LAB 2: STUDENT WORKSHEET

Fully Connected Neural Networks (FCNN)

Name: _____

Student ID: _____

Date: _____

PART 1: NETWORK DEPTH EXPERIMENT

Record the performance metrics for FCNNs with different depths (all with 128 neurons per layer).

Number of Hidden Layers	Test Accuracy (%)	Training Time (s)	Inference Time (ms)	Total Parameters
1				
2				
3				
4				

Based on your results, what is the relationship between network depth and:

- Model accuracy? _____
- Training time? _____
- Inference time? _____

PART 2: NETWORK WIDTH EXPERIMENT

Record the performance metrics for FCNNs with different widths (all with 2 hidden layers).

Hidden Layer Width	Test Accuracy (%)	Training Time (s)	Inference Time (ms)	Total Parameters
64				
128				
256				
512				

Based on your results, what is the relationship between network width and:

- Model accuracy? _____
- Training time? _____

- Parameter count? _____

PART 3: ACTIVATION FUNCTIONS

Record the performance metrics for FCNNs with different activation functions (all with 2 hidden layers, 128 neurons each).

Activation Function	Test Accuracy (%)	Training Time (s)	Epochs to Converge	Inference Time (ms)
ReLU				
Sigmoid				
Tanh				
ELU				

Which activation function:

- Achieved the highest accuracy? _____
- Converged the fastest? _____
- Had the fastest inference time? _____

PART 4: REGULARIZATION (DROPOUT)

Record the performance metrics for FCNNs with different dropout rates (all with 2 hidden layers, 128 neurons each, ReLU activation).

Dropout Rate	Test Accuracy (%)	Training Time (s)	Epochs to Converge	Training-Validation Gap
0.0				
0.2				
0.4				
0.6				

How did increasing dropout rate affect:

- Model generalization (training-validation gap)? _____
- Training time? _____
- Test accuracy? _____

PART 6: DATASET COMPARISON

Compare the performance of a standard FCNN (2 hidden layers, 128 neurons each, ReLU activation, 0.2 dropout) on both datasets.

Dataset	Test Accuracy (%)	Training Time (s)	Epochs to Converge
MNIST			
Fashion MNIST			

Why do you think there is a difference in performance between the two datasets?

PART 7: EFFICIENCY METRICS

Record the efficiency metrics for the best performing models.

Model Architecture	Accuracy/Million Parameters	
Best Accuracy Model:		
Fastest Training Model:		
Fastest Inference Model:		

PART 8: ANALYSIS QUESTIONS

1. Which network architecture would you recommend for deployment on a mobile device? Why?

2. How does increasing network complexity (depth and width) affect the trade-off between accuracy and computational efficiency?

3. What hyperparameter had the most significant impact on model performance? Explain why.

4. Based on your experiments, describe the ideal FCNN architecture for the MNIST dataset that balances accuracy and computational efficiency.

INSTRUCTOR COMMENTS

Grade: _____ / _____