Alzheimer's MRI Risk Predictor

Intended Use:

This model is intended to predict the user's dementia level based on an inputted MRI scan.

This model is not intended to be used in a professional medical setting. It is not for diagnosis of any kind, and it should never have the final say on any patient's case.

Training Data:

This model was trained on the Alzheimer MRI Disease Classification Dataset provided by Hack4Health. It is a publicly available dataset and does not contain any personally identifiable information. It has 5120 patients. The images in this dataset are all MRI scans from the axial view, paired with a ranking of how demented the patient is (Very Mild, Non, Moderate, Mild).

This data was put through a train/test/split where 80% of the data was for training and 20% was for validation. After this split, noise was added using the gaussian method to improve accuracy. Later, in the evaluation file the proper test data is retrieved from the test.parquet file.

Model Type:

This model is a Custom CNN (Convolutional Neural Network) model. Its inputs are 128x128 MRI grayscale images. It has three convolution layers with input shape (128,128,1) corresponding to image shape. Its filters are 32, 64, and then 128. Then the model does MaxPooling and there are two Dense layers with a softmax output layer needed to classify into four classes. The hidden layers all use 'relu' activation.

Performance:

This model performed very well with the following metrics:

- Test accuracy: 97.3%
- Weighted precision: 0.973
- Weighted recall: 0.973
- Weighted F1: 0.973

The model did the best identifying Non-Demented and Very Mild Demented classes. However, the Moderate Demented class had significantly fewer samples, causing its worse performance. The model also had the most trouble distinguishing between adjacent levels of severity such as Very Mild and Non-Demented.

The model also had a macro sensitivity of 0.939, indicating that it is very good at detecting true cases of dementia. It also had a macro specificity of 0.987 showing that it does not tend to predict false positives.

Limitations:

Alzheimer's cannot be predicted solely on one MRI slice. In order to fully predict its diagnosis, one would need multiple MRI images, as well as PET scans, cognitive scores, and clinical data. This model is only trained on one of the various aspects that contribute to Alzheimer's.

Bias and Fairness:

It is possible that this dataset is not properly representing all of the demographics of the global population. This means that performance might vary depending on age, scanner types, or methods of acquisition. These factors were not directly accounted for in training.

Ethical Concerns:

This model has the chance of predicting false positives/negatives, which, if trusted in a medical setting, could be detrimental to patients, causing unnecessary distress.

It is important to make sure data is private with this model, especially because a user is inputting their personal MRI scans that pertain to their health.

This model should only be used as a research aid and *never* as a tool or substitute for a professional medical diagnosis.