2. Advanced Machine Learning Course with Project

For learners ready to deepen their understanding:

Advanced Machine Learning Course (100 hours + 50 hours project)		
Module	**Topics**	**Duration**
Module 1: Advanced Supervised Learning	Regression Techniques: - Ridge and Lasso Regression - Elastic Net - Polynomial Regression Classification Algorithms: - Support Vector Machines (SVM) with Kernels - Advanced Decision Trees (CART, C4.5) - Random Forests and XGBoost	10 hours
Module 2: Unsupervised Learning	Clustering: - K-Means, K-Medoids, DBSCAN, Agglomerative Hierarchical Clustering - Self-Organizing Maps (SOM) Dimensionality Reduction: - Principal Component Analysis (PCA) - Independent Component Analysis (ICA) - t-SNE and UMAP for Visualization	8 hours
Module 3: Deep Learning Foundations	Neural Networks: - Deep Feed-Forward Networks (Multilayer Perceptrons) - Activation Functions (ReLU, Tanh, Softmax) - Backpropagation and Gradient Descent - Optimizers: SGD, Adam, RMSprop	8 hours
Module 4: Convolutional Neural Networks (CNNs)	- Introduction to CNNs: Convolution Layers, Pooling, Flattening, Fully Connected Layers - Architectures: LeNet, AlexNet, VGGNet, ResNet	12 hours

	- CNN for Image Classification and Object Detection	
Module 5: Recurrent Neural Networks (RNNs)	- Introduction to RNNs: Basic Structure, Backpropagation Through Time (BPTT) - Long Short-Term Memory (LSTM) - Gated Recurrent Unit (GRU) - Applications: Time Series Forecasting, Speech Recognition	10 hours
Module 6: Advanced Model Optimization	- Hyperparameter Tuning: Grid Search, Random Search, Bayesian Optimization - Cross-validation Techniques: Stratified, K-fold, Leave-one-out - Regularization Techniques: Dropout, Early Stopping, L1/L2 Regularization	6 hours
Module 7: Reinforcement Learning (RL)	- Introduction to RL: Markov Decision Processes (MDP), Q-Learning - Deep Q Networks (DQN) - Policy Gradient Methods, REINFORCE - Applications in Game Playing, Robotics	10 hours
Module 8: Natural Language Processing (NLP)	- Text Preprocessing: Tokenization, Lemmatization, Stop Words Removal - Word Embeddings: Word2Vec, GloVe, FastText - Sequence Models: LSTMs, GRUs - Transformers, BERT, GPT for NLP tasks	10 hours
Module 9: Advanced Topics in AI	- Generative Adversarial Networks (GANs) - Autoencoders and Variational Autoencoders (VAEs) - Transfer Learning - Few-shot Learning	6 hours
Module 10: Model Interpretability	- Shapley Values and LIME for Explainable AI - Feature Importance Analysis - Interpretable Deep Learning Models	6 hours

Module 11: Advanced Applications of AI	- AI in Healthcare: Disease Prediction, Imaging, Diagnostics - AI in Finance: Fraud Detection, Algorithmic Trading - Smart Cities and IoT-based AI Applications	8 hours
Module 12: Career Development & Wrap-up	- Portfolio Development and Presentation - Resume Building, LinkedIn Optimization - Job Placement Assistance and Interview Preparation	5 hours
	Total Learning Hours	**100 hours**

Project Phases	Topics	Duration
Phase 1: Problem Definition and Data Collection	- Identify the problem domain: AI/ML in Healthcare, Finance, IoT, Smart Cities, etc. - Data Collection and Preprocessing: Handling missing data, feature selection, feature engineering	10 hours
Phase 2: Model Building and Experimentation	- Develop and implement machine learning algorithms: Supervised, Unsupervised, Deep Learning Models - Experimentation: Fine-tune hyperparameters, cross-validation, etc.	15 hours
Phase 3: Evaluation and Optimization	- Evaluate model performance: Metrics (Accuracy, Precision, Recall, F1-score, AUC-ROC, etc.) - Optimize model: Hyperparameter tuning, feature selection, etc.	10 hours
Phase 4: Reporting and Final Presentation	- Prepare technical documentation and final report - Present results with visualizations and key findings to peers and instructors	10 hours
Phase 5: Career and Post-Project Support	- Portfolio Building: Showcase projects on GitHub - Resume review and LinkedIn optimization	5 hours
	Total Project Hours	**50 hours**