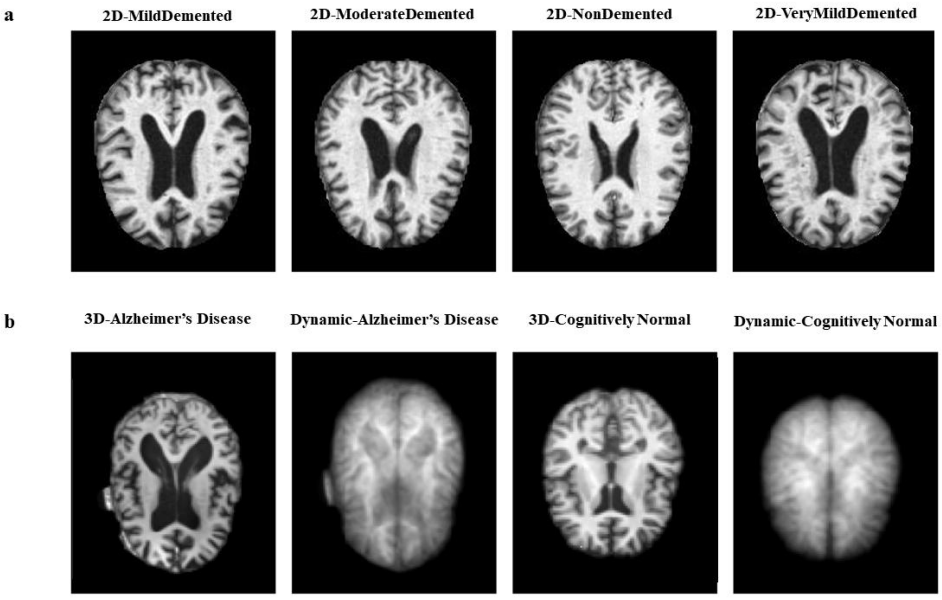
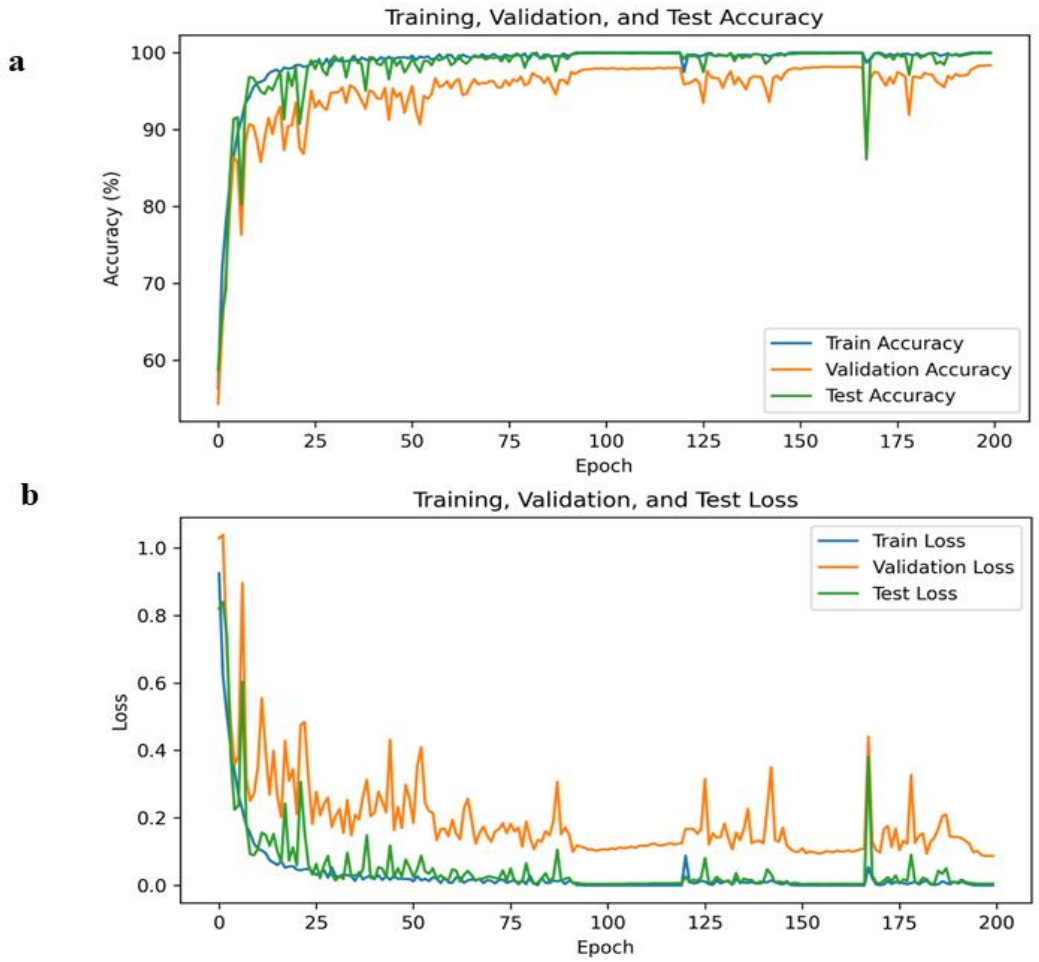
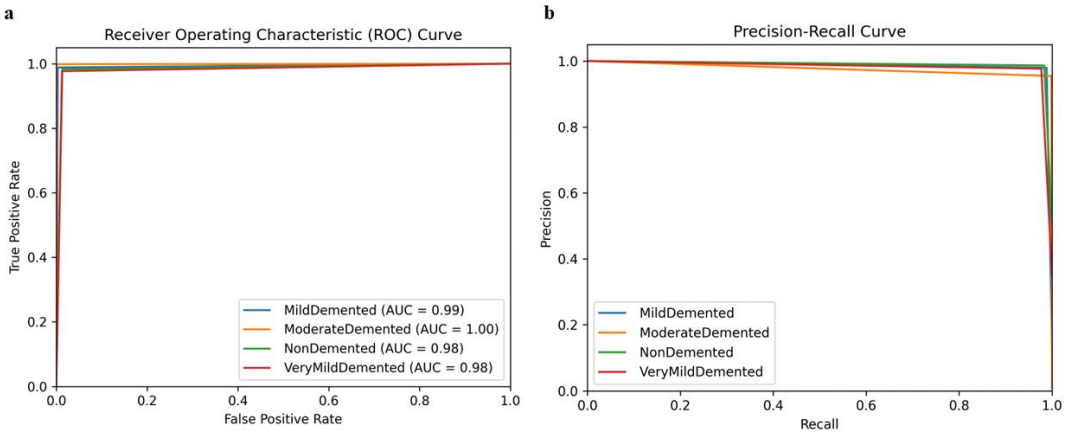


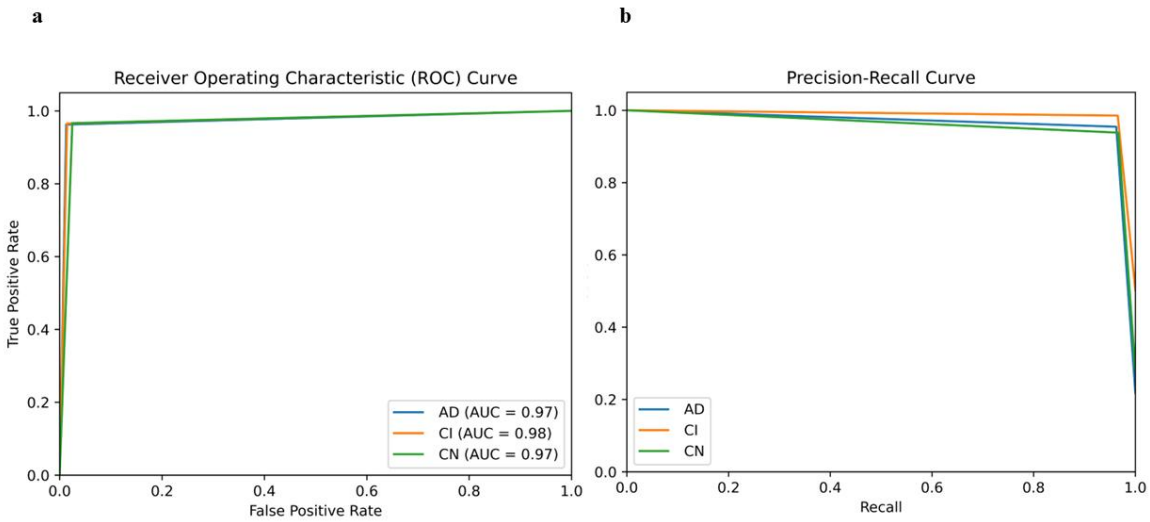
Supplementary Figure 1. Sample Visualizations from 2D and 3D Datasets for Alzheimer's Disease （AD) Classification. Panel a depicts examples from the 2D dataset. Panel b presents samples from the 3D dataset and their corresponding dynamic image transformations, categorizing Alzheimer's Disease and Cognitively Normal instances.



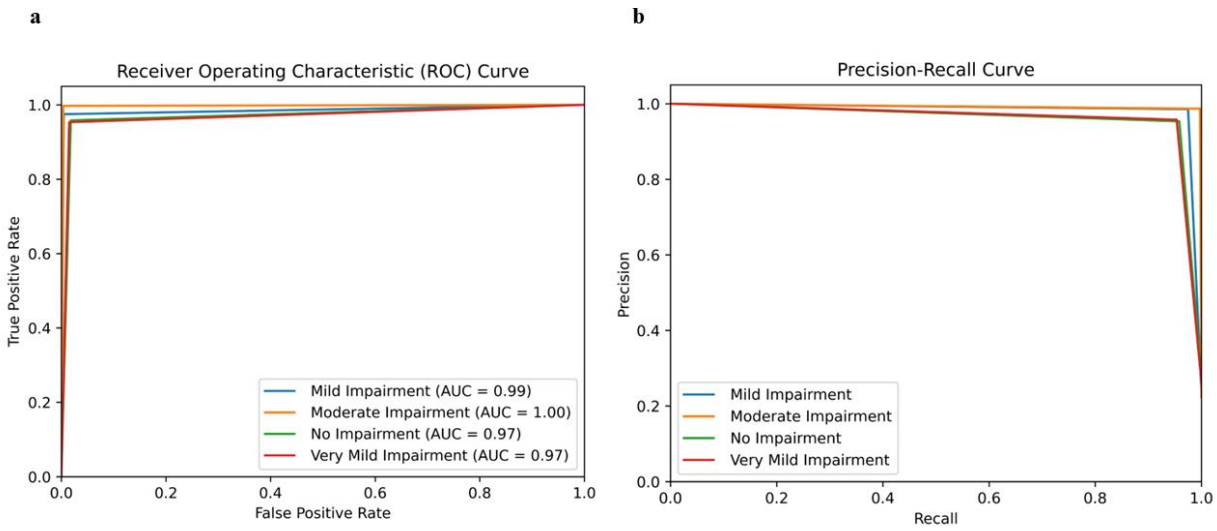
Supplementary Figure 2. Training, Validation, and Test Metrics for DAMNet: Panel a displays the accuracy curves, and Panel b shows the loss curves over 200 epochs, depicting the model's performance dynamics.



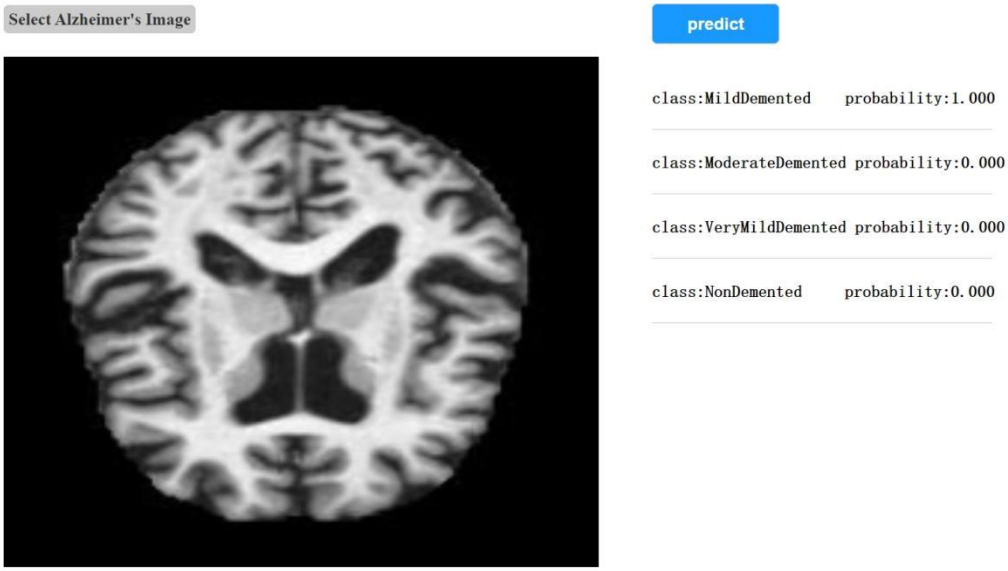
Supplementary Figure 3. Evaluation of the DAMNet Model Performance: Panel a presents the Receiver Operating Characteristic (ROC) curves with respective Area Under the Curve (AUC) scores for different dementia stages, while Panel b illustrates the Precision-Recall curves, highlighting the model's diagnostic ability.



Supplementary Figure 4. Evaluation of the DAMNet Model Performance:Panel a shows Receiver Operating Characteristic (ROC) curves and their respective Area Under the Curve (AUC) scores for different dementia stages, while Panel b illustrates Precision-Recall curves, demonstrating the model's diagnostic ability, using data from the Axial Public AD Dataset available at https://www.kaggle.com/datasets/katalniraj/adni-extracted-axial.



Supplementary Figure 5. Evaluation of the DAMNet Model Performance: Panel a shows Receiver Operating Characteristic (ROC) curves and their respective Area Under the Curve (AUC) scores for different dementia stages, while Panel b illustrates Precision-Recall curves, demonstrating the model's diagnostic ability, using the Combined Dataset proposed in the thesis from https://www.ijert.org/thesis-volume-12-2023, which comprises a blend of real and synthetic axial MRI data.



Supplementary Figure 6. A lightweight recognition framework for Alzheimer's disease image classification, designed based on DAMNet, represents an initial iteration with plans for further expansion and optimization, with the ultimate aim of broader translation into clinical applications.

Model	Params	Val_Acc
MobileNetV3-Small	**2.9M**	**95.2%**
MobileNetV3-Large	**5.4M**	**96.2%**
ResNet-18	**11.7M**	**96.6%**
ResNet-34	**21.8M**	**97.7%**
ResNet-50	**25.6M**	**94.3%**
ResNet-101	**44.6M**	**93.6%**
ResNet-152	**60.2M**	**93.0%**
DenseNet-121	**8M**	**97.4%**
DenseNet-161	**28.7M**	**97.1%**
DenseNet-169	**14.3M**	**97.6%**
DenseNet-201	**20M**	**97.6%**
VGG-11	**132.9M**	**93.1%**
VGG-13	**133.0M**	**93.8%**
VGG-16	**138M**	**99.5%**
VGG-19	**143.7M**	**99.7%**
ViT-Base/16	**86M**	**94.9%**
ViT-Base/32	**88M**	**87.8%**
Swin-Tiny	**29M**	**83.1%**
Swin-Small	**50M**	**83.4%**
Swin-Base	**88M**	**85.0%**
ConViT-Tiny	**0.05M**	**77.5%**
ConViT-Small	**1.0M**	**83.0%**
ConViT-Base	**9.7M**	**90.2%**
DAMNet	**7.4M**	**98.3%**

Supplementary Table 1. Comprehensive comparison of parameters and validation accuracies for all versions of selected models, illustrating their performance variations.

Model	Params	GFLOPS	Val_Acc
MobileNetV3-Large	**5.4M**	**0.22G**	**96.2%**
ResNet-34	**21.8M**	**3.7G**	**97.7%**
DenseNet-121	**8M**	**2.9G**	**97.4%**
VGG-16	**138M**	**15.5G**	**99.5%**
ViT-Base/16	**86M**	**17.6G**	**94.9%**
Swin-Base	**88M**	**15.4G**	**85.0%**
ConViT-Base	**9.7M**	**1.9G**	**90.2%**
DAMNet	**7.4M**	**1.1G**	**98.3%**

Supplementary Table 2. Comprehensive comparison of optimal versions of various models, showcasing their performance metrics.

Datasets	Best-Accuracy	Accuracy	Auc	F1	Precision	Recall
Axial	**99.6%**	**99.5%**	**97.3%**	**96.5%**	**96.5%**	**96.5%**
Combined Dataset	**99.2%**	**99.0%**	**98.3%**	**97.0%**	**97.0%**	**97.0%**

Supplementary Table 3. Performance evaluation of DAMNet, utilizing data from two distinct publicly available Alzheimer's disease datasets, to assess the generalization capability of our proposed DAMNet model for image classification in Alzheimer's disease.

Name of layers	Sparsity (%)
pre.0.weights	12.62
stage1.residual.0.weights	17.87
stage1.residual.3.weights	9.72
stage1.residual.6.weights	13.77
stage1.residual.8.weights	13.28
stage2.0.residual.0.weights	13.41
stage2.0.residual.3.weights	11.81
stage2.0.residual.6.weights	15.33
stage2.0.residual.8.weights	15.15
stage2.0.residual_1.0.weights	13.09
stage2.0.residual_1.3.weights	15.42
stage2.0.residual_1.6.weights	15.14
stage2.0.residual_1.8.weights	15.23
stage2.0.residual_2.0.weights	13.80
stage2.1.residual.0.weights	14.64
stage2.1.residual.3.weights	11.03
stage2.1.residual.6.weights	14.58
stage2.1.residual.8.weights	14.96
stage3.0.residual.0.weights	14.24
stage3.0.residual.3.weights	10.80
stage3.0.residual.6.weights	15.04
stage3.0.residual.8.weights	15.80
stage3.0.residual_1.0.weights	14.87
stage3.0.residual_1.3.weights	12.67
stage3.0.residual_1.6.weights	14.87
stage3.0.residual_1.8.weights	15.56
stage3.0.residual_2.0.weights	12.11
stage3.1.residual.0.weights	14.19

stage3.1.residual.3.weights	**10.82**
stage3.1.residual.6.weights	**14.40**
stage3.1.residual.8.weights	**14.97**
stage3.2.residual.0.weights	**14.21**
stage3.2.residual.3.weights	**11.40**
stage3.2.residual.6.weights	**14.14**
stage3.2.residual.8.weights	**15.48**
stage4.0.residual.0.weights	**13.23**
stage4.0.residual.3.weights	**10.42**
stage4.0.residual.6.weights	**14.55**
stage4.0.residual.8.weights	**15.68**
stage4.0.residual_1.0.weights	**14.14**
stage4.0.residual_1.3.weights	**14.08**
stage4.0.residual_1.6.weights	**14.34**
stage4.0.residual_1.8.weights	**15.54**
stage4.0.residual_2.0.weights	**13.53**
stage4.1.residual.0.weights	**15.06**
stage4.1.residual.3.weights	**10.56**
stage4.1.residual.6.weights	**14.46**
stage4.1.residual.8.weights	**15.82**
stage4.2.residual.0.weights	**15.00**
stage4.2.residual.3.weights	**10.68**
stage4.2.residual.6.weights	**14.47**
stage4.2.residual.8.weights	**15.39**
stage4.3.residual.0.weights	**14.91**
stage4.3.residual.3.weights	**11.23**
stage4.3.residual.6.weights	**14.22**
stage4.3.residual.8.weights	**15.88**
stage5.0.residual.0.weights	**14.46**

stage5.0.residual.3.weights	**10.53**
stage5.0.residual.6.weights	**13.99**
stage5.0.residual.8.weights	**16.65**
stage5.1.residual.0.weights	**15.12**
stage5.1.residual.3.weights	**11.92**
stage5.1.residual.6.weights	**15.88**
stage5.1.residual.8.weights	**16.72**
stage5.2.residual.0.weights	**16.15**
stage5.2.residual.3.weights	**12.75**
stage5.2.residual.6.weights	**19.16**
stage5.2.residual.8.weights	**16.27**
stage6.0.residual.0.weights	**17.03**
stage6.0.residual.3.weights	**12.87**
stage6.0.residual.6.weights	**22.96**
stage6.0.residual.8.weights	**16.71**
stage6.0.residual_1.0.weights	**16.22**
stage6.0.residual_1.3.weights	**14.65**
stage6.0.residual_1.6.weights	**18.74**
stage6.0.residual_1.8.weights	**17.34**
stage6.0.residual_2.0.weights	**16.99**
stage6.1.residual.0.weights	**17.20**
stage6.1.residual.3.weights	**13.70**
stage6.1.residual.6.weights	**24.97**
stage6.1.residual.8.weights	**16.51**
stage6.2.residual.0.weights	**17.86**
stage6.2.residual.3.weights	**13.10**
stage6.2.residual.6.weights	**27.59**
stage6.2.residual.8.weights	**18.98**
stage7.residual.0.weights	**16.69**

stage7.residual.3.weights	**11.71**
stage7.residual.6.weights	**21.46**
stage7.residual.8.weights	**16.72**
conv1.0.weights	**19.10**
conv2.weights	**29.24**

Supplementary Table 4. Detailed analysis of sparsity across network layers following a 20% pruning rate, aimed at evaluating the impact of pruning strategies.

Fold	Epoch20 Validation Accuracy	Epoch100 Validation Accuracy	Epoch20 Mean Accuracy	Epoch100 Mean Accuracy
1	**91.8**	**96.6**	**91.8**	**96.6**
2	**92.8**	**95.0**	**92.3**	**95.8**
3	**89.4**	**96.4**	**91.3**	**96.0**
4	**90.2**	**96.2**	**91.1**	**96.1**
5	**86.3**	**95.8**	**90.1**	**96.0**

Supplementary Table 5. Cross-Validation Performance of 5-Fold DAMNet on 2D Image Classification Task with 20 and 100 Epochs, Including Validation Accuracy and Mean Accuracy.

Fold	Epoch20 Validation Accuracy	Epoch50 Validation Accuracy	Epoch100 Validation Accuracy	Epoch20 Mean Accuracy	Epoch50 Mean Accuracy	Epoch100 Mean Accuracy
1	**94.3**	**94.0**	**96.2**	**94.3**	**94.0**	**96.2**
2	**93.8**	**94.4**	**95.9**	**94.0**	**94.2**	**96.1**
3	**96.4**	**96.4**	**95.9**	**94.8**	**94.9**	**96.0**
4	**93.2**	**96.4**	**97.0**	**94.4**	**95.3**	**96.3**
5	**95.9**	**93.7**	**95.6**	**94.7**	**95.0**	**96.1**
6	**94.7**	**94.7**	**94.7**	**94.7**	**94.9**	**95.9**
7	**92.6**	**96.0**	**96.8**	**94.4**	**95.1**	**96.0**
8	**95.1**	**95.9**	**97.4**	**94.5**	**95.2**	**96.2**
9	**94.6**	**95.9**	**94.9**	**94.5**	**95.3**	**96.1**
10	**94.0**	**95.4**	**97.0**	**94.5**	**95.3**	**96.2**

Supplementary Table 6. Cross-Validation Performance of 10-Fold DAMNet on 2D Image Classification Task with 20,50 and 100 Epochs, Including Validation Accuracy and Mean Accuracy.

Model	3D-Accuracy	3D-Auc	3D-F1	3D-Precision	3D-Recall	3D-Ap
Baseline	**88.0%**	**89.0%**	**87.0%**	**89.0%**	**85.0%**	**83.0%**
DAMNet	**93.0%**	**96.4%**	**93.6%**	**90.6%**	**96.7%**	**89.4%**

Supplementary Table 7. Comparative Performance Analysis of DAMNet Against Baseline Methodologies Adopted from Mainstream Literature (Xing X, et al., ECCV 2020), Focusing on 3D MRI Image Classification for Alzheimer's Disease Diagnosis.

Model	3D-Accuracy	3D-Auc	3D-F1	3D-Precision	3D-Recall	3D-Ap
Avg+VGG11+Att	**88.0%**	**89.0%**	**88.0%**	**85.0%**	**91.0%**	**82.0%**
DAMNet	**93.0%**	**96.4%**	**93.6%**	**90.6%**	**96.7%**	**89.4%**

Supplementary Table 8. Comparison of DAMNet and the Reference Method 'Avg+VGG11+Att' from Xing X et al. (ECCV 2020) on 3D MRI Alzheimer's Disease Classification, encompassing Accuracy, AUC, F1-Score, Precision, Recall, and Average Precision.

	Best-Epoch	3D-Accuracy	3D-Auc	3D-F1	3D-Precision	3D-Recall	3D-Ap
Fold1	**23**	**84.2%**	**84.2%**	**87.5%**	**85.7%**	**75.0%**	**74.8%**
Fold2	**110**	**88.2%**	**93.3%**	**91.7%**	**84.6%**	**100.0%**	**84.6%**
Fold3	**134**	**95.2%**	**99.1%**	**95.2%**	**100.0%**	**90.9%**	**95.7%**
DAMNet	**Comprehensive**	**89.5%**	**94.6%**	**90.0%**	**90.0%**	**90.0%**	**86.3%**

Supplementary Table 9. The performance assessment of DAMNet, conducted through 3-fold cross-validation comprising 150 epochs, is applied to 3D Alzheimer's disease images, aiming to elucidate the performance of DAMNet in a more refined manner.

	Best-Epoch	3D-Accuracy	3D-Auc	3D-F1	3D-Precision	3D-Recall	3D-Ap
Fold1	**122**	**94.7%**	**100.0%**	**94.1%**	**88.9%**	**100.0%**	**88.9%**
Fold2	**66**	**88.2%**	**89.4%**	**91.7%**	**84.6%**	**100.0%**	**84.6%**
Fold3	**101**	**90.5%**	**96.4%**	**90.9%**	**90.9%**	**90.9%**	**87.4%**
Fold4	**137**	**88.9%**	**93.8%**	**87.5%**	**100.0%**	**77.8%**	**88.9%**
DAMNet	**Comprehensive**	**90.7%**	**94.5%**	**91.1%**	**90.0%**	**92.3%**	**87.1%**

Supplementary Table 10. The performance assessment of DAMNet, conducted through 4-fold cross-validation comprising 150 epochs, is applied to 3D Alzheimer's disease images, aiming to elucidate the performance of DAMNet in a more refined manner.