Convolutional Neural Network

A Convolutional Neural Network (CNN) is a class of deep neural networks, most commonly applied to analyzing visual imagery. CNNs are characterized by their convolutional layers, which apply filters to input data to detect patterns such as edges, textures, and objects.

Key points about Convolutional Neural Networks:

Architecture: Consists of convolutional layers, pooling layers, and fully connected layers.

Convolutional Layers: Use filters to perform convolutions, capturing local spatial features.

Pooling Layers: Down-sample the spatial dimensions to reduce the amount of parameters and computation.

Applications: Image and video recognition, medical image analysis, and natural language processing.

Practical Example in Cybersecurity

Problem: Detecting malware from binary executable files converted to images.

Data: We'll simulate this with simple binary patterns.

Python Code:

```
import numpy as np
from keras.models import Sequential
from keras.layers import Conv2D, MaxPooling2D, Flatten, Dense
from keras.utils import to_categorical

# Simulated binary image data
X = np.random.rand(100, 28, 28, 1)  # 100 grayscale images of 28x28 pixels
y = np.random.randint(0, 2, 100)  # Binary labels (0 for benign, 1 for malware)

# Splitting data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Convert labels to categorical
y_train = to_categorical(y_train)
y_test = to_categorical(y_test)

# Building the CNN model
model = Sequential()
```

```
model.add(Conv2D(32, (3, 3), activation='relu', input_shape=(28, 28, 1)))
model.add(MaxPooling2D((2, 2)))
model.add(Flatten())
model.add(Dense(64, activation='relu'))
model.add(Dense(2, activation='softmax'))

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

# Training the model
model.fit(X_train, y_train, epochs=10, batch_size=10, verbose=0)

# Evaluating the model
loss, accuracy = model.evaluate(X_test, y_test, verbose=0)
print(f'Model Accuracy: {accuracy * 100:.2f}%')
```