

cifar-10

June 21, 2024

```
[7]: # Import necessary libraries
import tensorflow as tf
from tensorflow.keras.datasets import cifar10
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.utils import to_categorical
import matplotlib.pyplot as plt

# Load CIFAR-10 dataset
(X_train, y_train), (X_test, y_test) = cifar10.load_data()

# Normalize pixel values to be between 0 and 1
X_train = X_train / 255.0
X_test = X_test / 255.0

# Convert labels to categorical one-hot encoding
y_train = to_categorical(y_train, num_classes=10)
y_test = to_categorical(y_test, num_classes=10)

# Build CNN model
model = Sequential([
    Conv2D(32, (3, 3), activation='relu', padding='same', input_shape=(32, 32, 3)),
    MaxPooling2D((2, 2)),
    Conv2D(64, (3, 3), activation='relu', padding='same'),
    MaxPooling2D((2, 2)),
    Conv2D(128, (3, 3), activation='relu', padding='same'),
    MaxPooling2D((2, 2)),
    Flatten(),
    Dense(256, activation='relu'),
    Dropout(0.5),
    Dense(10, activation='softmax')
])

# Compile model
```

```

model.compile(optimizer=Adam(learning_rate=0.001),
    ↪loss='categorical_crossentropy', metrics=['accuracy'])

# Train model
history = model.fit(X_train, y_train, epochs=20, batch_size=128,
    ↪validation_data=(X_test, y_test), verbose=1)

# Evaluate model
loss, accuracy = model.evaluate(X_test, y_test, verbose=0)
print(f"Test Accuracy: {accuracy * 100:.2f}%")

# Plot training history
plt.figure(figsize=(10, 5))
plt.subplot(1, 2, 1)
plt.plot(history.history['accuracy'], label='Train Accuracy')
plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
plt.title('Training and Validation Accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()

plt.subplot(1, 2, 2)
plt.plot(history.history['loss'], label='Train Loss')
plt.plot(history.history['val_loss'], label='Validation Loss')
plt.title('Training and Validation Loss')
plt.xlabel('Epoch')
plt.ylabel('Loss')
plt.legend()
plt.tight_layout()
plt.show()

```

Downloading data from <https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz>
170498071/170498071 [=====] - 2s 0us/step

Epoch 1/20

391/391 [=====] - 116s 292ms/step - loss: 1.6040 -
accuracy: 0.4088 - val_loss: 1.2325 - val_accuracy: 0.5569

Epoch 2/20

391/391 [=====] - 109s 278ms/step - loss: 1.2041 -
accuracy: 0.5720 - val_loss: 1.0210 - val_accuracy: 0.6399

Epoch 3/20

391/391 [=====] - 109s 280ms/step - loss: 1.0434 -
accuracy: 0.6334 - val_loss: 0.9322 - val_accuracy: 0.6776

Epoch 4/20

391/391 [=====] - 109s 277ms/step - loss: 0.9272 -
accuracy: 0.6765 - val_loss: 0.8891 - val_accuracy: 0.6900

Epoch 5/20

391/391 [=====] - 110s 282ms/step - loss: 0.8366 -

```

accuracy: 0.7081 - val_loss: 0.7919 - val_accuracy: 0.7257
Epoch 6/20
391/391 [=====] - 105s 268ms/step - loss: 0.7749 -
accuracy: 0.7303 - val_loss: 0.7851 - val_accuracy: 0.7302
Epoch 7/20
391/391 [=====] - 112s 286ms/step - loss: 0.7135 -
accuracy: 0.7511 - val_loss: 0.8117 - val_accuracy: 0.7208
Epoch 8/20
391/391 [=====] - 105s 268ms/step - loss: 0.6597 -
accuracy: 0.7679 - val_loss: 0.7787 - val_accuracy: 0.7347
Epoch 9/20
391/391 [=====] - 112s 288ms/step - loss: 0.6157 -
accuracy: 0.7865 - val_loss: 0.7311 - val_accuracy: 0.7515
Epoch 10/20
391/391 [=====] - 107s 273ms/step - loss: 0.5767 -
accuracy: 0.7983 - val_loss: 0.7306 - val_accuracy: 0.7520
Epoch 11/20
391/391 [=====] - 106s 270ms/step - loss: 0.5379 -
accuracy: 0.8113 - val_loss: 0.7328 - val_accuracy: 0.7528
Epoch 12/20
391/391 [=====] - 106s 270ms/step - loss: 0.4922 -
accuracy: 0.8263 - val_loss: 0.7038 - val_accuracy: 0.7718
Epoch 13/20
391/391 [=====] - 111s 283ms/step - loss: 0.4609 -
accuracy: 0.8373 - val_loss: 0.7304 - val_accuracy: 0.7657
Epoch 14/20
391/391 [=====] - 104s 266ms/step - loss: 0.4303 -
accuracy: 0.8475 - val_loss: 0.7386 - val_accuracy: 0.7600
Epoch 15/20
391/391 [=====] - 108s 277ms/step - loss: 0.3964 -
accuracy: 0.8587 - val_loss: 0.7629 - val_accuracy: 0.7699
Epoch 16/20
391/391 [=====] - 107s 274ms/step - loss: 0.3688 -
accuracy: 0.8684 - val_loss: 0.7729 - val_accuracy: 0.7620
Epoch 17/20
391/391 [=====] - 103s 264ms/step - loss: 0.3463 -
accuracy: 0.8759 - val_loss: 0.7963 - val_accuracy: 0.7626
Epoch 18/20
391/391 [=====] - 105s 270ms/step - loss: 0.3257 -
accuracy: 0.8839 - val_loss: 0.7970 - val_accuracy: 0.7691
Epoch 19/20
391/391 [=====] - 110s 281ms/step - loss: 0.3072 -
accuracy: 0.8883 - val_loss: 0.7879 - val_accuracy: 0.7719
Epoch 20/20
391/391 [=====] - 110s 281ms/step - loss: 0.2868 -
accuracy: 0.8961 - val_loss: 0.8166 - val_accuracy: 0.7768
Test Accuracy: 77.68%

```

