

CODE:-

```
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.optimizers import Adam
import numpy as np

np.random.seed(0)
X = np.random.random((100, 10))
y = np.random.randint(2, size=(100,))

from tensorflow.keras.utils import to_categorical
y = to_categorical(y, num_classes=2)

from sklearn.model_selection import train_test_split
X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.2,
random_state=42)

model = Sequential([
Dense(64, activation='relu', input_shape=(X_train.shape[1],), use_bias=True),
Dense(32, activation='relu', use_bias=True),
Dense(2, activation='softmax', use_bias=True)
])

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

class CustomCallback(tf.keras.callbacks.Callback):
def on_epoch_begin(self, epoch, logs=None):
self.initial_weights = {layer.name: layer.get_weights() for layer in
self.model.layers}

def on_epoch_end(self, epoch, logs=None):
print(f"\nEpoch {epoch + 1}")
for layer in self.model.layers:
layer_name = layer.name
initial_weights = self.initial_weights[layer_name]
current_weights = layer.get_weights()

print(f"\nLayer: {layer_name}")
print(f"Initial Weights Shape: {np.shape(initial_weights[0])}")
print(f"Updated Weights Shape: {np.shape(current_weights[0])}")
print(f"Initial Biases Shape: {np.shape(initial_weights[1])}")
```

```

print(f"Updated Biases Shape: {np.shape(current_weights[1])}")

print(f"Initial Weights (first 5 values):\n{initial_weights[0].flatten()[:5]}")
print(f"Updated Weights (first 5 values):\n{current_weights[0].flatten()[:5]}")
print(f"Initial Biases (first 5 values):\n{initial_weights[1].flatten()[:5]}")
print(f"Updated Biases (first 5 values):\n{current_weights[1].flatten()[:5]}")

print(f"Loss: {logs['loss']:.4f}")
print(f"Validation Loss: {logs['val_loss']:.4f}")

model.fit(X_train, y_train, epochs=5, batch_size=16, validation_data=(X_val, y_val), callbacks=[CustomCallback()])

```

OUTPUT:-

Epoch 1/5

1/5 ————— **4s** 1s/step - accuracy: 0.3125 - loss: 0.7215

Epoch 1

Layer: dense_27

Initial Weights Shape: (10, 64)

Updated Weights Shape: (10, 64)

Initial Biases Shape: (64,)

Updated Biases Shape: (64,)

Initial Weights (first 5 values):

[-0.09857228 -0.1232888 0.16044897 0.27906427 -0.27461895]

Updated Weights (first 5 values):

[-0.09857228 -0.12010594 0.15720129 0.28003064 -0.2783087]

Initial Biases (first 5 values):

[0. 0. 0. 0. 0.]

Updated Biases (first 5 values):

[0.0000000e+00 -7.6003448e-04 -4.3661855e-03 -3.2958938e-05
-3.8514147e-03]

Layer: dense_28

Initial Weights Shape: (64, 32)

Updated Weights Shape: (64, 32)

Initial Biases Shape: (32,)

Updated Biases Shape: (32,)

Initial Weights (first 5 values):

[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]

Updated Weights (first 5 values):

[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]

Initial Biases (first 5 values):

[0. 0. 0. 0. 0.]

Updated Biases (first 5 values):

[-1.0130182e-04 -3.1142052e-05 -1.5106679e-04 -8.9727994e-04
-3.9741467e-04]

Layer: dense_29

Initial Weights Shape: (32, 2)
Updated Weights Shape: (32, 2)
Initial Biases Shape: (2,)
Updated Biases Shape: (2,)
Initial Weights (first 5 values):
[-0.4047172 -0.41059595 -0.12425593 -0.08877683 -0.13896272]
Updated Weights (first 5 values):
[-0.402993 -0.41232017 -0.12491003 -0.08812273 -0.13787214]
Initial Biases (first 5 values):
[0. 0.]
Updated Biases (first 5 values):
[0.00025818 -0.00025818]
Loss: 0.6960
Validation Loss: 0.6866
5/5 ————— **1s** 62ms/step - accuracy: 0.4543 - loss: 0.6980 - val_accuracy:
0.5500 - val_loss: 0.6866
Epoch 2/5
1/5 ————— **0s** 25ms/step - accuracy: 0.6250 - loss: 0.6665
Epoch 2

Layer: dense_27
Initial Weights Shape: (10, 64)
Updated Weights Shape: (10, 64)
Initial Biases Shape: (64,)
Updated Biases Shape: (64,)
Initial Weights (first 5 values):
[-0.09857228 -0.12010594 0.15720129 0.28003064 -0.2783087]
Updated Weights (first 5 values):
[-0.09857228 -0.11886251 0.15614279 0.28065544 -0.2785348]
Initial Biases (first 5 values):
[0.0000000e+00 -7.6003448e-04 -4.3661855e-03 -3.2958938e-05
-3.8514147e-03]
Updated Biases (first 5 values):
[0. 0.00136704 -0.00635329 -0.00027592 -0.00628769]

Layer: dense_28
Initial Weights Shape: (64, 32)
Updated Weights Shape: (64, 32)
Initial Biases Shape: (32,)
Updated Biases Shape: (32,)
Initial Weights (first 5 values):
[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]
Updated Weights (first 5 values):
[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]
Initial Biases (first 5 values):
[-1.0130182e-04 -3.1142052e-05 -1.5106679e-04 -8.9727994e-04
-3.9741467e-04]
Updated Biases (first 5 values):
[-3.5633976e-04 -9.7989287e-06 -1.4236982e-03 -1.6212421e-03
7.2553556e-04]

Layer: dense_29
Initial Weights Shape: (32, 2)
Updated Weights Shape: (32, 2)
Initial Biases Shape: (2,)

Updated Biases Shape: (2,)
Initial Weights (first 5 values):
[-0.402993 -0.41232017 -0.12491003 -0.08812273 -0.13787214]
Updated Weights (first 5 values):
[-0.4046599 -0.41065326 -0.12686048 -0.0861723 -0.13632394]
Initial Biases (first 5 values):
[0.00025818 -0.00025818]
Updated Biases (first 5 values):
[0.00059643 -0.00059643]
Loss: 0.6880
Validation Loss: 0.6896
5/5 ————— **0s** 14ms/step - accuracy: 0.5490 - loss: 0.6861 - val_accuracy:
0.5500 - val_loss: 0.6896
Epoch 3/5
1/5 ————— **0s** 24ms/step - accuracy: 0.5625 - loss: 0.6846
Epoch 3

Layer: dense_27
Initial Weights Shape: (10, 64)
Updated Weights Shape: (10, 64)
Initial Biases Shape: (64,)
Updated Biases Shape: (64,)
Initial Weights (first 5 values):
[-0.09857228 -0.11886251 0.15614279 0.28065544 -0.2785348]
Updated Weights (first 5 values):
[-0.09857228 -0.11692201 0.15690728 0.28174922 -0.27790475]
Initial Biases (first 5 values):
[0. 0.00136704 -0.00635329 -0.00027592 -0.00628769]
Updated Biases (first 5 values):
[0.0000000e+00 3.7960780e-03 -7.2228438e-03 2.3524262e-06
-8.8566830e-03]

Layer: dense_28
Initial Weights Shape: (64, 32)
Updated Weights Shape: (64, 32)
Initial Biases Shape: (32,)
Updated Biases Shape: (32,)
Initial Weights (first 5 values):
[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]
Updated Weights (first 5 values):
[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]
Initial Biases (first 5 values):
[-3.5633976e-04 -9.7989287e-06 -1.4236982e-03 -1.6212421e-03
7.2553556e-04]
Updated Biases (first 5 values):
[-8.4881246e-04 -1.4367251e-06 -2.0389566e-03 -1.7682720e-03
1.3612115e-03]

Layer: dense_29
Initial Weights Shape: (32, 2)
Updated Weights Shape: (32, 2)
Initial Biases Shape: (2,)
Updated Biases Shape: (2,)
Initial Weights (first 5 values):
[-0.4046599 -0.41065326 -0.12686048 -0.0861723 -0.13632394]

Updated Weights (first 5 values):
[-0.40668532 -0.40862784 -0.1279226 -0.08511018 -0.1352076]
Initial Biases (first 5 values):
[0.00059643 -0.00059643]
Updated Biases (first 5 values):
[0.00056607 -0.00056607]
Loss: 0.6810
Validation Loss: 0.6918
5/5 ————— **0s** 14ms/step - accuracy: 0.5465 - loss: 0.6831 - val_accuracy:
0.6000 - val_loss: 0.6918
Epoch 4/5
1/5 ————— **0s** 36ms/step - accuracy: 0.6250 - loss: 0.6620
Epoch 4

Layer: dense_27
Initial Weights Shape: (10, 64)
Updated Weights Shape: (10, 64)
Initial Biases Shape: (64,)
Updated Biases Shape: (64,)
Initial Weights (first 5 values):
[-0.09857228 -0.11692201 0.15690728 0.28174922 -0.27790475]
Updated Weights (first 5 values):
[-0.09857228 -0.11604892 0.15718424 0.28190205 -0.27758044]
Initial Biases (first 5 values):
[0.0000000e+00 3.7960780e-03 -7.2228438e-03 2.3524262e-06
-8.8566830e-03]
Updated Biases (first 5 values):
[0. 0.00556996 -0.00851996 -0.00079286 -0.01135337]

Layer: dense_28
Initial Weights Shape: (64, 32)
Updated Weights Shape: (64, 32)
Initial Biases Shape: (32,)
Updated Biases Shape: (32,)
Initial Weights (first 5 values):
[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]
Updated Weights (first 5 values):
[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]
Initial Biases (first 5 values):
[-8.4881246e-04 -1.4367251e-06 -2.0389566e-03 -1.7682720e-03
1.3612115e-03]
Updated Biases (first 5 values):
[-0.00102984 -0.00088209 -0.00271011 -0.0026105 0.00261355]

Layer: dense_29
Initial Weights Shape: (32, 2)
Updated Weights Shape: (32, 2)
Initial Biases Shape: (2,)
Updated Biases Shape: (2,)
Initial Weights (first 5 values):
[-0.40668532 -0.40862784 -0.1279226 -0.08511018 -0.1352076]
Updated Weights (first 5 values):
[-0.40867338 -0.40663978 -0.12840547 -0.08462732 -0.13416927]
Initial Biases (first 5 values):
[0.00056607 -0.00056607]

Updated Biases (first 5 values):

[0.00146736 -0.00146736]

Loss: 0.6766

Validation Loss: 0.6932

5/5 ————— **0s** 14ms/step - accuracy: 0.5708 - loss: 0.6718 - val_accuracy: 0.5500 - val_loss: 0.6932

Epoch 5/5

1/5 ————— **0s** 76ms/step - accuracy: 0.5000 - loss: 0.6546

Epoch 5

Layer: dense_27

Initial Weights Shape: (10, 64)

Updated Weights Shape: (10, 64)

Initial Biases Shape: (64,)

Updated Biases Shape: (64,)

Initial Weights (first 5 values):

[-0.09857228 -0.11604892 0.15718424 0.28190205 -0.27758044]

Updated Weights (first 5 values):

[-0.09857228 -0.11486574 0.15797628 0.28289467 -0.27734032]

Initial Biases (first 5 values):

[0. 0.00556996 -0.00851996 -0.00079286 -0.01135337]

Updated Biases (first 5 values):

[0. 0.00768869 -0.00938975 -0.00089179 -0.0127574]

Layer: dense_28

Initial Weights Shape: (64, 32)

Updated Weights Shape: (64, 32)

Initial Biases Shape: (32,)

Updated Biases Shape: (32,)

Initial Weights (first 5 values):

[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]

Updated Weights (first 5 values):

[0.18822491 -0.12701643 -0.1984387 -0.18967903 0.07061493]

Initial Biases (first 5 values):

[-0.00102984 -0.00088209 -0.00271011 -0.0026105 0.00261355]

Updated Biases (first 5 values):

[-0.00111277 -0.00062767 -0.00339557 -0.00268953 0.00318018]

Layer: dense_29

Initial Weights Shape: (32, 2)

Updated Weights Shape: (32, 2)

Initial Biases Shape: (2,)

Updated Biases Shape: (2,)

Initial Weights (first 5 values):

[-0.40867338 -0.40663978 -0.12840547 -0.08462732 -0.13416927]

Updated Weights (first 5 values):

[-0.41083416 -0.404479 -0.12951146 -0.08352133 -0.13301758]

Initial Biases (first 5 values):

[0.00146736 -0.00146736]

Updated Biases (first 5 values):

[0.00141123 -0.00141123]

Loss: 0.6717

Validation Loss: 0.6955

5/5 ————— **0s** 23ms/step - accuracy: 0.5247 - loss: 0.6687 - val_accuracy: 0.5500 - val_loss: 0.6955

<keras.src.callbacks.history.History at 0x7e4319dde380>