```
# Import necessary libraries
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Flatten, Dense, Dropout
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.datasets import cifar10
import matplotlib.pyplot as plt
import numpy as np

# Load CIFAR-10 dataset
(x_train, y_train), (x_test, y_test) = cifar10.load_data()

# Normalize pixel values to range [0, 1]
x_train = x_train.astype('float32') / 255.0
x_test  = x_test.astype('float32') / 255.0

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

# Create validation set (10% of training data)
x_val = x_train[-5000:]
y_val = y_train[-5000:]
x_train = x_train[:-5000]
y_train = y_train[:-5000]

# Define ANN model
model = Sequential([
    Flatten(input_shape=(32, 32, 3)),
    Dense(512, activation='relu'),
    Dropout(0.5),
    Dense(256, activation='relu'),
    Dense(10, activation='softmax')
])

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

# Train the model
history = model.fit(
    x_train, y_train,
    epochs=20,
    batch_size=64,
    validation_data=(x_val, y_val)
)

# Evaluate on test set
test_loss, test_acc = model.evaluate(x_test, y_test, verbose=0)
print(f"\nTest Accuracy: {test_acc:.4f}")
print(f"Test Loss: {test_loss:.4f}")

# Plot training/validation accuracy and loss
plt.figure(figsize=(12, 5))

# Accuracy plot
plt.subplot(1, 2, 1)
plt.plot(history.history['accuracy'], label='Train Acc')
plt.plot(history.history['val_accuracy'], label='Val Acc')
plt.title('Training and Validation Accuracy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

# Loss plot
plt.subplot(1, 2, 2)
plt.plot(history.history['loss'], label='Train Loss')
plt.plot(history.history['val_loss'], label='Val Loss')
plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()
```

```
plt.tight_layout()
plt.show()
```

```
Epoch 1/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 24s 32ms/step - accuracy: 0.1904 - loss: 2.2118 - val_accuracy: 0.2888 - val_loss: 1.9435
Epoch 2/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 21s 29ms/step - accuracy: 0.2368 - loss: 2.0262 - val_accuracy: 0.2958 - val_loss: 1.9646
Epoch 3/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 22s 31ms/step - accuracy: 0.2601 - loss: 1.9679 - val_accuracy: 0.3102 - val_loss: 1.9552
Epoch 4/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 22s 31ms/step - accuracy: 0.2546 - loss: 1.9809 - val_accuracy: 0.2914 - val_loss: 1.9930
Epoch 5/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 41s 31ms/step - accuracy: 0.2664 - loss: 1.9559 - val_accuracy: 0.2956 - val_loss: 1.9281
Epoch 6/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 22s 31ms/step - accuracy: 0.2776 - loss: 1.9281 - val_accuracy: 0.3124 - val_loss: 1.9250
Epoch 7/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 25s 35ms/step - accuracy: 0.2892 - loss: 1.9079 - val_accuracy: 0.2970 - val_loss: 1.9571
Epoch 8/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 37s 30ms/step - accuracy: 0.2896 - loss: 1.9105 - val_accuracy: 0.3262 - val_loss: 1.9310
Epoch 9/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 22s 31ms/step - accuracy: 0.2950 - loss: 1.8998 - val_accuracy: 0.3412 - val_loss: 1.9084
Epoch 10/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 40s 29ms/step - accuracy: 0.2997 - loss: 1.8926 - val_accuracy: 0.3480 - val_loss: 1.8936
Epoch 11/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 43s 32ms/step - accuracy: 0.3074 - loss: 1.8724 - val_accuracy: 0.3240 - val_loss: 1.9258
Epoch 12/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 40s 31ms/step - accuracy: 0.3130 - loss: 1.8658 - val_accuracy: 0.3272 - val_loss: 1.8974
Epoch 13/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 40s 30ms/step - accuracy: 0.3192 - loss: 1.8499 - val_accuracy: 0.3446 - val_loss: 1.8866
Epoch 14/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 22s 31ms/step - accuracy: 0.3182 - loss: 1.8525 - val_accuracy: 0.3194 - val_loss: 1.9144
Epoch 15/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 21s 29ms/step - accuracy: 0.3164 - loss: 1.8521 - val_accuracy: 0.3118 - val_loss: 1.9321
Epoch 16/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 22s 31ms/step - accuracy: 0.3240 - loss: 1.8394 - val_accuracy: 0.3522 - val_loss: 1.8640
Epoch 17/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 40s 30ms/step - accuracy: 0.3278 - loss: 1.8273 - val_accuracy: 0.3530 - val_loss: 1.8680
Epoch 18/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 22s 32ms/step - accuracy: 0.3247 - loss: 1.8374 - val_accuracy: 0.3402 - val_loss: 1.8671
Epoch 19/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 23s 32ms/step - accuracy: 0.3316 - loss: 1.8287 - val_accuracy: 0.3554 - val_loss: 1.8708
Epoch 20/20
704/704 ━━━━━━━━━━━━━━━━━━━━ 21s 30ms/step - accuracy: 0.3218 - loss: 1.8318 - val_accuracy: 0.3310 - val_loss: 1.9091

Test Accuracy: 0.3337
Test Loss: 1.8970
```