

Performance Analysis of CNN Models and Ensemble Learning for Multi-Class Brain Tumor Classification via MRI

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INTRODUCTION

With the advancement of technology, digital medical images have a major role in detecting many diseases. For example, in 2002, the Department of Radiology at the University Hospital of Geneva produced between 12,000 and 15,000 images daily. [1]
There are two types of brain tumors, primary and secondary, both of which affect the brain and settle there

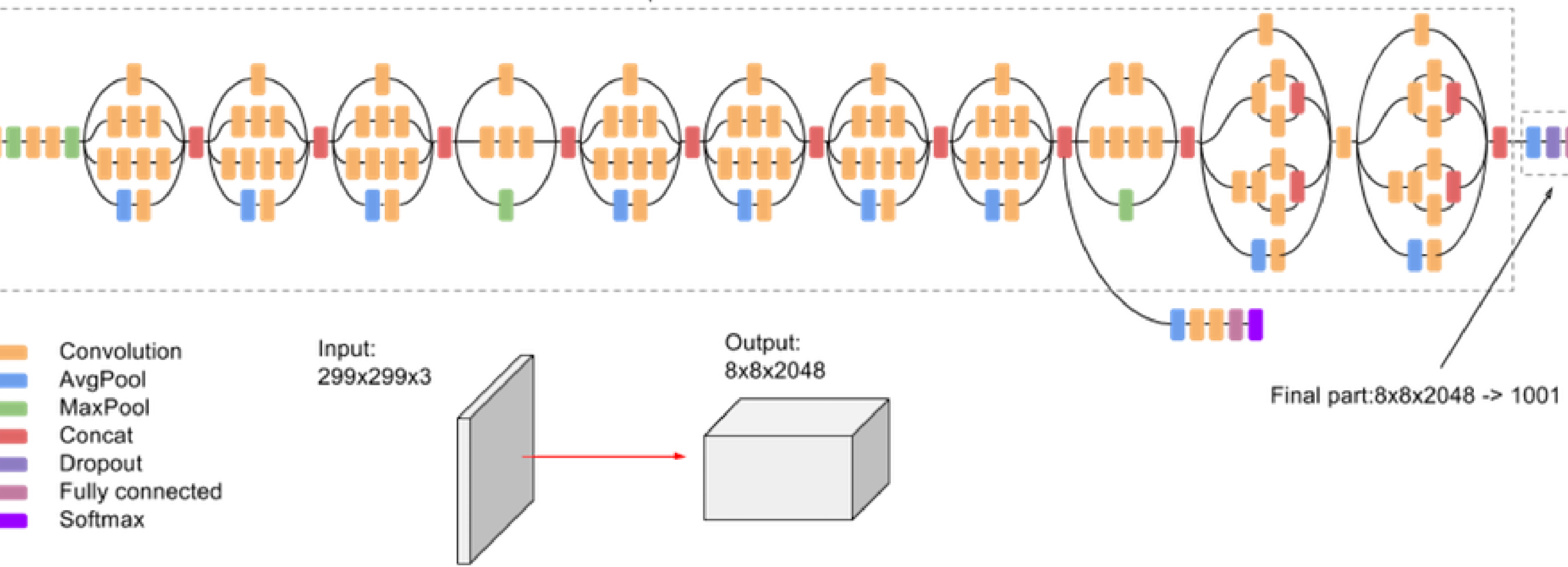
DATASET

The dataset used for this current work is from the brain tumor classification MRI dataset [2] this data is divided into four different classes and its distribution is 29.5 for meningioma tumor and 29.1 for glioma tumor and 14.1 for normal and 27.3 for pituitary tumor A Brain tumor is considered as one of the aggressive diseases, among children and adults. Brain tumors account for 85 topercent of all primary (CNS) tumors.

METHODOLOGY

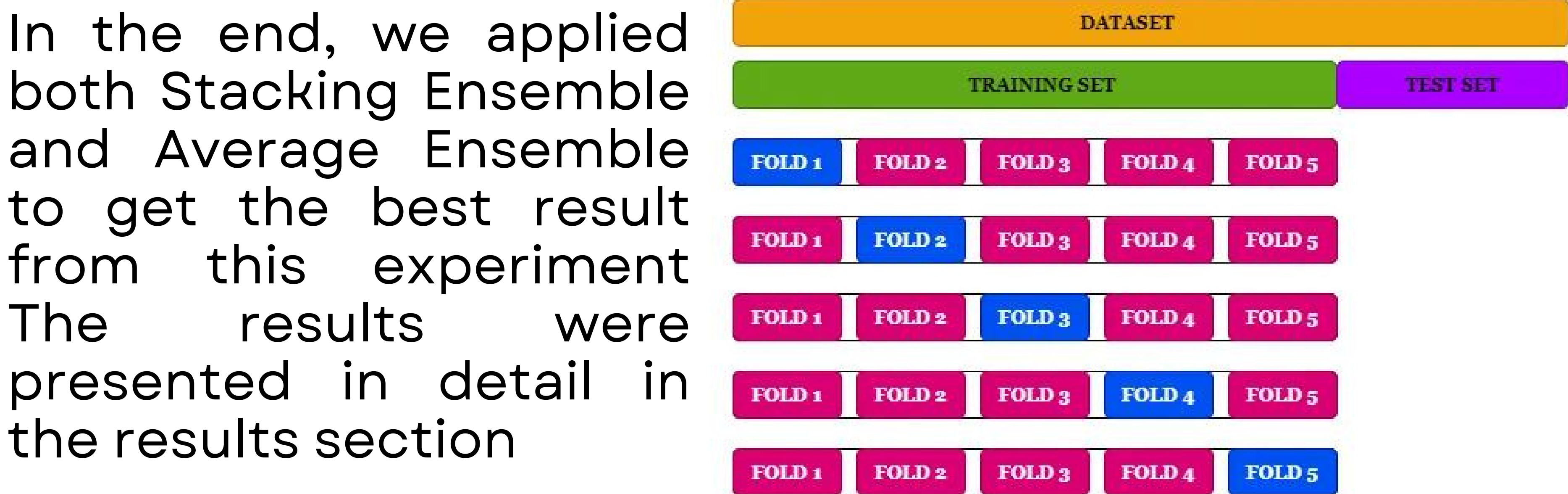
In our approach to enhancing medical images, we've used a two key filters: CLAHE [3] and Median filter better refinement as it helps in reducing any noise and irregularities, resulting in clearer and higher quality images

Using Hyperparameters tuning to git the best learning rate was 0.0001 and the kernels for dense layers were between 64 and 96 kernels.

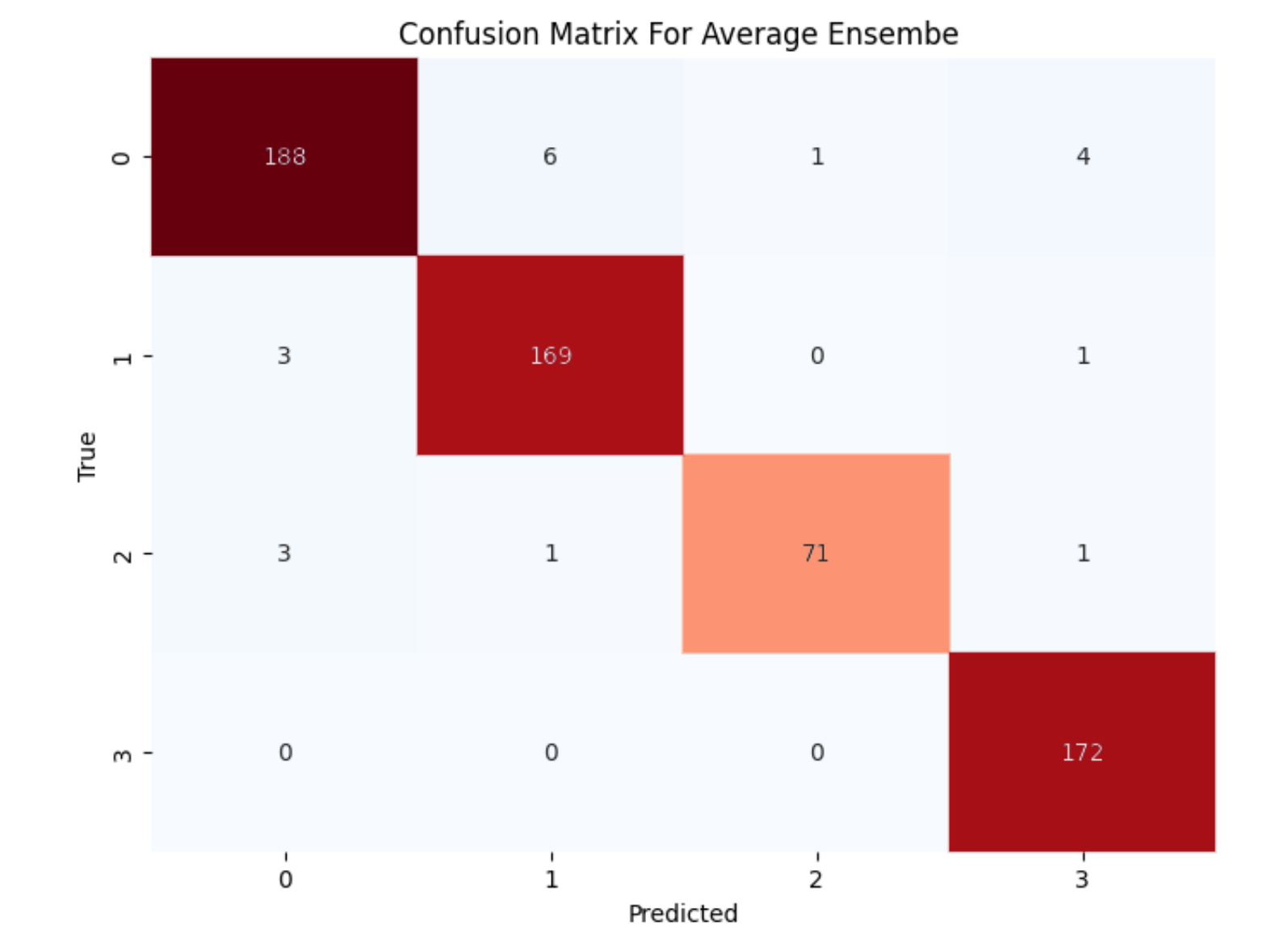
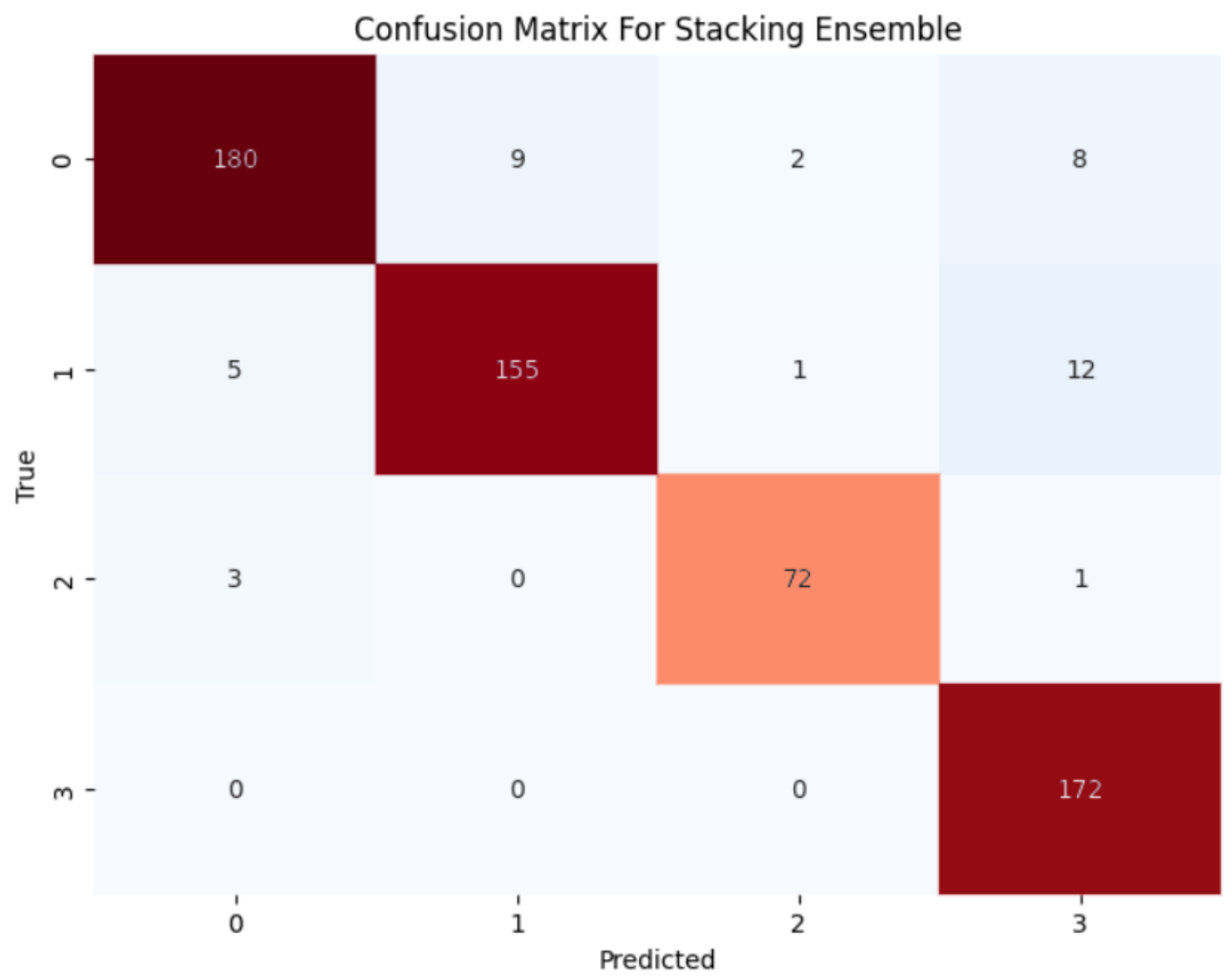


Using the Inception v3 contains 48 layers in network and trained on more than a million images from the ImageNet database [4]

We also used the Densenet 201 model and the Mobilenet V2 model, and we implemented k-Fold Cross-Validation in each model with K = 5 [5].



RESULTS



Results for Stacking Ensemble

Accuracy	F1 score	Accuracy	F1 score
0.9565	0.9554	0.9579	0.9572

Results for Average Ensemble

Accuracy	F1 score	Accuracy	F1 score
0.9677	0.9661	0.974	0.9669

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