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Final Project

PROJECT TITLE

A Deep Dive into Shape Recognition: Utilizing CNNs for Circle and Square Identification

AGENDA

- Introduction to Convolutional Neural Networks (CNNs)
- Synthetic Data Generation for Training
- Building a CNN Architecture for Shape Classification
- Training and Evaluating the Model
- Demonstration of Shape Prediction
- Discussion of Project Extensions

PROBLEM STATEMENTS

- How can we effectively classify images of shapes using machine learning?
- Can we successfully train a CNN without relying on external datasets?
- What are the key considerations for building and training a CNN for shape classification?
- How can we visualize and interpret the results of a CNN for better understanding?
- What are potential ways to extend this project for more complex image classification tasks?

PROJECT OVERVIEW

- Develop a CNN model capable of classifying images into circles and squares.
- Generate synthetic data to train the model without external datasets.
- Explore the model's architecture and training process.
- Evaluate model performance using accuracy metrics.
- Demonstrate model prediction capabilities on sample images.

WHO ARE THE END USERS?

- Machine learning enthusiasts seeking introductory CNN projects
- Students exploring computer vision and image classification
- Educators teaching deep learning concepts
- Developers experimenting with synthetic data generation
- Researchers interested in basic shape classification tasks

MY SOLUTION AND ITS VALUE PROPOSITION

- **Accessible CNN Learning**: Hands-on experience building a CNN without complex datasets.
- **Understanding CNN Concepts**: Explores core CNN layers, model compilation, and training techniques.
- **Synthetic Data Exploration**: Demonstrates data generation for model training.
- **Visualization and Interpretation**: Opportunities to visualize model results for better comprehension.
- **Foundation for Extension**: Serves as a basis for further experiments and real-world applications.

THE WOW IN MY SOLUTION

- **Learning Without Datasets**: Empowers users to create their own training data for CNNs.
- **Unlocking Shape Recognition**: Witness a machine's ability to "see" and classify shapes.
- **Building Intuition for Deep Learning**: Develop a deeper understanding of CNN mechanisms.
- **Potential for Real-World Applications**: Bridges the gap between learning and practical use cases.
- **Adaptable and Expandable**: Encourages experimentation with different shapes and model architectures.

MODELLING

- **Visualizing CNN Architecture**: Diagrams illustrating model layers and data flow.
- **Data Generation Process**: Graphical representation of synthetic image creation.
- **Performance Visualization**: Graphs depicting training progress and accuracy metrics.
- **Prediction Demonstration**: Interactive interface for testing the model on user-provided images.

RESULTS

- Achieved accuracy of 0.8075000047683716 on the generated test set.
- Successfully identified circles and squares in sample images

In [9]:
```
test_loss, test_acc = model.evaluate(X_test, y_test)
print('Test accuracy:', test_acc)
```

```
63/63 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 0.8153 - loss: 0.4200
Test accuracy: 0.8075000047683716
```

In [10]:
```
sample_image = np.expand_dims(X_test[0], axis=0)  # Add batch dimension
prediction = model.predict(sample_image)
predicted_class = np.argmax(prediction)
print('Predicted class:', ('Circle' if predicted_class == 0 else 'Square'))
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 117ms/step
Predicted class: Square
```