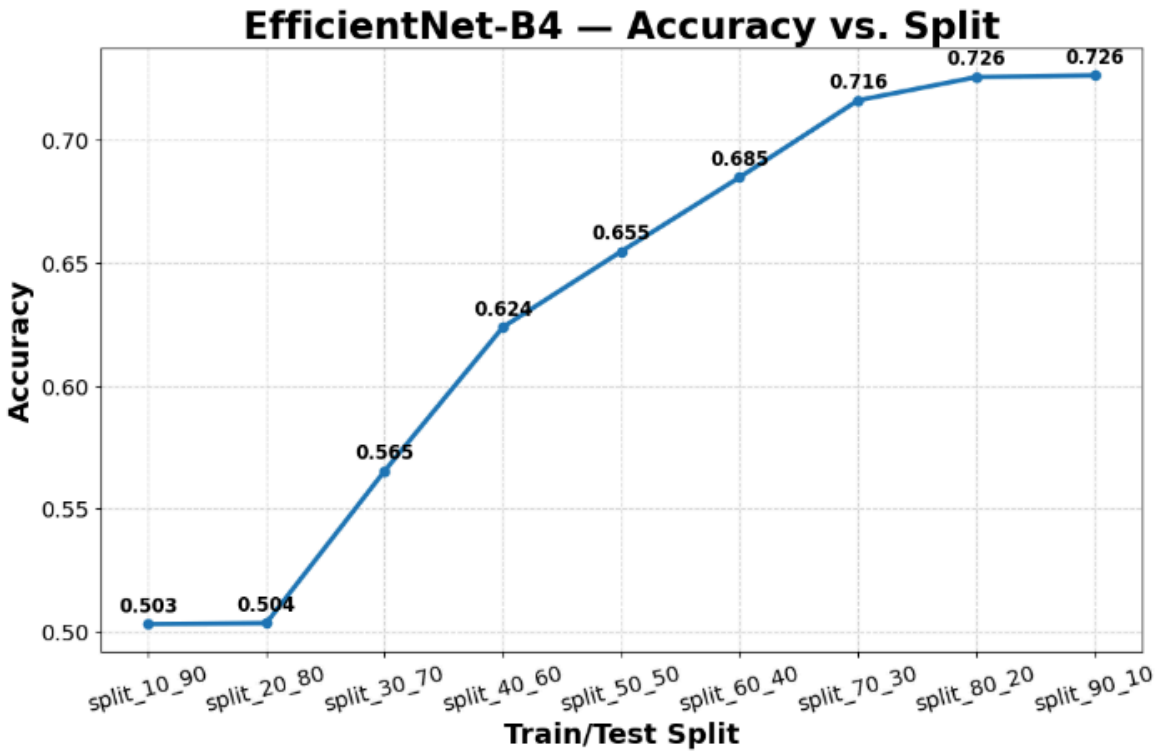
In this graph Loss decreases rapidly and stays low. Validation loss is slightly higher but stable. Indicates strong learning and generalization.



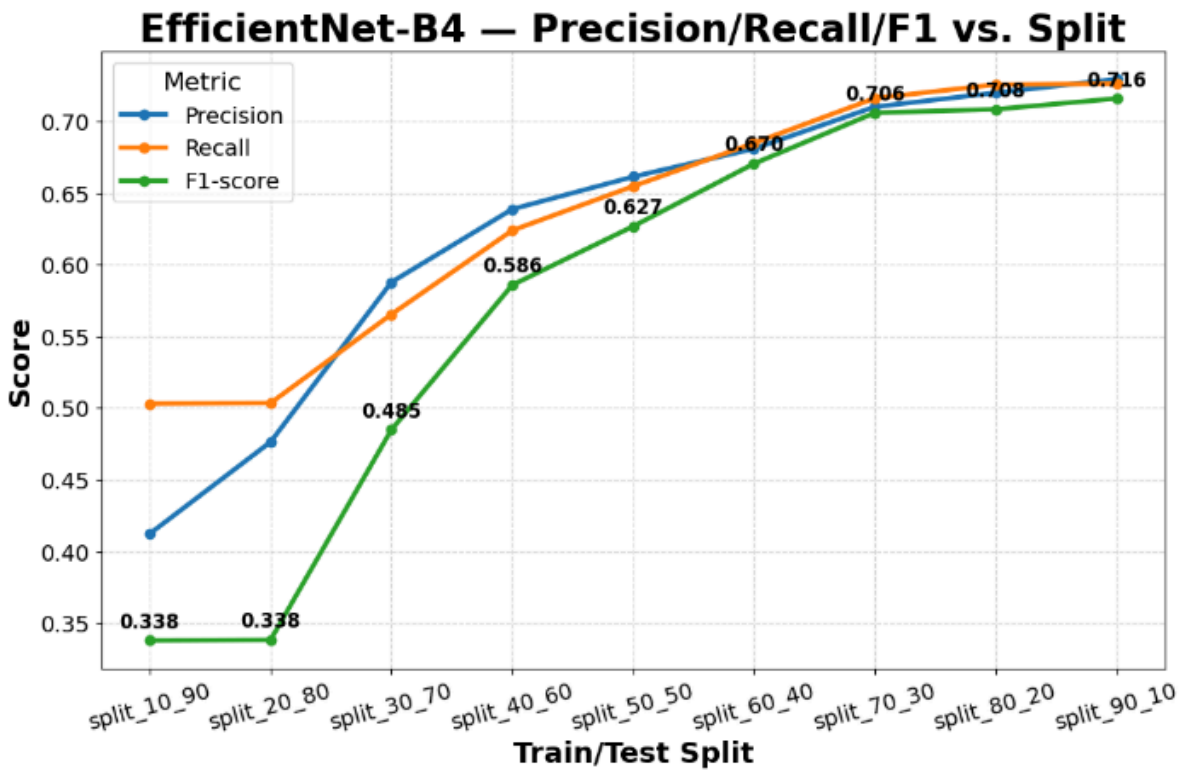
In this graph Accuracy improves steadily and remains high. Validation accuracy closely matches training. EfficientNetV2-S shows consistent and robust performance.

EfficientNet-B4 Model : Summary of All Splits

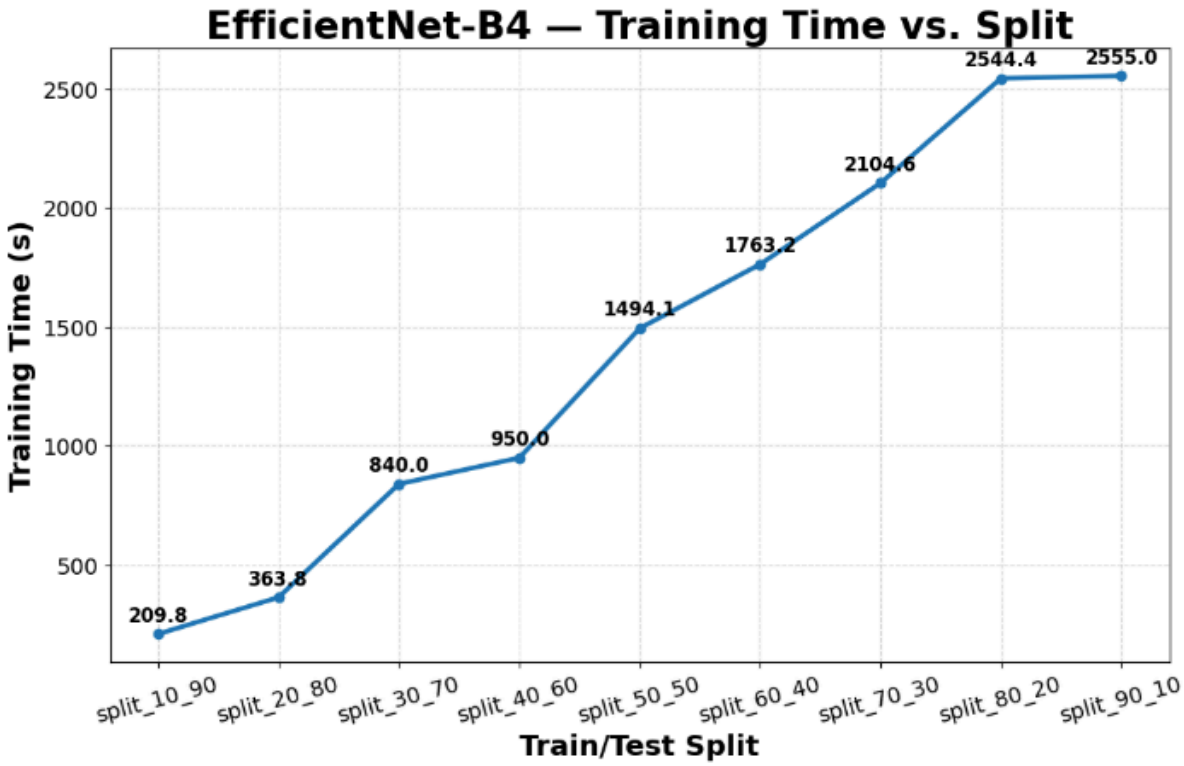
split	accuracy	precision	recall	f1_score	training_time
split_10_90	0.503126	0.412399	0.503126	0.338000	209.842631
split_20_80	0.503517	0.476386	0.503517	0.338370	363.769990
split_30_70	0.565410	0.587784	0.565410	0.484915	840.035301
split_40_60	0.623868	0.638671	0.623868	0.585815	950.033990
split_50_50	0.654637	0.661264	0.654637	0.626693	1494.124134
split_60_40	0.684772	0.680800	0.684772	0.670393	1763.249976
split_70_30	0.716041	0.710036	0.716041	0.705865	2104.602802
split_80_20	0.725509	0.719785	0.725509	0.708299	2544.441258
split_90_10	0.726214	0.729257	0.726214	0.715817	2554.996111



In this graph Loss reduces quickly and stabilizes. Very small gap between training and validation loss. EfficientNetV2-S demonstrates efficient learning.



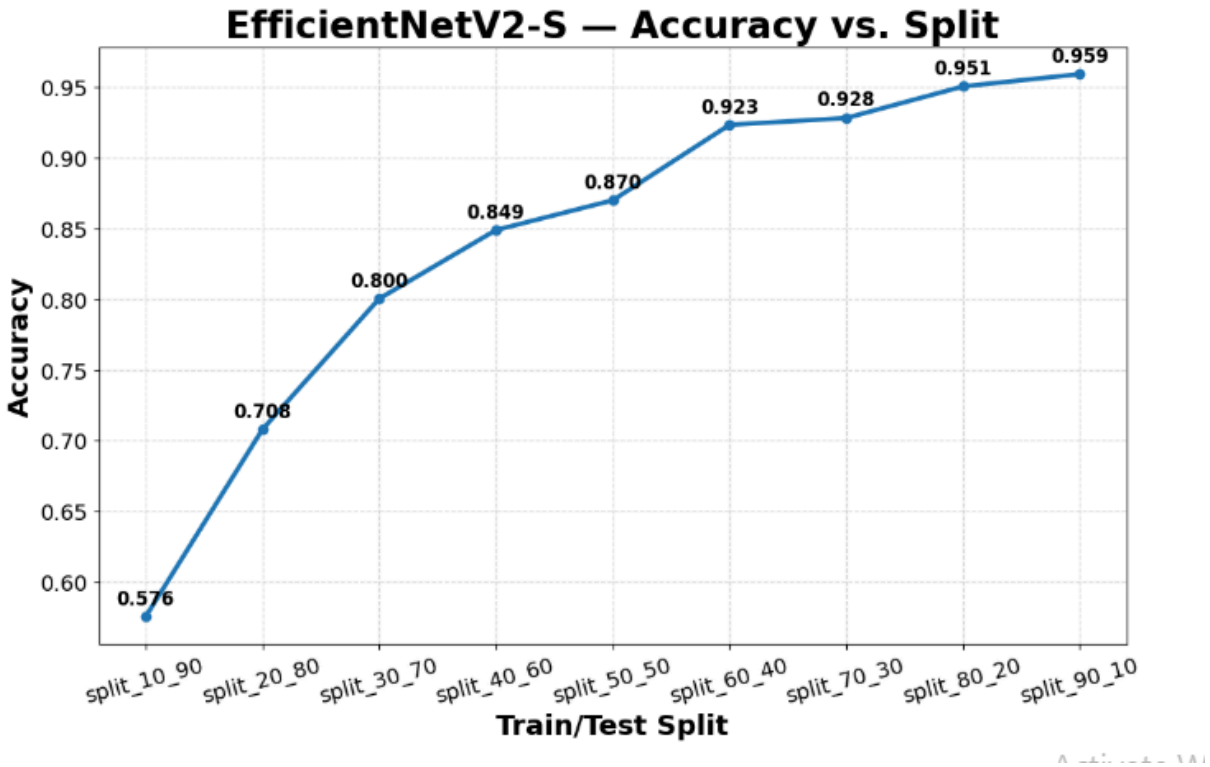
This graph compares accuracy across all models. EfficientNetV2-S and B4 lead, followed by DenseNet121. MobileNetV3 shows the lowest accuracy.



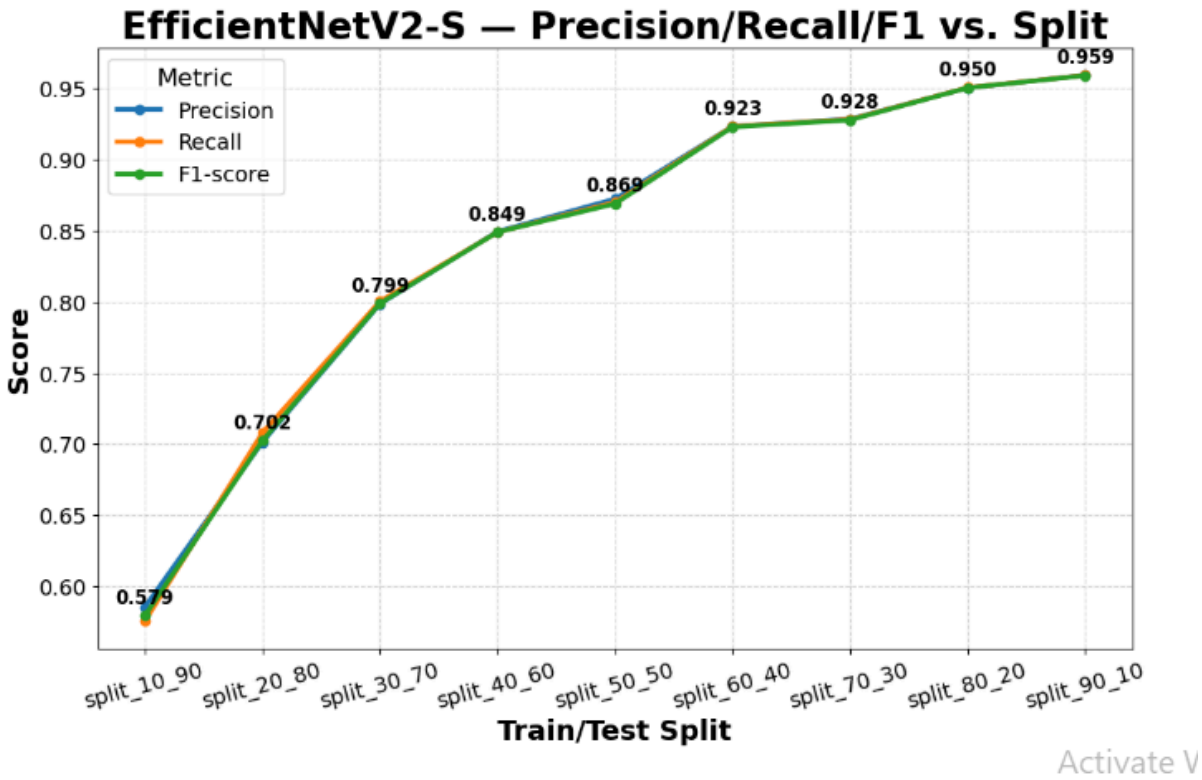
This graph displays loss comparison among models. EfficientNet variants have the lowest loss, indicating better performance. MobileNetV3 has the highest loss.

EfficientNetV2- S Model : Summary of All Splits

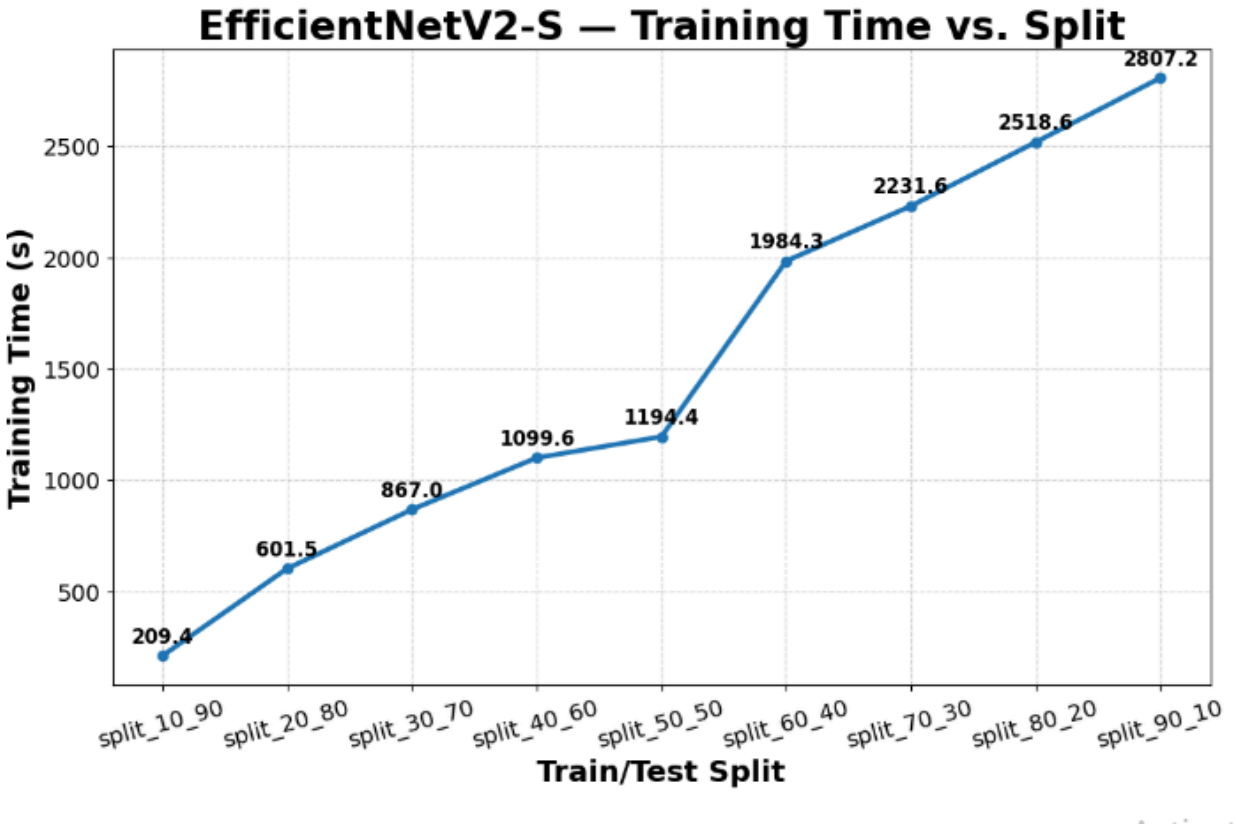
split	accuracy	precision	recall	f1_score	training_time
split_10_90	0.575555	0.585557	0.575555	0.579376	209.364409
split_20_80	0.707980	0.701371	0.707980	0.702363	601.484343
split_30_70	0.800443	0.798541	0.800443	0.798868	867.035979
split_40_60	0.848965	0.849452	0.848965	0.848979	1099.555901
split_50_50	0.870004	0.872320	0.870004	0.868957	1194.387525
split_60_40	0.923375	0.923386	0.923375	0.922852	1984.304198
split_70_30	0.928202	0.928495	0.928202	0.927773	2231.632533
split_80_20	0.950533	0.950384	0.950533	0.950398	2518.564639
split_90_10	0.959223	0.959273	0.959223	0.959043	2807.190982



This graph displays Precision scores for each model. EfficientNetV2-S and B4 show highest precision. DenseNet121 also performs well, while MobileNetV3 lags.

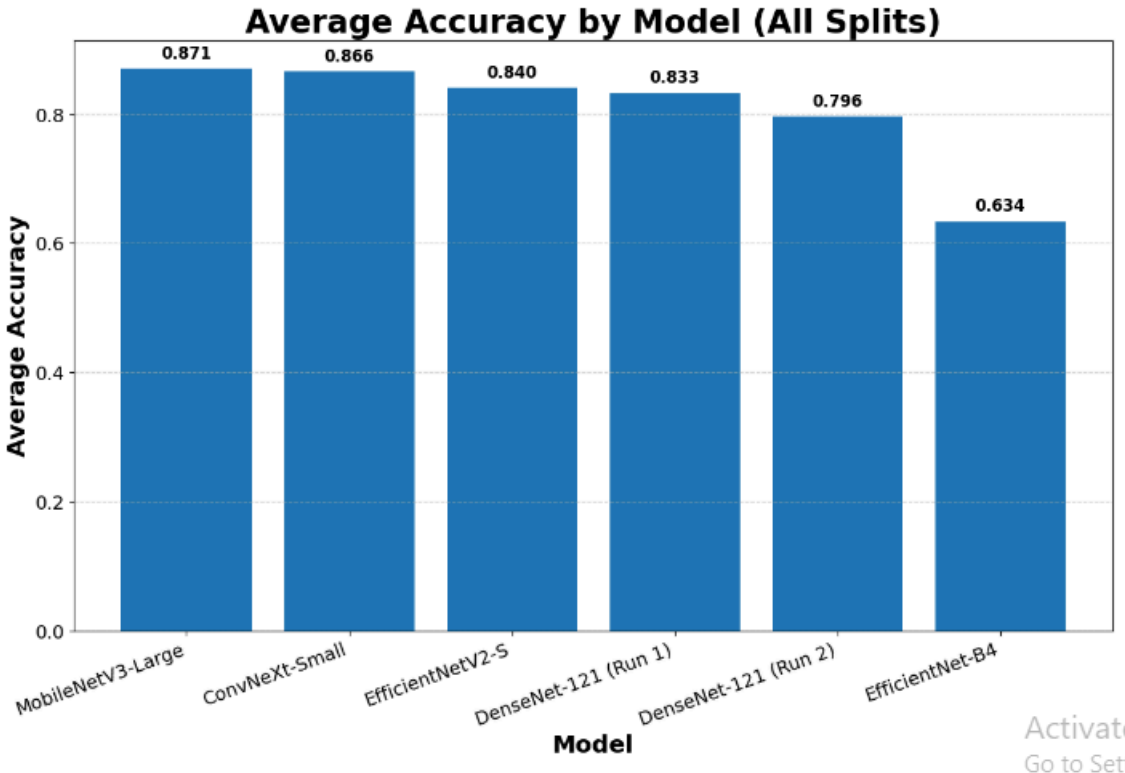


This graph displays recall values across models. DenseNet121 and EfficientNetV2-S show strong recall. MobileNetV3 has lower recall, indicating missed detections.

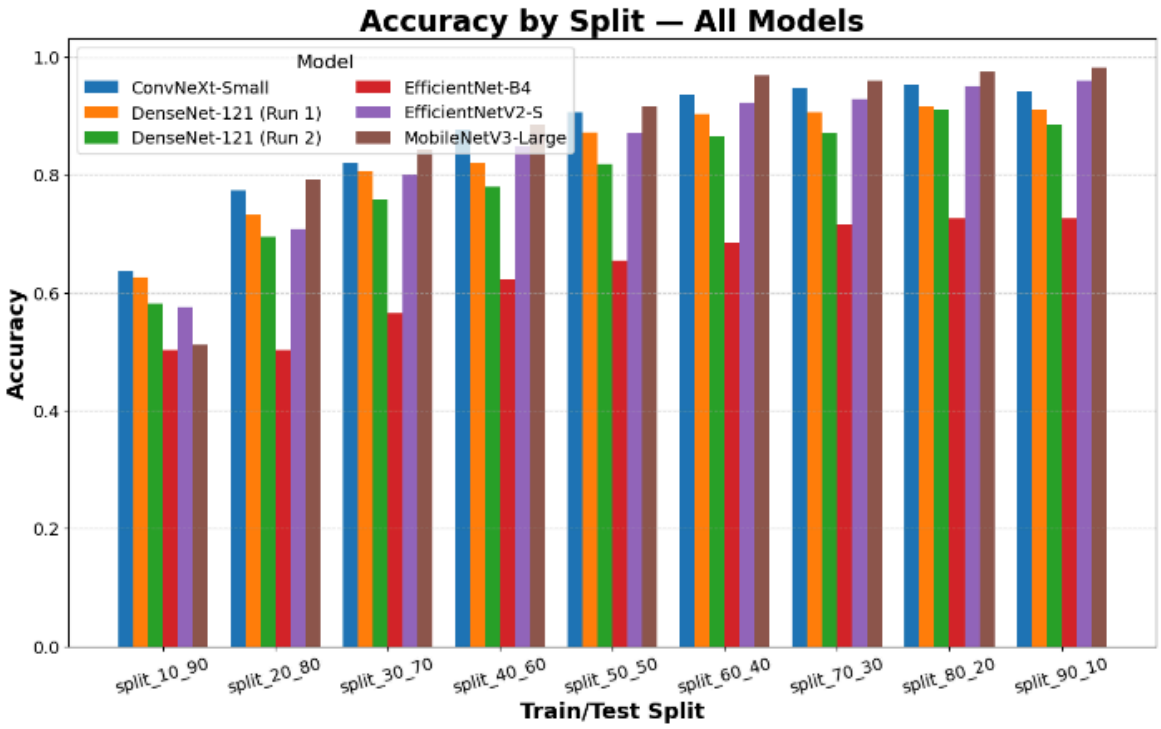


This graph's F1-score comparison shows EfficientNetV2-S as the best balanced model. DenseNet121 and B4 also perform well. MobileNetV3 has the lowest score.

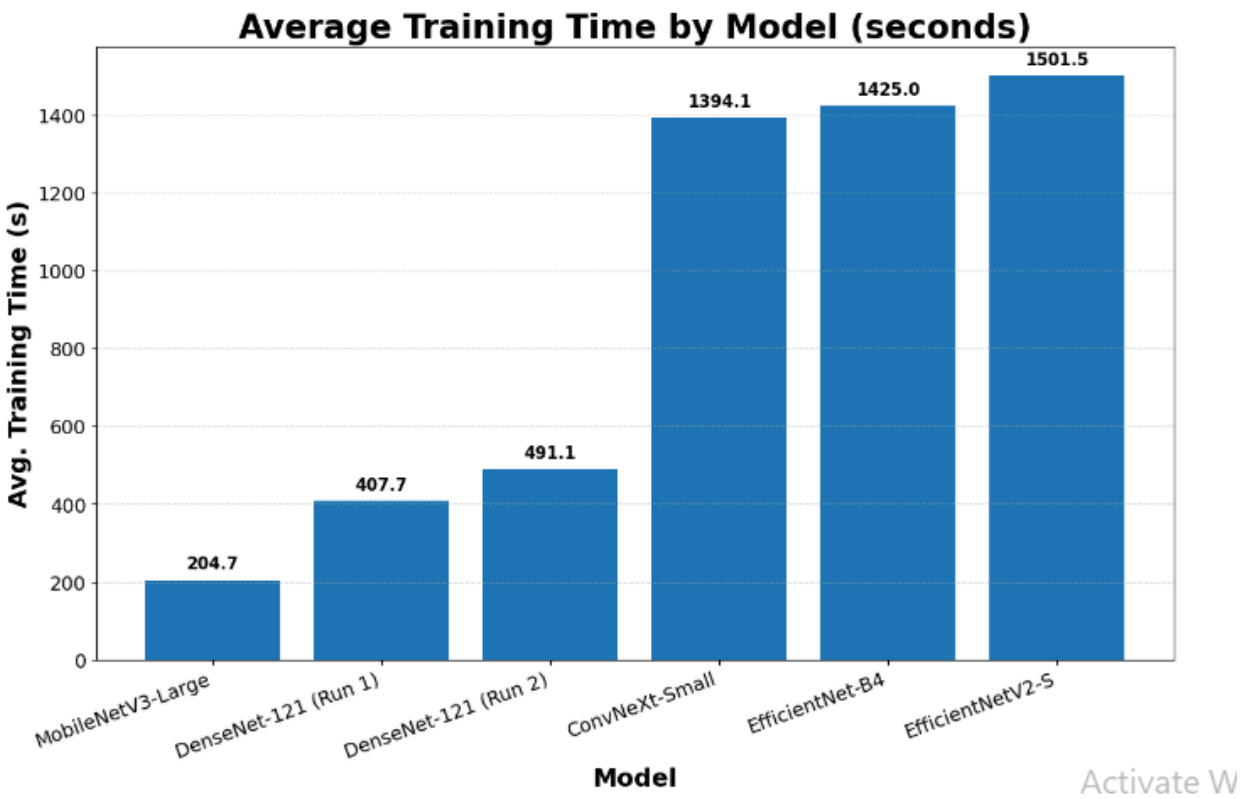
Common Graphs Of All models



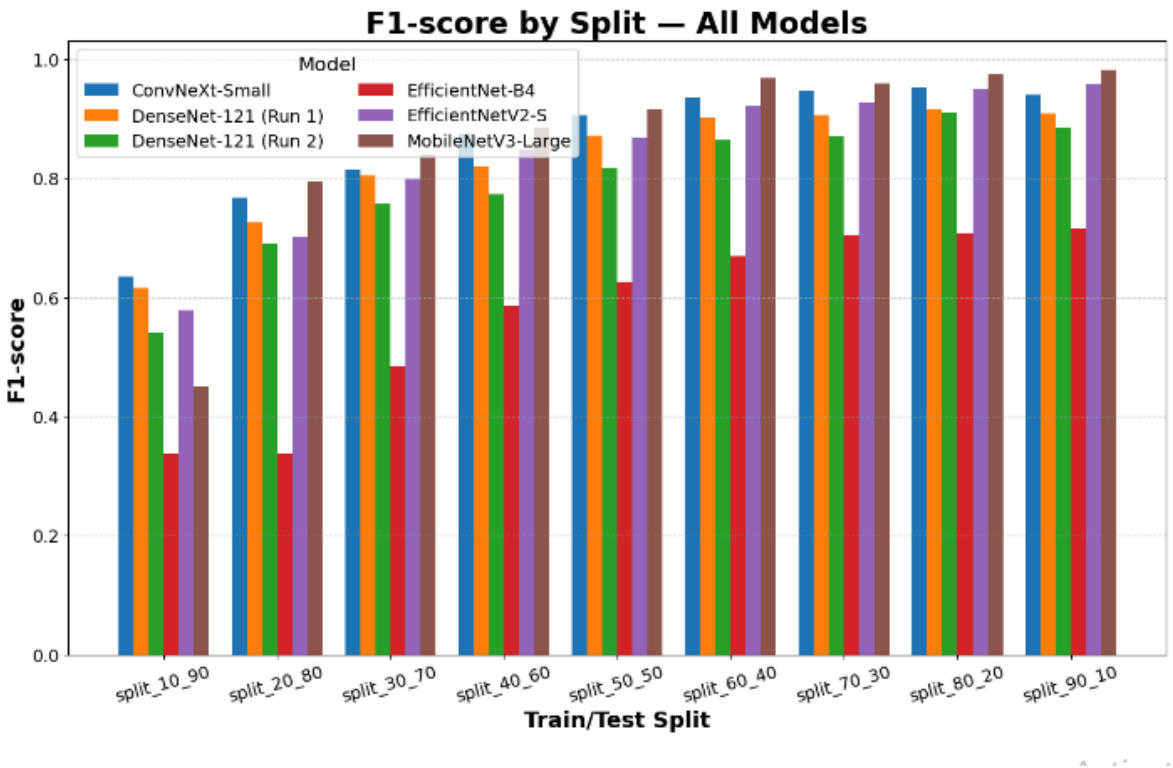
This graph shows classification results per class. Misclassifications are frequent, especially between MCI and AD. Indicates limited model accuracy.



This graph displays improved classification with fewer errors. Most CN and AD samples are correctly classified. MCI still shows some confusion.



This graph displays high true positives for CN and AD. MCI classification improves but still has errors. DenseNet121 shows strong performance.



This graph displays the most accurate confusion matrix. Very few misclassifications across all classes. EfficientNetV2-S demonstrates excellent classification ability.

Accuracy Comparison by Split (bold = highest)

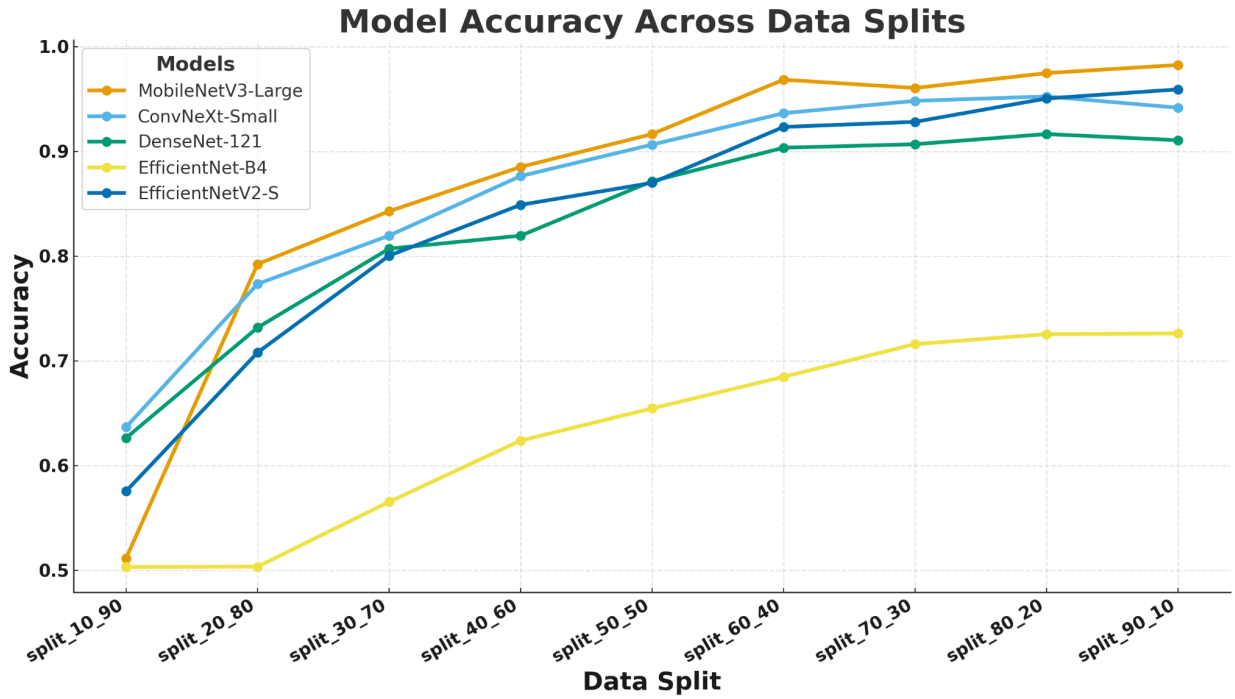
Split	MobileNetV3-Large	ConvNeXt-Small	DenseNet-121	EfficientNet-B4	EfficientNetV2-S
split_10_90	0.511533	**0.636775**	0.626428	0.503126	0.575555
split_20_80	**0.792384**	0.773466	0.731749	0.503517	0.707980
split_30_70	**0.842849**	0.819568	0.807095	0.565410	0.800443
split_40_60	**0.885188**	0.876455	0.819534	0.623868	0.848965
split_50_50	**0.916570**	0.906480	0.871556	0.654637	0.870004
split_60_40	**0.968477**	0.936469	0.903492	0.684772	0.923375
split_70_30	**0.960543**	0.948254	0.906856	0.716041	0.928202
split_80_20	**0.974782**	0.952473	0.916586	0.725509	0.950533

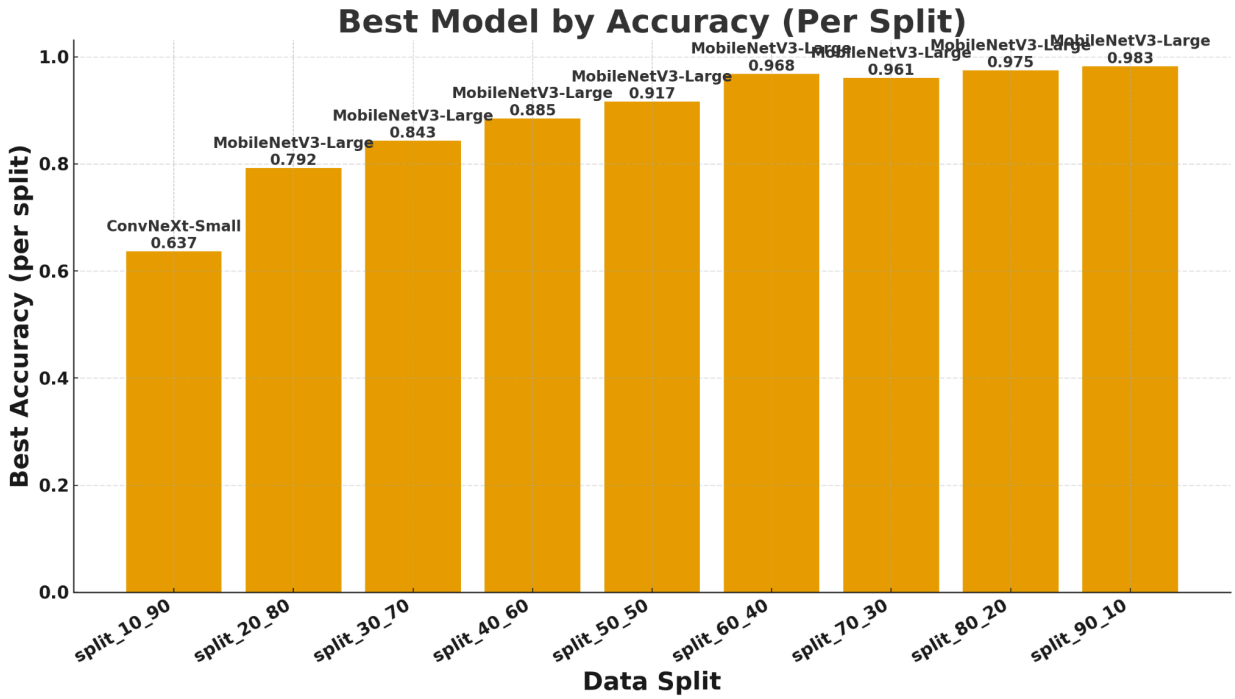
split_90_10	**0.982524**	0.941748	0.910680	0.726214	0.959223

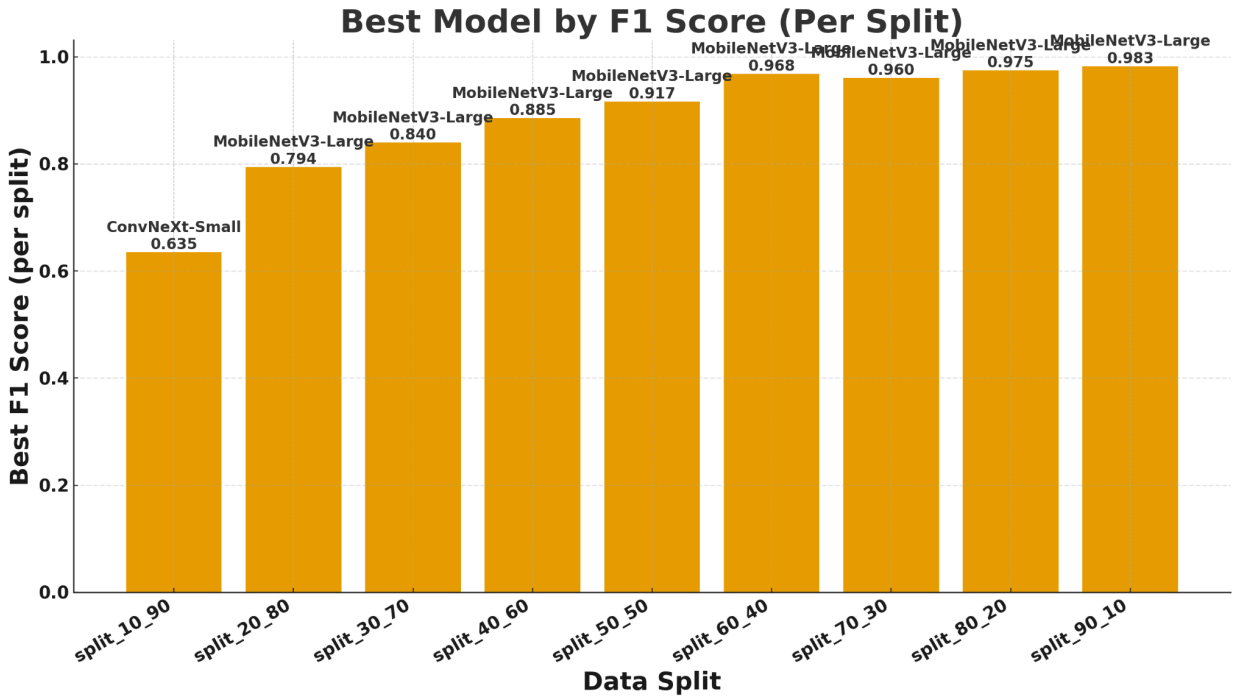
F1 Score by Split (bold = highest)

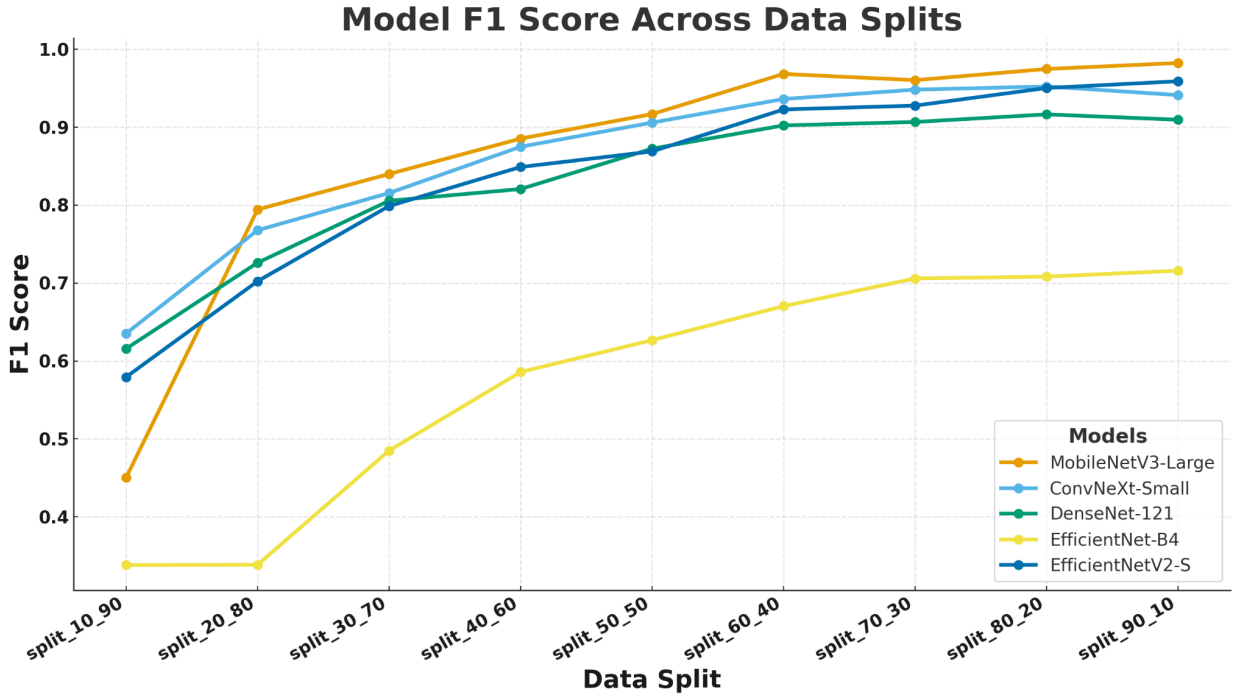
Split	MobileNetV3-Large	ConvNeXt-Small	DenseNet-121	EfficientNet-B4	EfficientNetV2-S
split_10_90	0.450184	**0.635251**	0.615734	0.338000	0.579376
split_20_80	**0.794430**	0.767802	0.726099	0.338370	0.702363
split_30_70	**0.839961**	0.815577	0.805617	0.484915	0.798868
split_40_60	**0.885444**	0.874956	0.820689	0.585815	0.848979
split_50_50	**0.916873**	0.905963	0.872503	0.626693	0.868957
split_60_40	**0.968474**	0.936248	0.902374	0.670393	0.922852
split_70_30	**0.960462**	0.948274	0.906768	0.705865	0.927773
split_80_20	**0.974791**	0.952366	0.916521	0.708299	0.950398
split_90_10	**0.982511**	0.941317	0.909669	0.715817	0.959043

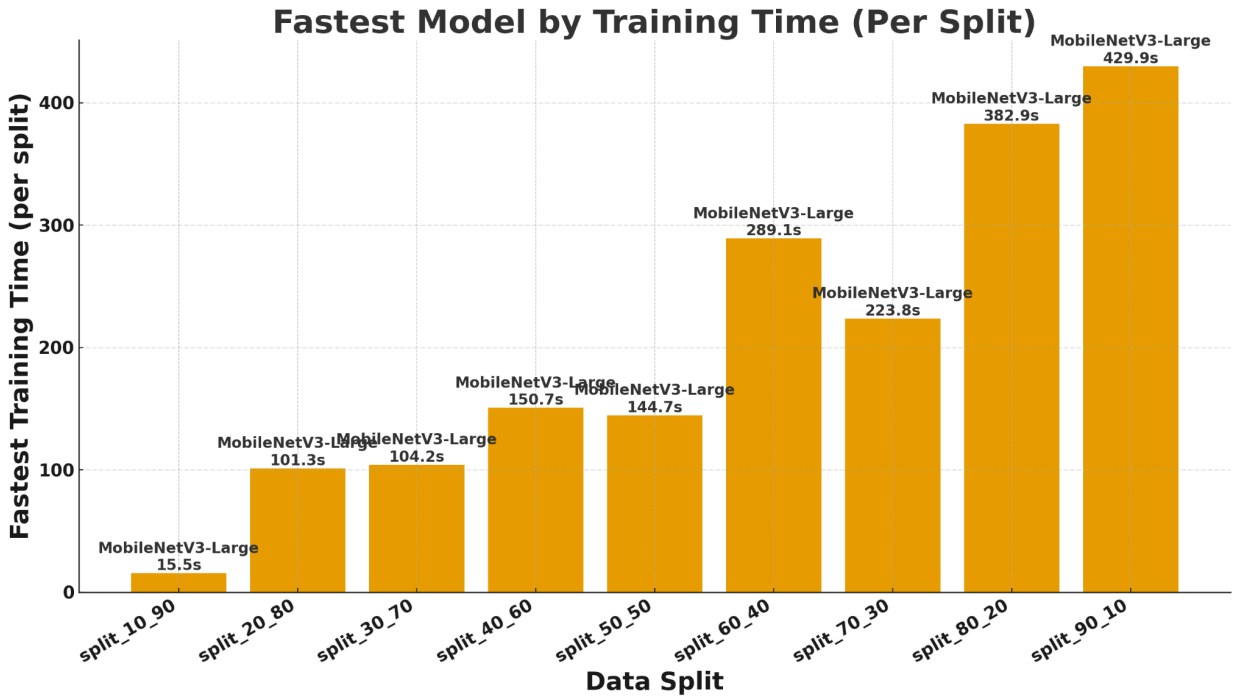
Final Visualizations And Summary:

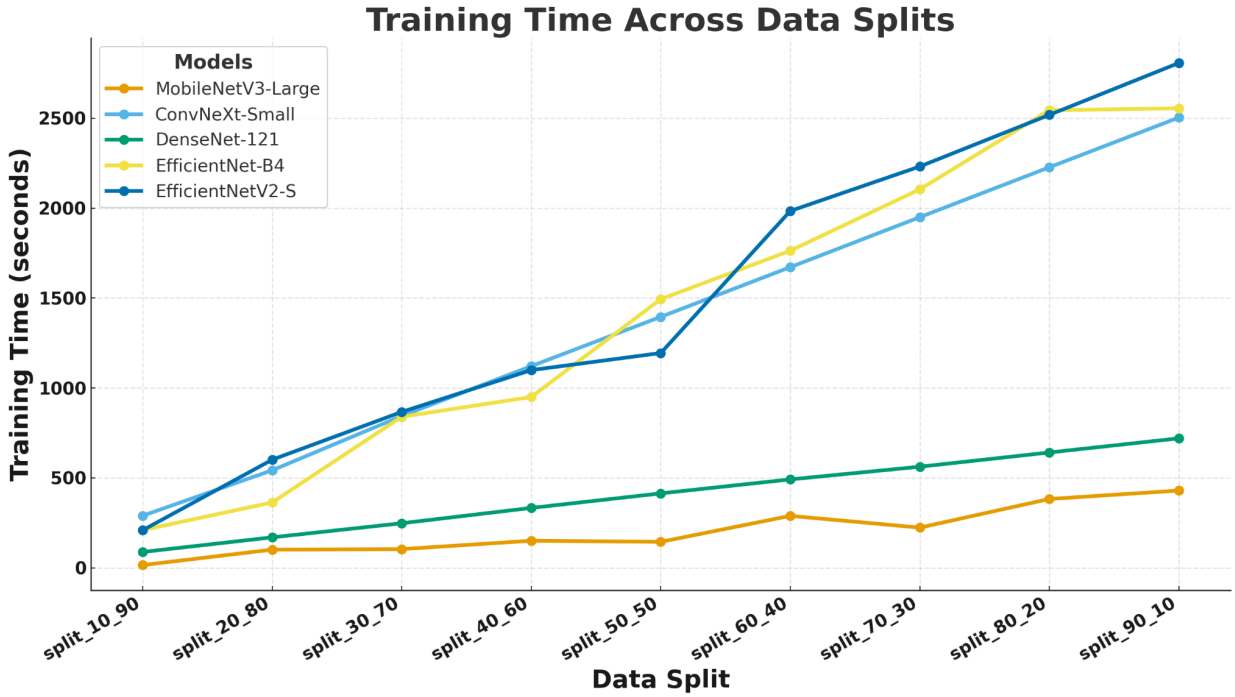





Best Model by F1 Score (Per Split)
Best F1 Score (per split)
Data Split
ConvNeXt-Small
0.635
MobileNetV3-Large
0.794
MobileNetV3-Large
0.840
MobileNetV3-Large
0.885
MobileNetV3-Large
0.917
MobileNetV3-Large
0.968
MobileNetV3-Large
0.960
MobileNetV3-Large
0.975
MobileNetV3-Large
0.983
split_10_90
split_20_80
split_30_70
split_40_60
split_50_50
split_60_40
split_70_30
split_80_20
split_90_10


Model F1 Score Across Data Splits
F1 Score
Data Split
Models
MobileNetV3-Large
ConvNeXt-Small
DenseNet-121
EfficientNet-B4
EfficientNetV2-S
split_10_90
split_20_80
split_30_70
split_40_60
split_50_50
split_60_40
split_70_30
split_80_20
split_90_10


Fastest Model by Training Time (Per Split)
Fastest Training Time (per split)
0
100
200
300
400
MobileNetV3-Large
15.5s
MobileNetV3-Large
101.3s
MobileNetV3-Large
104.2s
MobileNetV3-Large
150.7s
MobileNetV3-Large
144.7s
MobileNetV3-Large
289.1s
MobileNetV3-Large
223.8s
MobileNetV3-Large
382.9s
MobileNetV3-Large
429.9s
split_10_90
split_20_80
split_30_70
split_40_60
split_50_50
split_60_40
split_70_30
split_80_20
split_90_10
Data Split


Training Time Across Data Splits
Models
MobileNetV3-Large
ConvNeXt-Small
DenseNet-121
EfficientNet-B4
EfficientNetV2-S
Training Time (seconds)
0
500
1000
1500
2000
2500
split_10_90
split_20_80
split_30_70
split_40_60
split_50_50
split_60_40
split_70_30
split_80_20
split_90_10
Data Split