Month 3: Deep Learning Basics

Overview & Schedule (Weeks 9-12)

Week 9: Neural Networks Foundations

Day	Topic	Theory (Brief)	Practice (Brief)	Time
Day 1	Perceptrons & Architecture	Watch: 3Blue1Brown's But what is a Neural Network? (19 min). Concept: Neurons...	Paper: Draw a 2-3-1 network. Write out the formula for the output of one neur...	2h
Day 2	Activation Functions	Read: Activation Functions Explained (10 min). Understand: Why we need non-li...	Python: Plot `sigmoid(x)`, `tanh(x)`, and `relu(x)` using simple matplotlib.	2h
Day 3	Forward Pass & Backprop	Watch: 3Blue1Brown's Backpropagation Calculus (10 min). Concept: Chain rule a...	Conceptual: Trace the path of an error signal backwards through a simple draw...	2h

Week 10: Deep Learning Frameworks

Day	Topic	Theory (Brief)	Practice (Brief)	Time
Day 1	Intro to PyTorch/TensorFlow	Watch: Daniel Bourke's PyTorch in 25 Minutes (First section). Concept: Tensor...	Python: Install PyTorch. Create tensors. Perform matrix multiplication on GPU...	2h
Day 2	Building a NN in Code	Watch: Sentdex's Deep Learning with PyTorch P.2 (Data). Duration: ~20 mins.	Python: Define a subclass `class Net(nn.Module):`. Define 2 linear layers in ...	2h
Day 3	Training Loops	Read: Training a Classifier (PyTorch Blitz). Key steps: Zero grad -> Forward ...	Python: Write a training loop for your MNIST model. Train for 1 epoch.	2h

Week 11: Tuning Deep Nets

Day	Topic	Theory (Brief)	Practice (Brief)	Time
Day 1	Regularization (Dropout, L2)	Watch: StatQuest's Regularization Part 1 (L1/L2) (20 min). Concept: Penalizin...	Python: Add `dropout=0.5` to your PyTorch model layers. Compare training accu...	2h
Day 2	Optimizers (Adam, SGD)	Read: An overview of gradient descent optimization algorithms (Focus on Adam ...	Python: Switch optimizer from `SGD` to `Adam`. Observe convergence speed.	2h
Day 3	Hyperparameter Tuning	Watch: Grid Search vs Random Search (10 min).	Python: Use `GridSearchCV` (if using sklearn wrapper) or manual loop to test ...	2h

Week 12: Deep Learning Project

Day	Topic	Theory (Brief)	Practice (Brief)	Time
Day 1	Project Setup	Resource: CIFAR-10 Tutorial.	Setup: Download CIFAR-10. Create a DataLoader. Visualize 5 images.	2h
Day 2	Model Training	Concept: Model Checkpointing. Saving the best model, not the last.	Code: Implement logic to save `model.state_dict()` only if validation loss de...	2h
Day 3	Evaluation	Concept: Confusion Matrix for multi-class.	Viz: Create a 10x10 Heatmap of predictions vs actual labels.	2h