LAB 3: STUDENT WORKSHEET

Convolutional Neural Networks (CNN)

Name: _____

Student ID: _____

Date: _____

PART 1: BASIC CNN PERFORMANCE

Record the performance metrics for the basic CNN models on MNIST and CIFAR-10.

Dataset	Test Accuracy (%)	Training Time (s)	Inference Time (ms)	Total Parameters
MNIST				
CIFAR-10				

What are the key differences in performance between the two datasets? Why?

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PART 2: CNN ARCHITECTURE EXPLORATION

Record the performance metrics for different CNN architectures on MNIST.

Architecture	Test Accuracy (%)	Training Time (s)	Inference Time (ms)	Parameters
ShallowCNN				
DeepCNN				
WideCNN				
TinyCNN				

Record the performance metrics for different filter sizes on MNIST.

Filter Configuration	Test Accuracy (%)	Training Time (s)	Inference Time (ms)	Parameters
SmallFilters (2×2)				
LargeFilters (5×5)				
MixedFilters				

Based on your results:

1. How does network depth affect performance and efficiency?

2. How does network width affect performance and efficiency?

3. How do filter sizes affect performance and learned features?

PART 3: FEATURE VISUALIZATION

Describe what you observed in the filter and feature map visualizations:

1. What patterns did you notice in the first layer filters?

2. How did the feature maps change in deeper layers?

3. How did visualizations differ between architectures?

PART 4: TRANSFER LEARNING

Record the performance metrics for transfer learning models on CIFAR-10.

Model	Test Accuracy (%)	Training Time (s)	Inference Time (ms)	Trainable Parameters	Total Parameters
Basic CNN					
MobileNetV2 Transfer					
MobileNetV2 Fine-tuned					

How did transfer learning affect:

1. Model accuracy:

2. Training time:

3. Parameter efficiency:

PART 5: CNN VS FCNN COMPARISON

Compare the best CNN model from this lab with the best FCNN model from Lab 2.

Model Type	Test Accuracy (%)	Training Time (s)	Inference Time (ms)	Parameters	Accuracy/Million Params
Best FCNN					
Best CNN					

What are the key advantages of CNNs over FCNNs for image classification?

PART 6: EFFICIENCY METRICS

Record the efficiency metrics for the best models according to different criteria.

Criteria	Best Model	Accuracy (%)	Inference Time (ms)	Parameters	Accuracy/Million Params
Highest Accuracy					
Fastest Inference					
Most Parameter-Efficient					

PART 7: ANALYSIS QUESTIONS

1. How does the parameter sharing in CNN layers contribute to efficiency compared to FCNNs?

2. For resource-constrained mobile devices, which CNN architecture would you recommend and why?

3. When would transfer learning be most beneficial? When might it not be worth the additional complexity?

4. Based on your experiments, what is the relationship between model complexity (parameters) and accuracy in CNNs?

PART 8: REFLECTION

Write a short reflection (100-150 words) on what you learned about CNNs and their hardware implications.

INSTRUCTOR COMMENTS

Grade: _____ / _____