In [ ]:
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#class: B.E.A.I & D.S.
#Roll No:37
#Subject : Deep Learning (CL-IV)
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In [ ]:
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# Problem Statement : In this practical, we design and implement a CNN model for
# dataset (e.g., medical imaging, agriculture, or CIFAR-10). The model is optimi
# hyperparameters such as learning rate, filter size, number of layers, optimize
# improve performance.
```

In [1]:
```
#Step 1: Import Required Libraries
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropou
from tensorflow.keras.optimizers import Adam, SGD, RMSprop
from tensorflow.keras.datasets import cifar10
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import confusion_matrix
```

In [2]:
```
#Step 2: Load and Preprocess the Dataset
# Load CIFAR-10 dataset
(x_train, y_train), (x_test, y_test) = cifar10.load_data()

# Normalize pixel values (scale between 0 and 1)
x_train, x_test = x_train / 255.0, x_test / 255.0

# Convert labels to one-hot encoding
y_train = tf.keras.utils.to_categorical(y_train, num_classes=10)
y_test = tf.keras.utils.to_categorical(y_test, num_classes=10)
```

```
Downloading data from https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz
170498071/170498071 ━━━━━━━━━━━━━━━━━━━━ 2s 0us/step
```

In [3]:
```
#Step 3: Define and Optimize the CNN Model
# Hyperparameter tuning
learning_rate = 0.001
dropout_rate = 0.4
filter_size = (3,3)

# Build CNN model
model = Sequential([
    Conv2D(32, filter_size, activation='relu', input_shape=(32, 32, 3)),
    MaxPooling2D(2,2),
    Dropout(dropout_rate),

    Conv2D(64, filter_size, activation='relu'),
    MaxPooling2D(2,2),
    Dropout(dropout_rate),

    Flatten(),
    Dense(128, activation='relu'),
    Dropout(dropout_rate),
    Dense(10, activation='softmax')  # 10 classes (CIFAR-10)
])

# Compile the model using Adam optimizer
```

```
optimizer = Adam(learning_rate=learning_rate)
model.compile(optimizer=optimizer, loss='categorical_crossentropy', metrics=['ac
```

```
/usr/local/lib/python3.11/dist-packages/keras/src/layers/convolutional/base_conv.
py:107: UserWarning: Do not pass an `input_shape`/`input_dim` argument to a laye
r. When using Sequential models, prefer using an `Input(shape)` object as the fir
st layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

In [4]:
```
#Step 4: Train the Model
history = model.fit(x_train, y_train, epochs=10, batch_size=64, validation_data=
```

```
Epoch 1/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 77s 95ms/step - accuracy: 0.3041 - loss: 1.8840 - va
l_accuracy: 0.5318 - val_loss: 1.3469
Epoch 2/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 71s 82ms/step - accuracy: 0.4990 - loss: 1.4021 - va
l_accuracy: 0.5816 - val_loss: 1.2178
Epoch 3/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 81s 80ms/step - accuracy: 0.5471 - loss: 1.2759 - va
l_accuracy: 0.6114 - val_loss: 1.1170
Epoch 4/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 87s 87ms/step - accuracy: 0.5720 - loss: 1.2032 - va
l_accuracy: 0.6470 - val_loss: 1.0390
Epoch 5/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 79s 83ms/step - accuracy: 0.5974 - loss: 1.1414 - va
l_accuracy: 0.6618 - val_loss: 1.0170
Epoch 6/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 82s 83ms/step - accuracy: 0.6044 - loss: 1.1190 - va
l_accuracy: 0.6472 - val_loss: 1.0089
Epoch 7/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 80s 80ms/step - accuracy: 0.6172 - loss: 1.0861 - va
l_accuracy: 0.6770 - val_loss: 0.9405
Epoch 8/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 84s 83ms/step - accuracy: 0.6288 - loss: 1.0567 - va
l_accuracy: 0.6840 - val_loss: 0.9162
Epoch 9/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 80s 80ms/step - accuracy: 0.6389 - loss: 1.0289 - va
l_accuracy: 0.6887 - val_loss: 0.9307
Epoch 10/10
782/782 ━━━━━━━━━━━━━━━━━━━━ 82s 81ms/step - accuracy: 0.6413 - loss: 1.0209 - va
l_accuracy: 0.6920 - val_loss: 0.8945
```

In [5]:
```
#Step 5: Evaluate the Model
# Evaluate on test data
test_loss, test_acc = model.evaluate(x_test, y_test)
print("Test Accuracy:", test_acc)
```

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313/313 ━━━━━━━━━━━━━━━━━━━━ 4s 13ms/step - accuracy: 0.6908 - loss: 0.8927
Test Accuracy: 0.6919999718666077
```

In [6]:
```
#Step 6: Generate Confusion Matrix
# Predict classes
y_pred = np.argmax(model.predict(x_test), axis=1)
y_true = np.argmax(y_test, axis=1)

# Compute confusion matrix
cm = confusion_matrix(y_true, y_pred)

# Plot confusion matrix
plt.figure(figsize=(8,6))
```

```
sns.heatmap(cm, annot=True, cmap="Blues", fmt="d", xticklabels=range(10), ytickl
plt.xlabel("Predicted Label")
plt.ylabel("True  Label")
plt.title("Confusion Matrix")
plt.show()
```

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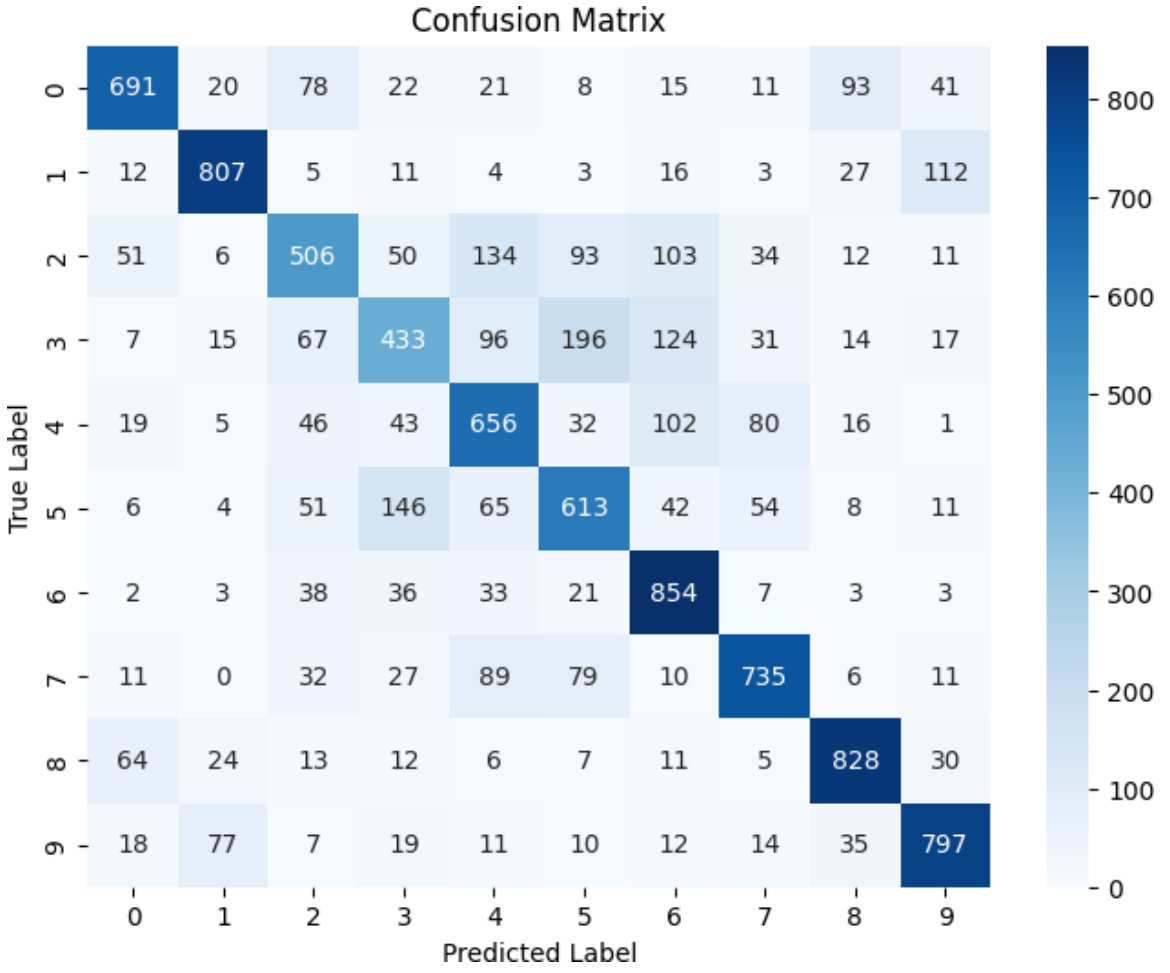
313/313 ━━━━━━━━━━━━━━━━━━━━ 3s 10ms/step
```



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