

Response to Reviewer 3 Comments

Point 1: The most innovation in this study is ADASYN oversampling, which is able to solve the problem for imbalanced dataset. Nevertheless, ADASYN oversampling has been adopted for a couple of times for CNN based classification of Alzheimer's disease in the previous studies (Feng and Li 2021; Koh et al. 2020), thus the presented classifier is not innovative enough.

Response 1: The main goal of the proposed DAD-Net is to obtain an accurate classification result for detecting AD in its earlier stages with better accuracy. The main contributions of the research study are three folds:

- We propose a new convolutional neural network architecture for detecting AD with relatively few parameters, and the proposed solution is ideal for training a smaller dataset.
- The previous methods' accuracy compromised on Alzheimer's data set due to an imbalanced number of classes. To handle the imbalance problem of the Alzheimer's data set, we exploited the ADASYN oversampling algorithm, which interpolates new images to balance the class samples.
- The Grad-CAM heat-map algorithm is utilized to visualize the class activation map, highlighting the features that lead to the classification of an image sample.
- The proposed model is extensively compared with several other approaches using various evaluation parameters: Accuracy, AUC, Precision, Recall, F1-score, and size of trainable parameters. It is observed that our approach outperforms other state-of-the-art models.

The main goal of this study is to develop a deep Convolutional Neural Network (CNN) for clearly identifying Alzheimer's disease using MRI. In this study, we offer a new CNN architecture for diagnosing Alzheimer's disease with a modest number of parameters, making it perfect for training a smaller dataset. This proposed model correctly separates the early stages of Alzheimer's disease and displays class activation patterns on the brain as a heat map. The proposed Detection of Alzheimer's Disease Network (DAD-Net) is developed from scratch to correctly classify the phases of Alzheimer's disease while reducing parameters and computation costs. So, the main goal of the study is not only to utilize the ADASYN oversampling method, it's utilized to increase the accuracy of Alzheimer's early stages detection which is an important factor for medical image processing.

Point 2: The authors implemented Grad-CAM algorithms to visualize the classification. However, the authors did not explain what the focus of CNN is and why the heat maps are like these.

Response 2: In the proposed model, we generated the heatmap using the Grad-CAM to show and highlight the infected part of the brain with different disease intensities. In this Figure, we can note that the left-most figure is different from the right-most figure because the right one is more infected than the left one. The heatmap generated through Grad-CAM is the first time utilized to differentiate

between the different stages and highlight the Alzheimer’s disease infected part according to the intensity level of the disease to guide the doctors in this proposed model.



Point 3: In table 1, the authors presented some comparisons for different models. However, are they based on the same dataset? If not, is that reasonable to directly compare them?

Response 3: Yes, almost all the models are based on the same dataset, and the reason for directly comparing and providing the literature survey of the most recent classification methods for AD.

Table 1. A literature evaluation of current cutting-edge approaches used in AD detection and classification.

Approach	Method	Accuracy	AUC	Precision	Recall	F1-Score	Imbalance Handling
Shereen [29]	DenseNet201 + ResNet101	94.86%	-	89.47%	83.74%	95.36%	None
Badiea [50]	AlexNet + ResNet50	94.8%	99.7%	-	-	-	None
Pradhan [31]	DenseNet169 + VGG19	82.6%	86.7%	-	-	-	None
Vasukidevi [52]	CapsNet	94.3%	-	94.92%	95.89%	95.19%	None
Battineni [33]	CNN Model	83.3%	-	-	-	-	None
Suganthe [16]	Inception-ResNet-v2	79.12%	81.9%	70.64%	28.22%	39.91%	None
Jyoti [34]	InceptionV4 + ResNet+ ADNet	93.18%	-	94%	93%	92%%	Data Augmentation
Jyoti [35]	DenseNet121 +DenseNet161 +DenseNet169	93.18%	-	94%	93%	92%	None
Jyoti [36]	InceptionV4	73.75%	-	-	-	-	None

Point 4: The authors are not careful enough. For example, they leveraged repeated sentences in the manuscript. Specifically, in row 215, they presented “the primary idea behind ADASYN is to use a weighted distribution for different minority class...”; in row 219, they presented the same sentence.

Response 4: Thank you for your insightful and valuable comments on the manuscript. In the revised version, we completed the proofreading and the repeated sentences are carefully removed from the whole manuscript, especially in line number 215 and line number 219.