Certificate Program in

Machine Learning and AI

8 Months Program | Certificate by E&ICT, IIT Roorkee

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About IIT Roorkee & EICT

IIT Roorkee (IITR) has been ranked the best among IITs, as per the QS World Best Universities Ranking 2019. E&ICT-IITR provides certification courses with emphasis on hands-on learning in basic and advanced topics and emerging technologies in Electronics and ICT. It is sponsored by the Ministry of Electronics and Information Technology, Govt. of India.

QS WORLD UNIVERSITY RANKINGS

#1st

Among the IITs in the 'Citations per Faculty' parameter
*QS World Rankings

INDIA TODAY

#5

Ranked Engineering College
*India Today 2020

nirf NATIONAL INSTITUTIONAL RANKING FRAMEWORK

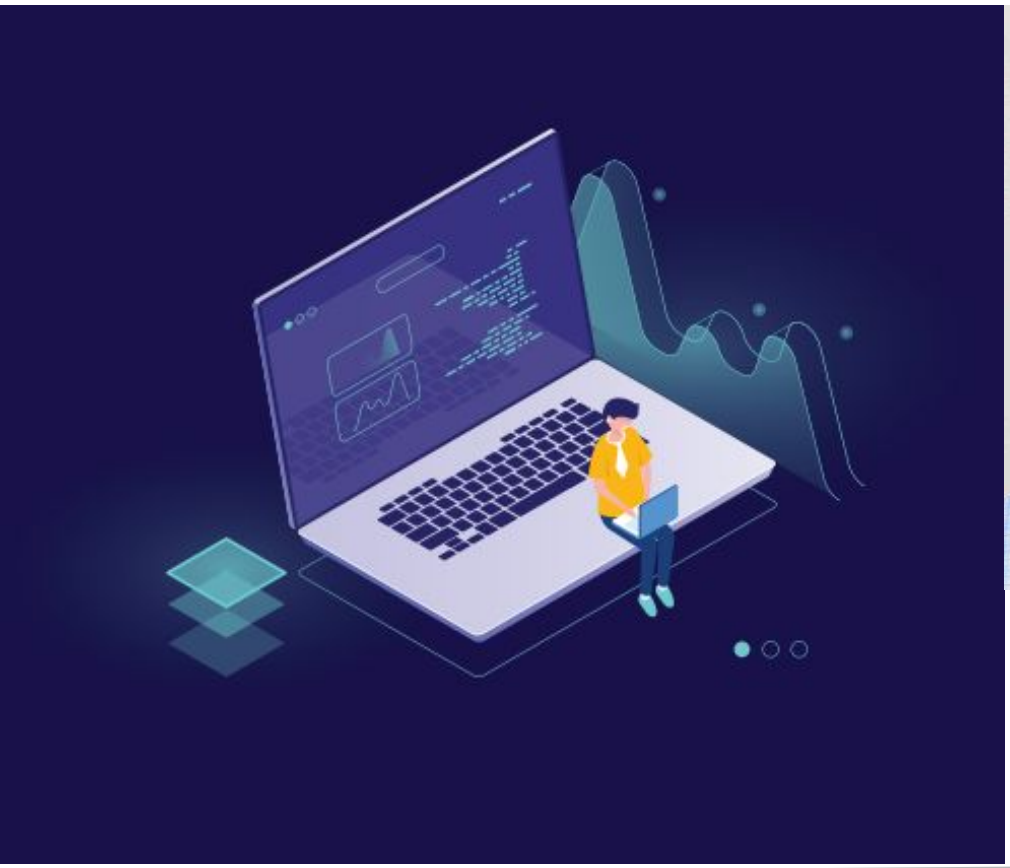
#6

Ranked for IITs
*NIRF 2020

QS WORLD UNIVERSITY RANKINGS

#12

Ranked Best Global Universities in India
*QS World Rankings



Prof. Sanjeev Manhas

Coordinator E-Learning Centre

IIT Roorkee

CloudxLab & Course

Cloudxlab is a team of developers, researchers, and educators who create gamified learning experiences for users. The company upskills engineers in deep tech to make them employable & future-ready. Cloudxlab is proud to collaborate with EICT-IITR to empower learners to solve complex problems with this Data Science course.

Our Students Work At

and more!

Sandeep Giri

Founder at CloudxLab

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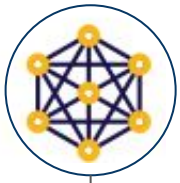
Why CloudxLab & IIT Roorkee

Earn certificate from IIT Roorkee.



Learn Machine Learning, Gen AI, Agentic AI from IIT Roorkee professor and industry experts and become expert in AI domain

Online cloud lab for hands-on for real-world experience

Best-in-class support Throughout your learning journey

Lifetime course access

Work on real-world projects.

Interact with the international community of peers via the discussion forum.

Mentors / Faculties

Prof. Pravendra Singh
Faculty CSE Dept,
IIT Roorkee

Course Instructor
Know More

Sandeep Giri
Founder at CloudxLab
Past: Amazon, InMobi, D.E.Shaw

Course Developer
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Abhinav Singh
Co-Founder at CloudxLab
Past: Byjus

Course Developer
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Praveen Pavithran
Co-Founder at Yatis
Past: YourCabs, Cypress Semiconductor

Course Developer
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Venkat Karun
Staff Software Engineer
Google

Course Advisor
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Shubh Tripathi
ML Engineer
CloudxLab

Course Instructor
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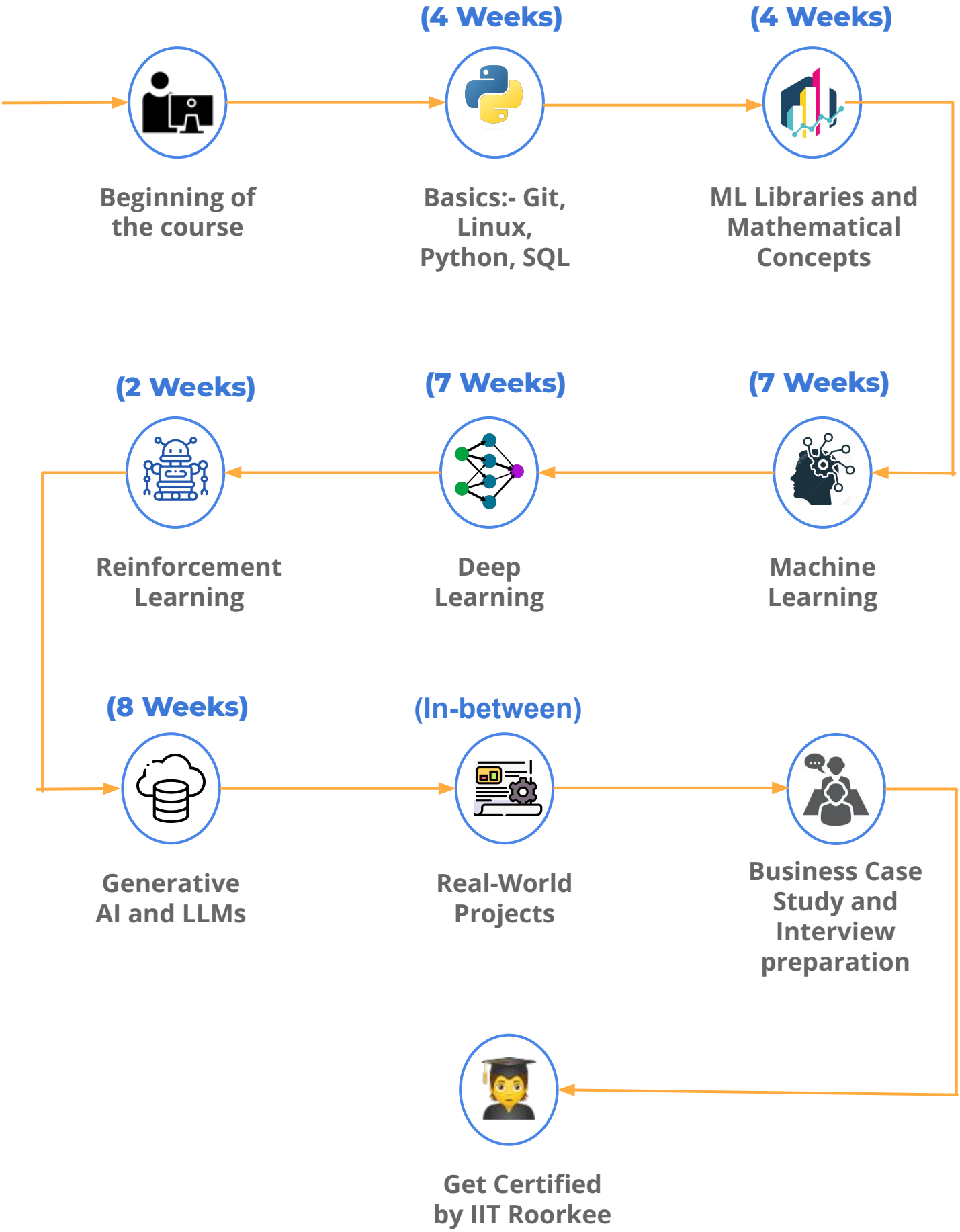
Learning Path



Course Curriculum

1. Linux, SQL & Git (Self-paced)

- Learn Linux command line fundamentals
- Understand file systems and navigation
- Write basic shell scripts
- Perform SQL queries and joins
- Analyze datasets using SQL
- Use Git for version control

2. Designing Your Own Number System (*Prologue · Sets the tone for the entire journey)*

- Choose a base and represent numbers
- Perform arithmetic in custom base systems
- Convert numbers between bases
- Understand binary representation in computing
- Learn positional number system concepts
- Build intuition through first principles

3. Python by Invention (*Python · Maths · DSA · Basic ML · LLMs · AI Agents)*

- Learn matrices, logs, and probability with Python
- Solve Python problems with increasing difficulty
- Build classes, objects, and reusable abstractions
- Analyze algorithms using Big O complexity
- Learn Bayes theorem and statistical concepts

Course Curriculum

- Solve problems using recursion techniques
- Build data structures: BST, queues, trees
- Implement algorithms: search, sort, graph traversal
- Solve problems using dynamic programming
- Implement Euclidean distance for ML tasks
- Build KNN, K-Means, Naive Bayes models
- Train and evaluate decision tree models
- Work with LLMs and embeddings
- Perform sentiment analysis using embeddings
- Understand temperature and randomness in LLMs
- Implement greedy and beam search decoding
- Build semantic search applications
- Create your first AI agent
- Build RAG-based document Q&A systems

4. Scientific Python & Data Wrangling *(NumPy · Pandas · Matplotlib · Projects)*

- Learn NumPy, Pandas, Matplotlib by building
- Clean and handle messy real-world datasets
- Perform feature engineering for better models
- Build recommendation systems from scratch
- Perform image manipulation and pixel operations
- Implement linear regression from scratch
- Apply gradient descent for model training
- Create interactive visualizations using Plotly

Course Curriculum

5. End to End Machine Learning *(Delivered by IIT Professors · Invent your own algorithm)*

- Build complete end-to-end machine learning pipelines
- Implement linear and logistic regression models
- Learn decision trees and ensemble methods
- Perform clustering and dimensionality reduction
- Evaluate models using standard performance metrics
- Apply cross-validation and hyperparameter tuning
- Deploy models using Flask and Docker
- Work on real datasets via Kaggle
- Build and showcase your ML portfolio
- Design your own algorithm as capstone

6. Foundations & ANNs in Deep Learning *(Build an ANN from scratch in NumPy)*

- Build artificial neural networks from scratch
- Learn backpropagation and optimization techniques
- Understand vanishing gradient problems
- Apply dropout and batch normalization
- Use transfer learning on custom datasets
- Fine-tune pre-trained models effectively
- Implement your own neural network architecture

Course Curriculum

7. Sequence Models & Attention *(RNN · LSTM · Attention · Autoencoders)*

- Learn RNN and LSTM architectures
- Build models for sequential data tasks
- Perform time-series forecasting using LSTMs
- Understand encoder-decoder model architecture
- Learn sequence-to-sequence model concepts
- Study attention and self-attention mechanisms
- Understand transformer model foundations
- Build autoencoders for representation learning

8. Transformers & Large Language Models *(Transformer Architecture · BERT · GPT · Fine-tuning)*

- Build transformer architecture from scratch
- Implement encoder, decoder, multi-head attention
- Understand positional encoding and normalization
- Learn feed-forward layers in transformers
- Study BERT and GPT model architectures
- Understand pre-training and fine-tuning concepts
- Fine-tune models on custom datasets
- Connect AI agents with transformer systems

9. Convolutional Neural Networks *(Derive convolutions · Design your own architecture)*

- Derive and implement convolution operations
- Build CNNs for image classification tasks
- Perform object detection using CNN models

Course Curriculum

- Apply transfer learning with pretrained CNNs
- Use VGG, ResNet, EfficientNet architectures
- Build GANs from scratch
- Train generator and discriminator networks
- Design and justify custom CNN architectures

10. Reinforcement Learning (*Design your own environment · Train your own agent)*

- Understand Markov decision processes and policies
- Learn reward shaping techniques for agents
- Implement Q-learning from scratch
- Build deep Q-networks for complex tasks
- Design custom environments for training agents
- Train agents using reinforcement learning methods
- Build end-to-end capstone project
- Deploy and present your final project

Projects

1. **Churn Email Inbox with Python**
    - In this project, we'll delve into the email activity of an open-source project development team. By leveraging Python libraries, we'll extract and analyze email data to understand communication patterns, identify potential churn (reduced participation), and gain insights into team dynamics.
2. **Image Denoising with Machine Learning**
    - In this project, we'll tackle the challenge of removing noise from images. We'll build a model that takes a noisy image as input and outputs a clean, denoised version. This project will involve exploring image processing techniques and training a machine learning model to effectively remove noise artifacts.
3. **Spam Classifier for Email Management**
    - This project focuses on building a spam classifier with Python. We'll utilize datasets from Apache Spam Assassin to train a model that can categorize emails as spam or legitimate (ham). This will equip you with the ability to filter unwanted messages and enhance your email management experience.
4. **Predicting Titanic Passenger Survival Rates**
    - The infamous RMS Titanic disaster serves as the backdrop for this project. We'll build a machine learning model capable of predicting passenger survival based on historical data. This project delves into data analysis and model building to uncover insights into the tragic event.

Projects

5. **K-Nearest Neighbors for Noisy Image Classification**
    - This project explores the use of the K-Nearest Neighbors (KNN) classifier for image classification. We'll utilize the MNIST dataset of handwritten digits to train a model that predicts the original image from its noisy version. This project provides a hands-on introduction to image processing and KNN classification.
6. **Credit Card Fraud Detection with Machine Learning**
    - This project tackles the critical issue of credit card fraud detection. We'll explore techniques like SMOTE to address imbalanced datasets and build a machine learning model capable of classifying fraudulent transactions. This project equips you with valuable skills to combat financial fraud.
7. **Building Cat vs Non-Cat Image Classifier using NumPy**
    - Get ready to build an image classifier from scratch! This project utilizes Python's NumPy library to implement a Logistic Regression classifier. We'll train the model to distinguish between images containing cats and those that don't. This provides a fundamental understanding of building image classifiers from the ground up.
8. **Iris Flowers Classification using Deep Learning and Keras**
    - This project ventures into the world of deep learning. We'll leverage Python's Tensorflow 2 Keras library to build a deep neural network classifier that identifies different flower species in the Iris dataset. This project offers an introduction to deep learning for image classification tasks.

Projects

9. **Classify Clothes from Fashion MNIST Dataset**
    - This project dives into fashion! We'll build a model to classify various clothing items using the Fashion MNIST dataset. This project introduces you to image classification techniques and working with datasets specifically designed for clothing recognition.
10. **Sentiment Analysis of "Iron Man 3" Movie**
    - Calling all Iron Man fans! This project explores sentiment analysis of movie reviews. We'll leverage Hive, a data warehouse tool, to analyze reviews for "Iron Man 3" and then utilize BI (Business Intelligence) tools like Tableau to visualize the sentiment data. This project combines data analysis and visualization to gain insights into audience reception.
11. **Image Classification with Pre-trained ResNet**
    - This project dives into image classification using Keras' pre-trained ResNet model. You'll explore the power of transfer learning and how this approach reduces training time and resource consumption. By building hands-on experience with pre-trained models, you'll gain a solid foundation in deep learning image classification.
12. **Building a Low-Latency Deep Learning Flask App**
    - This project focuses on optimizing a deep learning Flask application for speed. We'll refactor the codebase into microservices and leverage ZMQ networking to achieve low-latency inference

Projects

13. **Object Detection with Mask R-CNN and OpenCV**
    - This project introduces Mask R-CNN for object detection using OpenCV. We'll explore how to use a pre-trained TensorFlow model to identify objects in images. This project provides valuable insights for tasks like self-driving car development and image analysis.
14. **Converting image to a classical painting**
    - Unleash your artistic side with Neural Style Transfer! This project utilizes TensorFlow 2 to create images that blend the content of one image with the artistic style of another. Explore the power of convolutional neural networks and delve into a field that has fueled popular apps like Prisma.
15. **Deploying an Image Classification App on Heroku**
    - Ready to take your web app live? This project guides you through deploying an image classification app on Heroku, a cloud platform for web applications. This project empowers you to focus on development while Heroku handles deployment and management.
16. **Stock Closing Price Prediction using Deep Learning**
    - This project ventures into the world of financial forecasting. We'll build a model using Keras and Python to predict stock closing prices. This project delves into time-series modeling and equips you with valuable skills for financial analysis and prediction.

Projects

17. **How to make computer learn to play CartPole game**
    - Welcome to the world of Reinforcement Learning! This project uses OpenAI Gym to train a computer agent to play the CartPole game. Through this project, you'll gain hands-on experience with reinforcement learning concepts and how an agent learns through trial and error.
18. **Building and Deploying a Spark Application**
    - This project guides you through building a complete Spark application, from local development to deployment on a cluster. Apache Spark is a powerful framework for handling large datasets, and this project equips you with the skills to leverage its capabilities.
19. **Parse Apache Access Logs using Spark**
    - This project delves into parsing Apache access logs using Spark. You'll learn how to extract valuable insights from web server log data, providing valuable information for website optimization and user experience improvement.
20. **Real-time E-commerce Analytics Dashboard**
    - This project takes e-commerce analytics to the next level! We'll build a real-time analytics dashboard leveraging technologies like Apache Spark, Kafka, Spark Streaming, Node.js, Socket.IO, and Highcharts. This project equips you with the skills to create dynamic dashboards that provide real-time insights into e-commerce activity.

Projects

21. **MovieLens Data Exploration with Hive**
    - This project focuses on the MovieLens dataset, a popular resource for movie recommendation systems. We'll utilize Hive, a data warehouse tool, to analyze the data and uncover interesting patterns related to movie preferences and user behavior.
22. **Movie Recommendation System with Spark MLlib**
    - Building on the MovieLens data analysis, this project ventures into building a movie recommendation system with Spark MLlib. Spark MLlib is a machine learning library for Apache Spark, and this project equips you with the skills to create systems that recommend movies to users based on their preferences.
23. **Predicting Bike Rental Demand**
    - This project tackles a practical problem – predicting bike rental demand. We'll build a model that analyzes past data to forecast future demand for bike rentals. This project provides valuable insights for optimizing bike sharing systems and resource allocation.
24. **Analyzing NYSE Data with Hive**
    - The New York Stock Exchange (NYSE) data holds a wealth of information for financial analysis. This project utilizes Hive to process and analyze NYSE data, allowing you to uncover trends and insights relevant to the stock market.

Projects

25. **Building end-to-end Machine Learning Project**
    - In this project we will build a machine learning model to predict housing prices using California Housing data.. We will learn various data manipulation, visualization and cleaning techniques using various libraries of Python like Pandas, Scikit-Learn and Matplotlib. This project covers building a Machine Learning project end-to-end.
26. **Performing Sentiment Analysis with LLMs**
    - In this project, we will use **OpenAI embeddings** to conduct sentiment analysis on customer reviews. By exploring the capabilities of LLMs, we aim to extract nuanced sentiment from textual data, providing valuable insights for businesses to enhance customer satisfaction and decision-making.
27. **Building your own GPT from scratch using Tensorflow**
    - In this project we will build our GPT from scratch. Then we will train it on the **Shakespear** data. The result will be a language model capable of generating text with a distinctive Shakespearean flair.
28. **Building a RAG based chat agent with Langchain and OpenAI**
    - In this project, we'll integrate RAG (Retriever-Augmented Generation) with Langchain to develop a sophisticated chat agent. Leveraging Chroma as a vector store, we'll store and retrieve relevant data based on user inquiries. This data will be seamlessly passed to GPT, enabling the generation of accurate and contextually relevant responses to customer queries.

Projects

29. **Building a RAG based chat agent web app using Flask**

    - Create a user-friendly web application using Flask that integrates our RAG-based chat agent that we created in the previous project. Users can interact with the chat agent directly on the web, asking questions and receiving responses generated by advanced language models.

30. **Building a Text to SQL Query Generator using Langchain**

    - This project enables the generation of SQL queries from natural language prompts. By providing the database schema and the user's query, the system utilizes GPT to generate SQL queries tailored to the user's needs. Execute the generated queries on your MySQL database effortlessly, simplifying the process of retrieving data through intuitive natural language interactions.

31. **Developing a Voice-Controlled RAG Chat Agent App**

    - This project extends our existing RAG-based chat agent to incorporate voice commands. By integrating **text-to-speech** and **speech-to-text** functionalities, users can engage in voice conversations with the chat agent. Enhance user experience and accessibility by enabling intuitive voice interactions, fostering seamless communication between the customer and the chat agent.

Projects

32. **Group mobile app reviews to generate clean actionable insights**
    - This project focuses on **clustering** mobile app reviews to extract meaningful insights. Through clustering techniques, we'll organize reviews into groups, allowing us to identify key areas for improvement or action. By analyzing these insights, our company can prioritize enhancements and address user concerns effectively, fostering continual improvement and enhancing user satisfaction with our mobile app.
33. **Building an OpenAI agent to automate daily tasks**
    - Build your own **OpenAI-powered assistant** to tackle daily tasks. Choose routines, train on your language, and watch it streamline your life. Ideal for busy professionals and AI enthusiasts.
34. **Building a QR Code AI Art Generator**
    - This project aims to generate QR codes with artistic designs. By leveraging the **Midjourney** and **DALL-E** APIs, we'll infuse creativity into QR code generation, transforming them into visually appealing artworks.
35. **Building an image editor to edit images using text**
    - This project focuses on creating an application for editing images using natural language commands. Leveraging the Midjourney and DALL-E APIs, users can manipulate images through text input, enabling intuitive editing processes.

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- Showcase your course project to Professors and peers
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