| Learning track | Modules | Key Topics | Coverage depth | Duration (hrs) |
|---|---|---|---|---|
| AI Fundamentatals | Essentials of Python | Core languagre | pre-read | |
| | | Using Numpy | pre-read | |
| | | Using PANDAS | pre-read | |
| | | Viz tools | pre-read | |
| | | datasets - sklearn/UCI | pre-read | |
| | Intro on AI | What are DS/ML/DL/AI and RL, GenAI, Large Language models | Slides, example demos | 0.5 |
| | Statistics Essentials Primer | Data types, tables, feature types | pre-read | 0 |
| | | Sampling tech in DS | concepts/code/ Examples | 0.5 |
| | | Central measures | pre-read | |
| | | Data dispersion | pre-read | |
| | | Data distributions | concepts/code/ Examples | 0.5 |
| | | Symmetry | pre-read | |
| | | Variances and COV | concepts/code/ Examples | 0.5 |
| | | Corr and M.C | concepts/code/ Examples | 0.5 |
| | MCQs | | | 0.5 |
| | Understand sense of data | Basic sanity of data | concepts/code/ Examples | 0.5 |
| | | Missing data analysis | concepts/code/ Examples | 0.5 |
| | | Outlier and cardinality assessment | concepts/code/ Examples | 0.25 |
| | | Data Encoding methods | concepts/code/ Examples | 0.25 |
| | | Data scaling | concepts/code/ Examples | 0.5 |
| | | Overcome imbalance | concepts/code/ Examples | 0.5 |
| | | Data splitting | concepts/code/ Examples | 0.25 |
| | MCQs | | | 0.5 |
| | Machine Learning - Primer | ML - Concepts, models, insights | concepts/code/ Examples | 0.75 |
| | | Model eval methods | concepts/code/ Examples | 1 |
| | | Distance and similarity measures | concepts/code/ Examples | 1 |
| | | Sup model - KNN | concepts/code/ Examples | 4 |
| | | Basics of Lin reg | concepts/code/ Examples | 4 |
| | | Unsup - KMEANS | concepts/code/ Examples | 2 |
| | MCQs | | | 0.5 |

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| **Advanced AI** | Classical MLs (SUP) | Logistic regression | concepts/code/ Examples | 0.5 |
| | | Polynomial regression | concepts/code/ Examples | 0.5 |
| | | Decision trees | concepts/code/ Examples | 0.5 |
| | | Random Forests | concepts/code/ Examples | 0.25 |
| | | Ensemble learning | concepts/code/ Examples | 0.5 |
| | | Support vector machines | concepts/code/ Examples | 0.5 |
| | MCQs | | | 0.5 |
| | Feature Engineering | Selection methods | concepts/code/ Examples | 1 |
| | | Extraction methods | concepts/code/ Examples | 1 |
| | MCQs | | | 0.5 |
| | Unsupervised learning | Clustering (Agg, DBSCAN…) | concepts/code/ Examples | 0.75 |
| | MCQs | | | 0.5 |
| | ML with gradients | Limitations with MLs | concepts/code/ Examples | 0.5 |
| | | gradients and derivatives | concepts/code/ Examples | 0.75 |
| | | Loss fucntions | concepts/code/ Examples | 0.5 |
| | | regression - ML with grad | concepts/code/ Examples | 0.5 |
| | Deep Learning - Primer | Activation functions | concepts/code/ Examples | 0.75 |
| | | Perceptrons and MLPs | concepts/code/ Examples | 0.75 |
| | | TF/Keras - layers | concepts/code/ Examples | 0.5 |
| | | Data loading | concepts/code/ Examples | 0.5 |
| | | Metrics | concepts/code/ Examples | 0.5 |
| | | Model building | concepts/code/ Examples | 0.75 |
| | | Hyperparameter tuning | concepts/code/ Examples | 0.5 |
| | | Applying Keras | concepts/code/ Examples | 0.5 |
| | | Keras unilities | concepts/code/ Examples | 1 |
| | Conv Nets, PTM, TL | Limitations of ANNs/MLPs | concepts/code/ Examples | 0.5 |
| | | CNN arch | concepts/code/ Examples | 0.5 |
| | | Basic components of CNN | concepts/code/ Examples | 0.5 |
| | | Applications and use cases with CNN | concepts/code/ Examples | 0.5 |
| | | Use of PTMs | concepts/code/ Examples | 0.5 |
| | MCQs | | | 0.5 |

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| **Applied DS** | NLP | Basics of NLP | concepts/code/ Examples | 0.75 |
| | | Text pre-processing techniques (tokenization, stemming, lemmatization) | concepts/code/ Examples | 0.75 |
| | | regex & pattern matching | | 0.75 |
| | | Sentiment analysis | concepts/code/ Examples | 1 |
| | | Named Entity Recognition (NER) | concepts/code/ Examples | 1 |
| | | Vectorization | concepts/code/ Examples | 1 |
| | Time Series applications | Concepts | concepts/code/ Examples | 0.5 |
| | | preprocessing | concepts/code/ Examples | 0.5 |
| | | Statistical approach | concepts/code/ Examples | 0.75 |
| | | Using DL | concepts/code/ Examples | 1 |
| | Deployment and Model Serving | Basics of deploying ML models | Using AWS | 1.5 |
| | MCQs | | | 0.5 |
| | | | | **10** |
| **Innovative AI** | Classical Gen AI | Autoencoders | concepts/code/ Examples | 0.75 |
| | | VAEs | concepts/code/ Examples | 0.5 |
| | | Generative Adversarial Nets Architecture: | | 0.5 |
| | | Applications of GANs | | 0.5 |
| | Sequence models | RNNs | concepts/code/ Examples | 0.5 |
| | | Limitations of RNNs | concepts/code/ Examples | 0.25 |
| | | LSTMs & GRUs | concepts/code/ Examples | 0.25 |
| | | Applications | concepts/code/ Examples | 0.5 |
| | | recap of vectorization for texts (count/TF-IDF/hashing/BM25 (focus on BM25 for Gen AI models) | | 0.5 |
| | | Embeddings - Word2vec and sent2vec<br>- GENSIM examples<br>- Spacy examples | | 0.5 |
| | | Seq2Seq model arch<br>Attention mechanism | | 0.25 |
| | | subword tokenization | | 0.5 |
| | | Transformer arch<br>BERT (model) | | 1 |
| | Leveraging Hugging face models | Overview of all typical NLP applications (LANGUAGE MODELS) | | 1 |

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| Large Language models (LLMs) | Overview | 0.25 |
| | List of popular LLMs (OpenAI, Llama, BLOOM…) - key features and comparision | 0.25 |
| | connecting to OpenAI | 0.5 |
| | connecting to Azure OpenAI | 0.25 |
| | Introduction to Prompt Engineering | 0.25 |
| | **The Art of Crafting Prompts**: Principles, techniques & best practices | 0.25 |
| | **Type of Prompts:** Zero shot, One Shot , Few shot prompts, Chain-of-thought etc | 0.25 |
| | **Conceptual understanding** - Tokens, Max Tokens, temparature | 0.25 |
| | Standard methods for formatting, summarizing, inferring prompts to get best results. | 0.25 |
| | Use OpenAI or AZ OpenAI - Question Anwering, NLI examples | 0.5 |
| | Use OpenAI or AZ OpenAI - Embeddings - Applications with embeddings (ML, Zero shot, search, Viz) | 1 |
| Vector Databases | Overview and why it is needed for LLMs related applications | 0.25 |
| | Key features of Vector DBs | 0.5 |
| | overview on ChromaDB with examples (usage) | 0.5 |
| | Data ingestion and indexing | 1 |
| | embedding and preprocessing | 1 |
| | overview on pinecone with examples (usage) | 0.25 |
| | embedding and preprocessing | 1 |
| | Data ingestion and indexing | 1 |
| | Vector similarity search fundamentals | 0.5 |
| | PINECONE integrations (openAI) | 1 |

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| | Retrieval Augmented Generation (In-context learning) - **RAG** | Overview on RAG - purpose, process, limitations | 0.75 |
| | | **Example Use case 1** - NLI bot (scientific data) with OpenAI and Chromadb | 1.5 |
| | | **Example Use case 2** - QA bot (oscar awards) with OpenAI and Chromadb | 1.5 |
| | | Intro on Langchain - LangChain framework and its components | 0.5 |
| | | - setup langchain (OpenAI and AZ OpenAI) | 0.5 |
| | | **Example Use case 3** - QA bot (text data) with OpenAI and Pinecone, langchain | 1.5 |
| | Challenges with LLMs | Overview on best practices and challenges | 1 |
| | Explainable AI | Explanable solution for ML models | 1 |
| | | Explanable solution for DL models | 1 |
| | | | **27.75** |
| **Reinforcement learning** | Classical RL | MAB | 1 |
| | | MDP | 1 |
| | | DP | 0.5 |
| | | MC | 1 |
| | | TD | 2 |
| | Value Based | DQN, DDQN | 2 |
| | PG based | REINFORCE, PPO | 1 |
| | | | **8.5** |
| | | | **83.75** |