



Deep Learning Training Course

CURRICULUM

Module I – Foundations of Deep Learning

- Introduction to Deep Learning
- Difference between Machine Learning and Deep Learning
- Biological Inspiration: Neurons and the Human Brain
- Artificial Neural Networks (ANNs)
- Structure of a Neural Network (Input, Hidden, Output Layers)
- Activation Functions (Sigmoid, ReLU, Tanh, Softmax)
- Forward Propagation and Backpropagation
- Loss Functions and Optimization
- Gradient Descent and Learning Rate
- Overfitting, Underfitting, and Regularization Techniques

Module II – Neural Network Implementation with Python

- Building Neural Networks from Scratch (NumPy)
- Introduction to Deep Learning Frameworks (TensorFlow & PyTorch)
- Creating and Training Models in TensorFlow
- Creating and Training Models in PyTorch
- Hyperparameter Tuning
- Model Evaluation and Metrics
- Saving and Loading Models
- Batch Normalization and Dropout
- Early Stopping and Callbacks
- Practical Implementation on Simple Datasets

Module III – Model Creation with TensorFlow

- Introduction to TensorFlow Ecosystem
- Tensors, Variables, and Operations
- Building Neural Networks with Keras API
- Model Compilation, Training, and Evaluation
- Callbacks (EarlyStopping, ModelCheckpoint)
- TensorBoard for Visualization
- Implementing CNNs, RNNs, and Transfer Learning
- Hyperparameter Tuning (KerasTuner)
- Saving & Loading Models (SavedModel, H5)
- Hands-on Projects using TensorFlow

Module IV – Model Creation with PyTorch

- Introduction to PyTorch Framework
- Tensors, Autograd, and Computational Graph
- Building Neural Networks using nn.Module
- Optimizers and Loss Functions
- Training Loops and Backpropagation
- GPU Acceleration (CUDA)
- Implementing CNNs, RNNs, and Transformers
- Using torchvision and torchtext
- Model Saving, Loading, and Evaluation
- Real-World Projects with PyTorch

Module V – Computer Vision

- Introduction to CV and Image Processing
- Image Representation and Color Models
- Image Filtering and Edge Detection
- Object Detection (Haar, HOG)
- CNNs for Image Classification
- Image Augmentation Techniques
- Face Detection and Recognition
- Transfer Learning with CNNs
- Image Segmentation
- OCR (Optical Character Recognition)

Module VI – Advanced Deep Learning Architectures

- Convolutional Neural Networks (CNNs) – Theory and Architecture
- Applications of CNNs (Image Classification, Object Detection)
- Recurrent Neural Networks (RNNs)
- Long Short-Term Memory (LSTM) and GRU Networks
- Autoencoders and Variational Autoencoders (VAEs)
- Generative Adversarial Networks (GANs)
- Transfer Learning and Pretrained Models
- Attention Mechanism
- Transformers Overview
- Practical Implementation with Real-World Use Cases

Module VII – Natural Language Processing (NLP) Fundamentals

- Introduction to NLP
- NLP Pipeline and Text Preprocessing
- Tokenization, Stopwords Removal, Stemming, and Lemmatization
- Bag of Words and TF-IDF
- Word Embeddings (Word2Vec, GloVe, FastText)
- Part-of-Speech (PoS) Tagging and Named Entity Recognition (NER)
- Language Models and Probability-Based NLP
- Text Classification and Sentiment Analysis
- Sequence-to-Sequence Models
- Evaluation Metrics in NLP

Module VIII – Neural Network-based NLP Models

- Embedding Layers in Deep Learning
- RNNs, LSTMs, and GRUs for Text Data
- Encoder-Decoder Architecture
- Attention Mechanism in NLP
- Transformer Models (BERT, GPT, T5)
- Fine-tuning Pretrained Models for NLP Tasks
- Text Generation and Summarization
- Machine Translation
- Chatbot and Question-Answering Systems

Module IX – Model Optimization and Regularization

- Gradient Descent Variants (SGD, Momentum, RMSProp, Adam)
- Learning Rate Scheduling
- Weight Initialization Techniques
- Dropout and Early Stopping
- Batch Normalization and Layer Normalization
- Data Augmentation as Regularization
- Loss Function Selection (MSE, Cross-Entropy, Huber, etc.)
- Dealing with Overfitting and Underfitting
- Practical Tips for Training Stability
- Tuning and Debugging Deep Models

Module X – Model Testing and Performance Analysis

- Evaluation Metrics for Classification and Regression
- Confusion Matrix and ROC-AUC
- Precision-Recall and F1-Score Analysis
- Cross-Validation Techniques
- Hyperparameter Tuning (Grid Search, Random Search, Bayesian)
- Experiment Tracking Tools (MLflow, Weights & Biases)
- Error Analysis and Model Diagnostics
- Handling Imbalanced Data (SMOTE, Class Weights)
- Model Comparison and Selection
- Reproducibility and Documentation

Module XI – Model Deployment

- Model Serialization (Pickle, Joblib, SavedModel)
- Creating REST APIs using Flask/FastAPI
- Containerization with Docker
- Deploying Models on Cloud (AWS, GCP, Azure)
- Model Monitoring and Logging
- CI/CD for ML Pipelines
- Streamlit/Gradio for Interactive Demos
- Model Versioning and Rollback
- Model Governance and Lifecycle Management

Module XII – AI Deep Learning Project Development

- Defining Project Objectives
- Problem Formulation
- Data Collection and Cleaning
- Model Selection
- Training and Tuning
- Evaluation and Metrics
- Deployment Strategy
- Feedback Loop and Maintenance
- Documentation and Reporting
- Case Study Development

Thank You!

Thank you for downloading our curriculum!

We're excited to be part of your learning journey. Feel free to reach out if you need more information.

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