Build a CNN Based Classifier for Classifying the Objects using CIFAR100 Dataset.

Requirements:

- Seven Number of Convolutional 2D Layers starting with 1024 filters.
- Kernel size 3 x 3
- Two Average Pooling Layers, in the sixth and seventh Convolutional Layer.
- Stride 2
- Padding ‘0’
- Optimizer Adam
- Loss function catagorical_crossentropy

```
import tensorflow as tf
from tensorflow.keras.datasets import cifar100
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, AveragePooling2D, Flatten, Dense
from sklearn.metrics import confusion_matrix, classification_report
from tensorflow.keras.utils import to_categorical
import matplotlib.pyplot as plt
```

```
# Load CIFAR-100 dataset
(train_images, train_labels), (test_images, test_labels) = cifar100.load_data()
```

```
Downloading data from https://www.cs.toronto.edu/~kriz/cifar-100-python.tar.gz
169001437/169001437 [==============================] - 3s 0us/step
```

```
# Data Preprocessing (Normalization)
train_images = train_images.astype('float32')
test_images = test_images.astype('float32')
train_images /= 255.0
test_images /= 255.0
```

```
# One-hot encode labels
train_labels = to_categorical(train_labels)
test_labels = to_categorical(test_labels)
```

```
print(train_images.shape[1:])
```

```
(32, 32, 3)
```

```
# Create a Sequential model
model = Sequential()

# First convolutional layer
model.add(Conv2D(1024, kernel_size=(3, 3), activation='relu', input_shape=(32, 32, 3)))

# Second convolutional layer
model.add(Conv2D(512, kernel_size=(3, 3), activation='relu'))

# Third convolutional layer
model.add(Conv2D(256, kernel_size=(3, 3), activation='relu'))

# Fourth convolutional layer
model.add(Conv2D(128, kernel_size=(3, 3), activation='relu'))

# Fifth convolutional layer
model.add(Conv2D(64, kernel_size=(3, 3), activation='relu'))

# Sixth convolutional layer
model.add(Conv2D(32, kernel_size=(3, 3), activation='relu'))

# First pooling layer
model.add(AveragePooling2D(pool_size=(2, 2), strides=2, padding='same'))

# Seventh convolutional layer
model.add(Conv2D(16, kernel_size=(3, 3), activation='relu'))

# Second pooling layer
model.add(AveragePooling2D(pool_size=(2, 2), strides=2, padding='same'))

# Flatten the output of the convolutional layers
model.add(Flatten())

# Dense layer with 100 output units and softmax activation
model.add(Dense(100, activation='softmax'))
```

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

```
# Train the model
history=model.fit(train_images, train_labels, epochs=5, batch_size=32, validation_data=(test_images, test_labels))
```

```
Epoch 1/5
1563/1563 [==============================] - 139s 88ms/step - loss: 4.2373 - accuracy: 0.0529 - val_loss: 3.9060 - val_accuracy: 0.
Epoch 2/5
1563/1563 [==============================] - 138s 88ms/step - loss: 3.6936 - accuracy: 0.1361 - val_loss: 3.5591 - val_accuracy: 0.
Epoch 3/5
1563/1563 [==============================] - 136s 87ms/step - loss: 3.3681 - accuracy: 0.1996 - val_loss: 3.3197 - val_accuracy: 0.
Epoch 4/5
1563/1563 [==============================] - 138s 88ms/step - loss: 3.1265 - accuracy: 0.2441 - val_loss: 3.1516 - val_accuracy: 0.
Epoch 5/5
1563/1563 [==============================] - 136s 87ms/step - loss: 2.9585 - accuracy: 0.2779 - val_loss: 3.0136 - val_accuracy: 0.
```

```
# Evaluate the model on the test set
test_loss, test_acc = model.evaluate(test_images, test_labels)
print('Test accuracy:', test_acc)
```

```
313/313 [==============================] - 8s 27ms/step - loss: 3.0136 - accuracy: 0.2662
Test accuracy: 0.2662000060081482
```

```
# Make predictions on the test set
predictions = model.predict(test_images)
```

```
313/313 [==============================] - 8s 26ms/step
```

```
# Calculate confusion matrix
cm = confusion_matrix(test_labels.argmax(axis=1), predictions.argmax(axis=1))
print('Confusion Matrix:\n', cm)
```

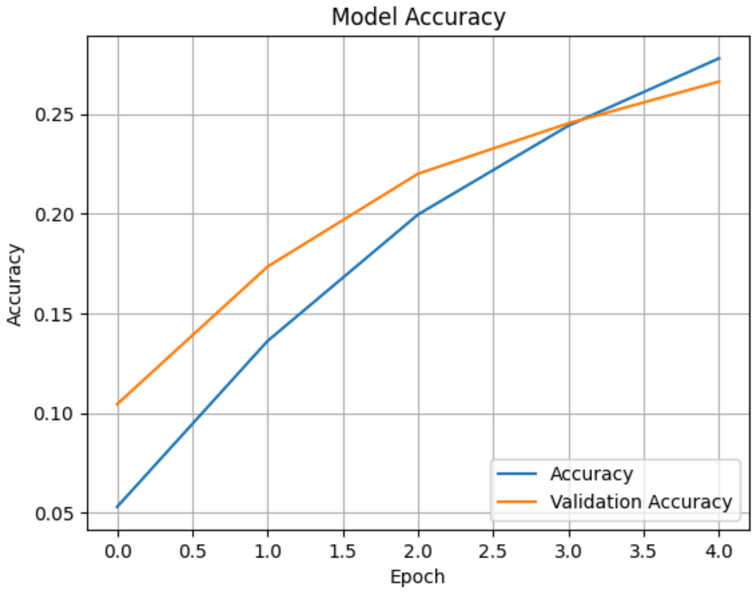
```
Confusion Matrix:
 [[42  1  2 ...  0  0  0]
 [ 1 27  1 ...  0  1  1]
 [ 1  1 16 ...  3  2  1]
 ...
 [ 0  0  0 ... 45  0  0]
 [ 2  0  5 ...  1  6  1]
 [ 1  0  1 ...  3  0  6]]
```

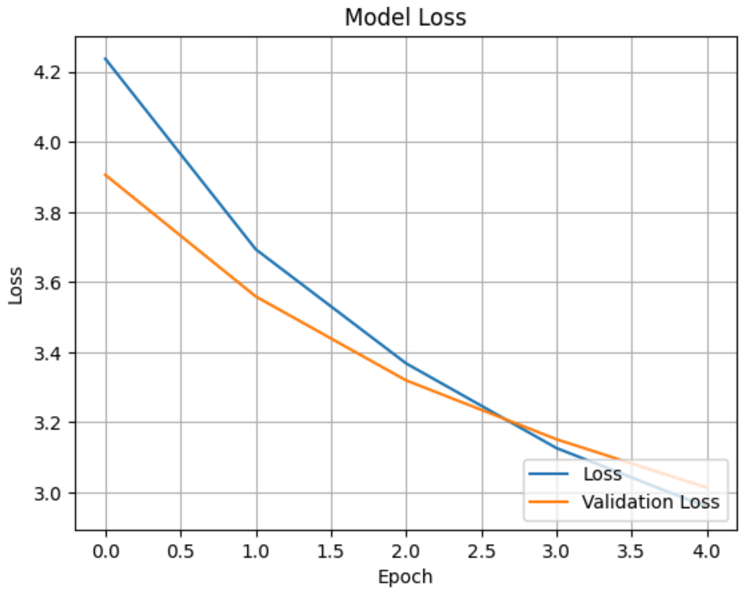
```
# Generate classification report
print('Classification Report:\n', classification_report(test_labels.argmax(axis=1), predictions.argmax(axis=1)))
```

Show hidden output

```
# Plot accuracy and loss curves
plt.plot(history.history['accuracy'], label='Accuracy')
plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
plt.title('Model Accuracy')
plt.ylabel('Accuracy')
plt.xlabel('Epoch')
plt.legend(loc='lower right')
plt.grid(True)
plt.show()

plt.plot(history.history['loss'], label='Loss')
plt.plot(history.history['val_loss'], label='Validation Loss')
plt.title('Model Loss')
plt.ylabel('Loss')
plt.xlabel('Epoch')
plt.legend(loc='lower right')
plt.grid(True)
plt.show()
```


Model Accuracy
Accuracy
0.05
0.10
0.15
0.20
0.25
Epoch
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Accuracy
Validation Accuracy


Model Loss
Loss
3.0
3.2
3.4
3.6
3.8
4.0
4.2
Epoch
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Loss
Validation Loss