A Synopsis

of

Mini Project – AIML Lab [CC3230]

**Customer Churn Prediction and Recommendation System**

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towards the partial fulfillment of the requirement for the award of the degree of

**BACHELOR OF TECHNOLOGY**

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**INTRODUCTION**

With the increasing use of online platforms and subscription-based services, businesses are facing the challenge of customer retention. Predicting customer churn and offering personalized recommendations have become essential tools for improving customer satisfaction and increasing revenue. The ability to predict when a customer is likely to leave a service allows companies to implement targeted interventions to retain valuable users. Similarly, providing tailored recommendations can enhance the user experience and encourage continued engagement.

This project focuses on two primary objectives: churn prediction and the development of a recommendation system. By analysing historical data, the churn prediction model will forecast the likelihood of customers discontinuing their subscriptions or services. The recommendation system will suggest relevant products or services to users based on their past behaviour, preferences, and interactions.

The dataset for this project is sourced from Kaggle and includes various customer attributes such as demographics, usage patterns, subscription history, and interaction data. Using machine learning techniques, including classification models for churn prediction and collaborative filtering or content-based approaches for recommendations, the system will be able to provide actionable insights for businesses.

A critical feature of this project is the integration of both churn prediction and recommendations into a seamless user interface, enabling businesses to access predictions and recommendations in real time. The final product will be a web-based platform that allows users to upload their customer data, receive churn predictions, and view personalized recommendations.

By undertaking this mini project, I aim to apply machine learning techniques to solve real-world business challenges. The combination of churn prediction and recommendation systems will help companies reduce customer attrition, enhance customer satisfaction, and drive growth. This project will not only deepen my understanding of machine learning but also contribute to the broader field of AI-driven business solutions.

**MOTIVATION**

The ability to predict customer churn and provide personalized recommendations has become a crucial asset for businesses aiming to enhance user satisfaction and retention. As industries become more data-driven, the need to develop intelligent systems that can forecast customer behaviour and suggest relevant products or services has never been more pressing. Businesses that can predict and act upon churn signals can reduce customer attrition, while effective recommendation systems can boost user engagement and revenue.

My motivation for this project stems from a deep interest in applying machine learning to solve real-world business challenges. As companies face increasing competition and pressure to retain customers, utilizing data to make informed decisions becomes vital. The development of a churn prediction system and recommendation engine offers an opportunity to work with state-of-the-art machine learning techniques while addressing an essential problem in business operations.

Furthermore, the challenge of building a dual-purpose system—predicting churn and offering personalized recommendations—aligns with my goal of applying theoretical knowledge to create practical solutions with immediate business impact. The integration of both models into a user-friendly web platform ensures that the research has tangible applications for businesses seeking to optimize customer experience and retention.

By working on this project, I aim to contribute to the growing field of AI-driven business solutions. This project is not only an opportunity to enhance my technical skills but also a way to make a meaningful impact on how businesses engage with and retain their customers in a competitive market.

**PROBLEM STATEMENT**

With the increasing number of subscription-based services and e-commerce platforms, businesses are facing significant challenges in retaining customers. Customer churn, where users discontinue their services or subscriptions, is a major concern, leading to lost revenue and growth stagnation. Similarly, providing relevant product or service recommendations is crucial to maintaining user engagement. Traditional methods for addressing churn and offering recommendations are often static and fail to adapt to individual customer behaviors in real time.

The primary challenge is to develop a system that can accurately predict customer churn and provide personalized recommendations to retain users and enhance their experience. The solution should be scalable, efficient, and easy to integrate into existing business workflows, allowing companies to act on predictions and recommendations promptly.

**Objectives:**

1. Develop a machine learning model capable of predicting customer churn based on historical data.
2. Implement a recommendation system that suggests relevant products or services based on user behaviour.
3. Utilize a dataset with customer attributes such as demographics, usage patterns, and interactions to train and evaluate the models.
4. Create a web-based tool that allows businesses to input customer data, receive churn predictions, and view personalized recommendations.
5. Ensure that both models are scalable, efficient, and capable of real-time performance.
6. Assess the models' accuracy, efficiency, and robustness in different business environments.

**Pros & Cons of Existing Methods:**

**Pros:**

* Traditional customer churn models, such as logistic regression and decision trees, provide interpretable insights into the factors driving customer attrition.
* Collaborative filtering and content-based recommendation systems have been successfully implemented in various platforms like e-commerce and streaming services.
* Machine learning models offer the potential for dynamic and data-driven solutions to predict churn and recommend products in real time.

**Cons:**

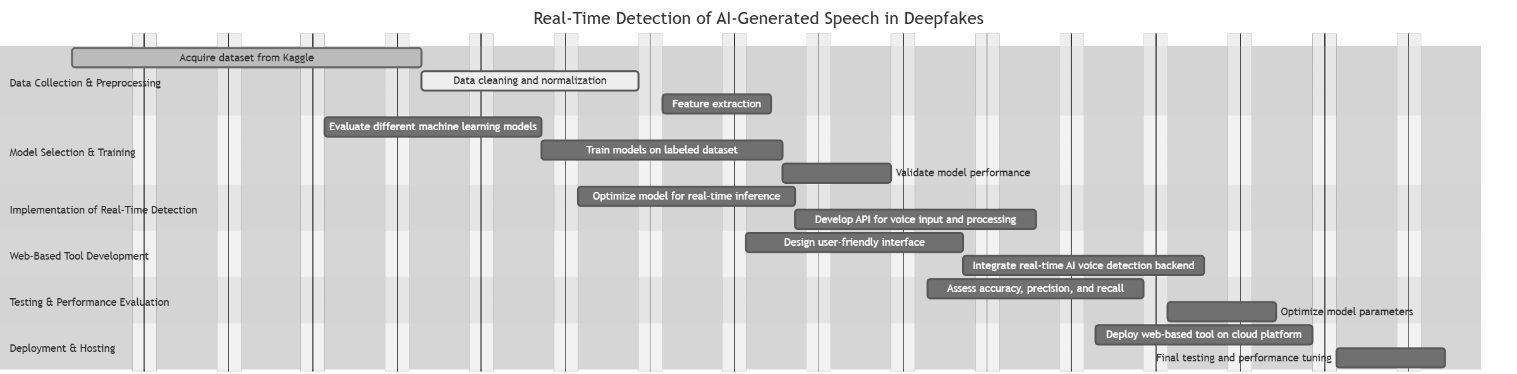
* Many existing churn prediction models are based on static datasets and do not adapt to changing customer behaviours over time.
* Some recommendation systems rely heavily on historical data, which can limit their effectiveness for new customers with minimal interaction history.
* Traditional models can be computationally expensive and require ongoing maintenance to remain accurate as customer data evolves.
* Current solutions for churn prediction and recommendations are often complex and require significant expertise to implement and maintain.

By addressing these limitations, this project aims to develop a scalable and efficient churn prediction and recommendation system that can provide valuable insights and actionable recommendations for businesses, helping them reduce customer attrition and enhance engagement.

**METHODOLOGY**

To achieve the objectives of this project, the following steps will be followed:

1. Data Collection & Preprocessing
   * Acquire the dataset from Kaggle, containing customer attributes, usage patterns, and interaction data.
   * Perform data cleaning, including handling missing values and outliers.
   * Conduct feature extraction and normalization to ensure uniformity across different customer attributes.
2. Model Selection & Training
   * Evaluate various machine learning models (e.g., Logistic Regression, Decision Trees, Random Forest, XGBoost) for churn prediction.
   * For the recommendation system, assess collaborative filtering, content-based filtering, and hybrid approaches.
   * Train the models using labelled datasets, and split data into training and testing sets to validate performance.
3. Implementation of Real-Time Prediction & Recommendations
   * Optimize churn prediction and recommendation models for real-time inference with minimal latency.
   * Develop an API for processing customer data and generating predictions and recommendations.
4. Web-Based Tool Development
   * Design and implement a user-friendly web interface that allows businesses to input customer data and receive predictions and recommendations.
   * Integrate the churn prediction and recommendation models with backend processing.
5. Testing & Performance Evaluation
   * Assess the accuracy, precision, recall, and F1 score for churn prediction models.
   * Evaluate the relevance and accuracy of recommendations through metrics like Mean Absolute Error (MAE) and Root Mean Square Error (RMSE).
   * Conduct performance tuning to optimize model efficiency and real-time performance.
6. Deployment & Hosting
   * Deploy the web-based tool on a cloud platform (e.g., AWS, Heroku).
   * Conduct final testing, performance evaluation, and model parameter optimization before the public release.



Gantt Chart of Methodology

This structured methodology ensures a systematic approach towards achieving the project's objectives and delivering a functional AI voice detection system.

**FACILITIES REQUIRED**

**Software Requirements:**

* Python (with libraries such as TensorFlow, PyTorch, Librosa, and Scikit-learn)
* Flask/Django for web backend development
* React.js/HTML/CSS for frontend development
* MongoDB/MySQL for database management (if required)
* Cloud services (AWS, Google Cloud, or Azure) for hosting
* Jupyter Notebook for development and experimentation

**Hardware Requirements:**

* There are no specific hardware requirements for this project, as it will be conducted on my personal computer. In the event that additional computational resources are needed, I will request access to the lab's equipment.

**BIBLIOGRAPHY & REFERENCES**

Dataset: [Customer Churn Dataset](https://www.kaggle.com/datasets/muhammadshahidazeem/customer-churn-dataset?resource=download)

Research Papers:

* [A Review on Machine Learning Methods for Customer Churn Prediction and Recommendations for Business Practitioners | IEEE Journals & Magazine | IEEE Xplore](https://ieeexplore.ieee.org/abstract/document/10531735)
* [A comparison of machine learning techniques for customer churn prediction - ScienceDirect](https://www.sciencedirect.com/science/article/abs/pii/S1569190X15000386)