

Model Development Phase Template

Date	10 JULY 2024
Team ID	SWTID1720111029
Project Title	Unveiling Climate Change Dynamics through Earth Surface Temperature Analysis
Maximum Marks	10 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 a summary and training and validation performance metrics for multiple models, presented through respective screenshots.

Initial Model Training Code (5 marks):

```
from keras.models import Sequential
from keras.layers import Dense, LSTM, Input

model = Sequential()
model.add(Input(shape=(X_train_scaled.shape[1], 1)))
model.add(LSTM(128, return_sequences=True))
model.add(LSTM(64, return_sequences=False))
model.add(Dense(25))
model.add(Dense(1))
model.compile(optimizer='adam', loss='mean_squared_error')

model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
lstm (LSTM)	(None, 9, 128)	66,560
lstm_1 (LSTM)	(None, 64)	49,408
dense (Dense)	(None, 25)	1,625
dense_1 (Dense)	(None, 1)	26

Total params: 117,619 (459.45 KB)
Trainable params: 117,619 (459.45 KB)
Non-trainable params: 0 (0.00 B)

[5]:

```
# Train the model
history = model.fit(X_train_scaled, y_train_scaled, epochs=100, batch_size=32, validation_split=0.2,verbose=2)
```

Epoch 92/100
40/40 - 0s - 8ms/step - loss: 0.0021 - val_loss: 0.0033
Epoch 93/100
40/40 - 0s - 7ms/step - loss: 0.0020 - val_loss: 0.0024
Epoch 94/100
40/40 - 0s - 8ms/step - loss: 0.0022 - val_loss: 0.0026
Epoch 95/100
40/40 - 0s - 7ms/step - loss: 0.0019 - val_loss: 0.0025
Epoch 96/100
40/40 - 0s - 7ms/step - loss: 0.0021 - val_loss: 0.0025
Epoch 97/100
40/40 - 0s - 7ms/step - loss: 0.0020 - val_loss: 0.0023
Epoch 98/100
40/40 - 0s - 7ms/step - loss: 0.0021 - val_loss: 0.0024
Epoch 99/100
40/40 - 0s - 8ms/step - loss: 0.0019 - val_loss: 0.0036
Epoch 100/100
40/40 - 0s - 7ms/step - loss: 0.0021 - val_loss: 0.0023

Model Validation and Evaluation Report (5 marks):

Model	Summary	Training and Validation Performance Metrics																		
Model 1 RNN	<div>Model: "sequential"</div> <table><thead><tr><th>Layer (type)</th><th>Output Shape</th><th>Param #</th></tr></thead><tbody><tr><td>simple_rnn (SimpleRNN)</td><td>(None, 9, 100)</td><td>10,200</td></tr><tr><td>dropout (Dropout)</td><td>(None, 9, 100)</td><td>0</td></tr><tr><td>simple_rnn_1 (SimpleRNN)</td><td>(None, 100)</td><td>20,100</td></tr><tr><td>dropout_1 (Dropout)</td><td>(None, 100)</td><td>0</td></tr><tr><td>dense (Dense)</td><td>(None, 1)</td><td>101</td></tr></tbody></table> <div>Total params: 30,401 (118.75 KB) Trainable params: 30,401 (118.75 KB) Non-trainable params: 0 (0.00 B)</div>	Layer (type)	Output Shape	Param #	simple_rnn (SimpleRNN)	(None, 9, 100)	10,200	dropout (Dropout)	(None, 9, 100)	0	simple_rnn_1 (SimpleRNN)	(None, 100)	20,100	dropout_1 (Dropout)	(None, 100)	0	dense (Dense)	(None, 1)	101	<div>Epoch 95/100 40/40 - 0s - 5ms/step - loss: 0.0011 - val_loss: 2.3302e-04 Epoch 96/100 40/40 - 0s - 5ms/step - loss: 0.0012 - val_loss: 2.0587e-04 Epoch 97/100 40/40 - 0s - 5ms/step - loss: 0.0012 - val_loss: 4.7437e-04 Epoch 98/100 40/40 - 0s - 4ms/step - loss: 0.0010 - val_loss: 2.5463e-04 Epoch 99/100 40/40 - 0s - 4ms/step - loss: 0.0011 - val_loss: 9.2723e-04 Epoch 100/100 40/40 - 0s - 5ms/step - loss: 0.0011 - val_loss: 6.8474e-04</div>
Layer (type)	Output Shape	Param #																		
simple_rnn (SimpleRNN)	(None, 9, 100)	10,200																		
dropout (Dropout)	(None, 9, 100)	0																		
simple_rnn_1 (SimpleRNN)	(None, 100)	20,100																		
dropout_1 (Dropout)	(None, 100)	0																		
dense (Dense)	(None, 1)	101																		

Model 2
GRU

Model: "sequential"		
Layer (type)	Output Shape	Param #
gru (GRU)	(None, 9, 100)	30,900
dropout (Dropout)	(None, 9, 100)	0
gru_1 (GRU)	(None, 100)	60,600
dropout_1 (Dropout)	(None, 100)	0
dense (Dense)	(None, 1)	101
Total params: 91,601 (357.82 KB)		
Trainable params: 91,601 (357.82 KB)		
Non-trainable params: 0 (0.00 B)		

Epoch 95/100
40/40 - 0s - 9ms/step - loss: 0.0019 - val_loss: 8.8830e-04
Epoch 96/100
40/40 - 0s - 8ms/step - loss: 0.0018 - val_loss: 9.6317e-04
Epoch 97/100
40/40 - 0s - 8ms/step - loss: 0.0017 - val_loss: 9.4827e-04
Epoch 98/100
40/40 - 0s - 8ms/step - loss: 0.0018 - val_loss: 0.0013
Epoch 99/100
40/40 - 0s - 9ms/step - loss: 0.0020 - val_loss: 8.4683e-04
Epoch 100/100
40/40 - 0s - 9ms/step - loss: 0.0016 - val_loss: 8.2268e-04

Model 3
LSTM

Model: "sequential"		
Layer (type)	Output Shape	Param #
lstm (LSTM)	(None, 9, 128)	66,560
lstm_1 (LSTM)	(None, 64)	49,408
dense (Dense)	(None, 25)	1,625
dense_1 (Dense)	(None, 1)	26
Total params: 117,619 (459.45 KB)		
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Epoch 95/100
40/40 - 0s - 7ms/step - loss: 0.0019 - val_loss: 0.0025
Epoch 96/100
40/40 - 0s - 7ms/step - loss: 0.0021 - val_loss: 0.0025
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