

Model Development Phase Template

Date	19 July 2024
Team ID	SWTID1720627211
Project Title	Cognitive Care: Early Intervention for Alzheimer's Disease
Maximum Marks	4 Marks

Initial Model Training Code, Model Validation and Evaluation Report

The initial model training code will be showcased in the future through a screenshot. The model validation and evaluation report will include classification reports, accuracy, and confusion matrices for multiple models, presented through respective screenshots.

Initial Model Training Code:

Xception Model

XCEPTION MODEL

```
[ ] for layer in xcep_model.layers:
    layer.trainable = False

[ ] from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import SeparableConv2D, BatchNormalization, GlobalAveragePooling2D, Dropout
custom_inception_model = Sequential([
    xcep_model,
    Dropout(0.5),
    GlobalAveragePooling2D(),
    Flatten(),
    BatchNormalization(),
    Dense(512, activation='relu'),
    BatchNormalization(),
    Dropout(0.5),
    Dense(256, activation='relu'),
    BatchNormalization(),
    Dropout(0.5),
    Dense(128, activation='relu'),
    BatchNormalization(),
    Dropout(0.5),
    Dense(64, activation='relu'),
    BatchNormalization(),
    Dropout(0.5),
    Dense(4, activation='softmax')
], name = "inception_cnn_model")
```

```
[ ] custom_inception_model.compile(
    loss='categorical_crossentropy',
    optimizer='adam',
    metrics=['accuracy']
)

[ ] train_labels_resaped = train_labels.reshape(train_data.shape[0], -1) # Reshape to (num_samples, num_classes)
    history = custom_inception_model.fit(train_data, train_labels_resaped, validation_data=(val_data, val_labels), epochs=30)
```

VGG19 Model

```
VGG19 MODEL

[ ] from tensorflow.keras.applications import VGG19
    vgg19_model = VGG19(weights='imagenet', include_top = False, input_shape = (IMG_SIZE, IMG_SIZE, 3))

[ ] for layer in vgg19_model.layers:
    layer.trainable = False

[ ] model = Sequential([
    vgg19_model,
    Flatten(),
    Dense(512, activation='relu'),
    Dropout(0.5),
    Dense(256, activation='relu'),
    Dropout(0.5),
    Dense(128, activation='relu'),
    Dropout(0.5),
    Dense(64, activation='relu'),
    Dense(4, activation='softmax')
])

[ ] model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

[ ] train_labels_resaped = train_labels.reshape(train_data.shape[0], -1) # Reshape to (num_samples, num_classes)
    history = model.fit(train_data, train_labels_resaped, validation_data=(val_data, val_labels), epochs=30)
```

Inception V3 Model

```
INCEPTION V3 MODEL

[ ] Suggested code may be subject to a license | stackoverflow.com/questions/74683647/how-to-read-inception-v3-model-summary
    from tensorflow.keras.applications import InceptionV3
    inception_model = InceptionV3(weights='imagenet', include_top = False, input_shape = (IMG_SIZE, IMG_SIZE, 3))

[ ] for layer in inception_model.layers:
    layer.trainable = False

[ ] Suggested code may be subject to a license | mhhm2005eg/CarND-Behavioral-Cloning-P3 |
    model = Sequential([
        inception_model,
        Flatten(),
        Dense(512, activation='relu'),
        Dropout(0.5),
        Dense(256, activation='relu'),
        Dropout(0.5),
        Dense(128, activation='relu'),
        Dropout(0.5),
        Dense(64, activation='relu'),
        Dense(4, activation='softmax')
    ])

[ ] model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

[ ] history = model.fit(train_data, train_labels_resaped, validation_data=(val_data, val_labels), epochs=30)
```

Model Validation and Evaluation Report:

Model	Summary	Training and Validation Performance Metrics
Xception	<pre> Model: "inception_cnn_model" ===== Layer (type) Output Shape Param # ===== xception (Functional) (None, 6, 6, 2048) 20861480 dropout (Dropout) (None, 6, 6, 2048) 0 global_average_pooling2d (GlobalAveragePooling2D) (None, 2048) 0 flatten (Flatten) (None, 2048) 0 batch_normalization_4 (BatchNormalization) (None, 2048) 8192 dense (Dense) (None, 512) 1049088 batch_normalization_5 (BatchNormalization) (None, 512) 2048 dropout_1 (Dropout) (None, 512) 0 dense_1 (Dense) (None, 256) 131328 batch_normalization_6 (BatchNormalization) (None, 256) 1024 dropout_2 (Dropout) (None, 256) 0 dense_2 (Dense) (None, 128) 32896 batch_normalization_7 (BatchNormalization) (None, 128) 512 dropout_3 (Dropout) (None, 128) 0 dense_3 (Dense) (None, 64) 8256 dropout_4 (Dropout) (None, 64) 0 batch_normalization_8 (BatchNormalization) (None, 64) 256 dense_4 (Dense) (None, 4) 260 ===== Total params: 22095340 (84.29 MB) Trainable params: 1227844 (4.68 MB) Non-trainable params: 20867496 (79.60 MB) </pre>	<pre> Epoch 1/30 205/205 [=====] - 44s 153ms/step - loss: 1.4065 - accuracy: 0.4169 - val_loss: 0.9724 - val_accuracy: 0.5082 Epoch 2/30 205/205 [=====] - 23s 114ms/step - loss: 0.9665 - accuracy: 0.5567 - val_loss: 0.7551 - val_accuracy: 0.6626 Epoch 3/30 205/205 [=====] - 24s 117ms/step - loss: 0.8244 - accuracy: 0.6219 - val_loss: 0.6636 - val_accuracy: 0.6968 Epoch 4/30 205/205 [=====] - 24s 116ms/step - loss: 0.7695 - accuracy: 0.6472 - val_loss: 0.6314 - val_accuracy: 0.7126 Epoch 5/30 205/205 [=====] - 24s 116ms/step - loss: 0.7181 - accuracy: 0.6785 - val_loss: 0.6173 - val_accuracy: 0.7029 Epoch 6/30 205/205 [=====] - 24s 120ms/step - loss: 0.6875 - accuracy: 0.6914 - val_loss: 0.6028 - val_accuracy: 0.7161 Epoch 7/30 205/205 [=====] - 24s 117ms/step - loss: 0.6557 - accuracy: 0.7128 - val_loss: 0.5763 - val_accuracy: 0.7364 Epoch 8/30 205/205 [=====] - 23s 111ms/step - loss: 0.6331 - accuracy: 0.7204 - val_loss: 0.5685 - val_accuracy: 0.7492 Epoch 9/30 205/205 [=====] - 24s 116ms/step - loss: 0.6066 - accuracy: 0.7412 - val_loss: 0.5378 - val_accuracy: 0.7590 Epoch 10/30 205/205 [=====] - 24s 117ms/step - loss: 0.5861 - accuracy: 0.7516 - val_loss: 0.5175 - val_accuracy: 0.7743 Epoch 11/30 205/205 [=====] - 23s 111ms/step - loss: 0.5654 - accuracy: 0.7584 - val_loss: 0.5000 - val_accuracy: 0.7761 Epoch 12/30 205/205 [=====] - 23s 111ms/step - loss: 0.5417 - accuracy: 0.7696 - val_loss: 0.4878 - val_accuracy: 0.7883 Epoch 13/30 205/205 [=====] - 23s 112ms/step - loss: 0.5241 - accuracy: 0.7803 - val_loss: 0.4690 - val_accuracy: 0.7871 Epoch 14/30 205/205 [=====] - 23s 112ms/step - loss: 0.5055 - accuracy: 0.7948 - val_loss: 0.4711 - val_accuracy: 0.8011 </pre>
Vgg19	<pre> Model: "sequential" ===== Layer (type) Output Shape Param # ===== vgg19 (Functional) (None, 5, 5, 512) 20024384 flatten (Flatten) (None, 12800) 0 dense (Dense) (None, 512) 6554112 dropout (Dropout) (None, 512) 0 dense_1 (Dense) (None, 256) 131328 dropout_1 (Dropout) (None, 256) 0 dense_2 (Dense) (None, 128) 32896 dropout_2 (Dropout) (None, 128) 0 dense_3 (Dense) (None, 64) 8256 dense_4 (Dense) (None, 4) 260 ===== Total params: 26751236 (102.95 MB) Trainable params: 6726852 (25.66 MB) Non-trainable params: 20024384 (76.39 MB) </pre>	<pre> Epoch 1/30 205/205 [=====] - 48s 182ms/step - loss: 1.5782 - accuracy: 0.2635 - val_loss: 1.3864 - val_accuracy: 0.2508 Epoch 2/30 205/205 [=====] - 27s 134ms/step - loss: 1.3864 - accuracy: 0.2570 - val_loss: 1.3864 - val_accuracy: 0.2495 Epoch 3/30 205/205 [=====] - 28s 136ms/step - loss: 1.3865 - accuracy: 0.2466 - val_loss: 1.3863 - val_accuracy: 0.2495 Epoch 4/30 205/205 [=====] - 28s 135ms/step - loss: 1.3864 - accuracy: 0.2484 - val_loss: 1.3864 - val_accuracy: 0.2495 Epoch 5/30 205/205 [=====] - 28s 135ms/step - loss: 1.3866 - accuracy: 0.2492 - val_loss: 1.3863 - val_accuracy: 0.2502 Epoch 6/30 205/205 [=====] - 28s 135ms/step - loss: 1.3864 - accuracy: 0.2552 - val_loss: 1.3864 - val_accuracy: 0.2495 Epoch 7/30 205/205 [=====] - 28s 135ms/step - loss: 1.3865 - accuracy: 0.2568 - val_loss: 1.3863 - val_accuracy: 0.2502 Epoch 8/30 205/205 [=====] - 32s 159ms/step - loss: 1.3868 - accuracy: 0.2523 - val_loss: 1.3867 - val_accuracy: 0.2508 Epoch 9/30 205/205 [=====] - 33s 159ms/step - loss: 1.3868 - accuracy: 0.2478 - val_loss: 1.3865 - val_accuracy: 0.2502 Epoch 10/30 205/205 [=====] - 28s 136ms/step - loss: 1.3867 - accuracy: 0.2426 - val_loss: 1.3865 - val_accuracy: 0.2502 Epoch 11/30 205/205 [=====] - 33s 159ms/step - loss: 1.3865 - accuracy: 0.2539 - val_loss: 1.3863 - val_accuracy: 0.2508 Epoch 12/30 205/205 [=====] - 33s 159ms/step - loss: 1.3863 - accuracy: 0.2542 - val_loss: 1.3865 - val_accuracy: 0.2495 Epoch 13/30 205/205 [=====] - 28s 136ms/step - loss: 1.3867 - accuracy: 0.2529 - val_loss: 1.3864 - val_accuracy: 0.2495 Epoch 14/30 205/205 [=====] - 32s 159ms/step - loss: 1.3870 - accuracy: 0.2413 - val_loss: 1.3864 - val_accuracy: 0.2495 Epoch 15/30 205/205 [=====] - 33s 159ms/step - loss: 1.3866 - accuracy: 0.2414 - val_loss: 1.3863 - val_accuracy: 0.2495 Epoch 16/30 205/205 [=====] - 33s 159ms/step - loss: 1.3867 - accuracy: 0.2367 - val_loss: 1.3863 - val_accuracy: 0.2495 Epoch 17/30 205/205 [=====] - 33s 160ms/step - loss: 1.3867 - accuracy: 0.2523 - val_loss: 1.3864 - val_accuracy: 0.2495 </pre>

Inception V3

```

model: 'sequential'
=====
Layer (type)                Output Shape              Param #
=====
inception_v3 (Functional)    (None, 4, 4, 2048)        21802784

flatten (Flatten)            (None, 32768)              0

dense (Dense)                (None, 512)                16777728

dropout (Dropout)            (None, 512)                0

dense_1 (Dense)              (None, 256)                131328

dropout_1 (Dropout)          (None, 256)                0

dense_2 (Dense)              (None, 128)                32896

dropout_2 (Dropout)          (None, 128)                0

dense_3 (Dense)              (None, 64)                 8256

dense_4 (Dense)              (None, 4)                  260
=====
Total params: 38753252 (147.83 MB)
Trainable params: 16950468 (64.66 MB)
Non-trainable params: 21802784 (83.17 MB)

```

```

Epoch 1/30
205/205 [=====] - 32s 97ms/step - loss: 4.1756 - accuracy: 0.2550 - val_loss: 1.3861 - val_accuracy: 0.2550
Epoch 2/30
205/205 [=====] - 12s 61ms/step - loss: 1.3888 - accuracy: 0.2420 - val_loss: 1.3856 - val_accuracy: 0.2569
Epoch 3/30
205/205 [=====] - 13s 62ms/step - loss: 1.3851 - accuracy: 0.2425 - val_loss: 1.3789 - val_accuracy: 0.2624
Epoch 4/30
205/205 [=====] - 13s 63ms/step - loss: 1.3879 - accuracy: 0.2480 - val_loss: 1.3863 - val_accuracy: 0.2495
Epoch 5/30
205/205 [=====] - 13s 63ms/step - loss: 1.3865 - accuracy: 0.2480 - val_loss: 1.3864 - val_accuracy: 0.2495
Epoch 6/30
205/205 [=====] - 13s 61ms/step - loss: 1.3866 - accuracy: 0.2448 - val_loss: 1.3863 - val_accuracy: 0.2495
Epoch 7/30
205/205 [=====] - 13s 63ms/step - loss: 1.3865 - accuracy: 0.2428 - val_loss: 1.3863 - val_accuracy: 0.2495
Epoch 8/30
205/205 [=====] - 13s 63ms/step - loss: 1.3865 - accuracy: 0.2442 - val_loss: 1.3865 - val_accuracy: 0.2495
Epoch 9/30
205/205 [=====] - 13s 65ms/step - loss: 1.3865 - accuracy: 0.2509 - val_loss: 1.3864 - val_accuracy: 0.2582
Epoch 10/30
205/205 [=====] - 13s 64ms/step - loss: 1.3864 - accuracy: 0.2429 - val_loss: 1.3863 - val_accuracy: 0.2495
Epoch 11/30
205/205 [=====] - 13s 64ms/step - loss: 1.3865 - accuracy: 0.2417 - val_loss: 1.3864 - val_accuracy: 0.2495
Epoch 12/30
205/205 [=====] - 13s 65ms/step - loss: 1.3865 - accuracy: 0.2468 - val_loss: 1.3864 - val_accuracy: 0.2495
Epoch 13/30
205/205 [=====] - 13s 64ms/step - loss: 1.3864 - accuracy: 0.2529 - val_loss: 1.3864 - val_accuracy: 0.2495
Epoch 14/30
205/205 [=====] - 13s 64ms/step - loss: 1.3864 - accuracy: 0.2489 - val_loss: 1.3863 - val_accuracy: 0.2582
Epoch 15/30
205/205 [=====] - 13s 63ms/step - loss: 1.3866 - accuracy: 0.2457 - val_loss: 1.3863 - val_accuracy: 0.2582
Epoch 16/30
205/205 [=====] - 13s 65ms/step - loss: 1.3863 - accuracy: 0.2477 - val_loss: 1.3864 - val_accuracy: 0.2495
Epoch 17/30
205/205 [=====] - 13s 63ms/step - loss: 1.3863 - accuracy: 0.2524 - val_loss: 1.3864 - val_accuracy: 0.2495

```