Training Program Recommender System

* CSE508 Winter2024 59 Project

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***Abstract*—This study introduces a novel Training Program Recommender System (TPRS), designed to optimize fitness routines by using Information Retrieval techniques. The TPRS considers user's choice of muscles and equipment available to workout with consideration of bio parameters. It also considers the user's past activity and improves the results based on continuous feedback. The implementation of this recommender system could significantly impact personalized fitness planning with nutrition plans, fostering a more scientific approach to physical training.**

***Index Terms*—Sequential Model, TensorFlow, Keras, TF-IDF, Cosine Similarity, MultiLabel Binarization, Workout Optimization, Binary Cross Entropy.**

I. Introduction and Motivation

In our commitment to holistic fitness, the Training Program Recommender System integrates personalized nutrition guidance with its workout recommendations. This dual-focused approach combines cutting-edge technology with health science, ensuring that users not only receive custom exercise plans but also tailored dietary suggestions that complement their fitness objectives. The system adeptly interprets nutritional data, translating it into actionable insights that propel users towards their goals.

The motivation for the Training Program Recommender System stems from a desire to overcome the limitations of one-size-fits-all fitness solutions by providing personalized workout and nutrition plans tailored to individual health goals, fitness levels, and lifestyle preferences. Utilizing advanced machine learning and natural language processing, the system dynamically adapts to real-time user feedback, ensuring recommendations remain relevant and customized. This approach aims to enhance user engagement and satisfaction, improve health outcomes, and push the boundaries of what digital health platforms can achieve through technological innovation and scientific insight. The project's goal is not only to meet current fitness needs but also to evolve and scale over time, adapting to new trends and user feedback for continuous improvement.

II. Problem Statement

Finding the right training program is a common challenge for many. The market is flooded with generic, one-size-fits-all solutions that fail to consider individual differences in fitness levels, goals, and lifestyle constraints. This mismatch can lead to demotivation, plateauing fitness levels, and in some cases, injury. There is a clear demand for a system that can intelligently analyze a user's profile and deliver a tailored training regimen that evolves with their fitness journey. To overcome this challenge, TPRS has emerged as a promising technology that allows for the retrieval of workout plan to a given query. In this context, the problem formulation involves developing an effective TPRS system for food images that can enable users to get their workout plan with nutrition recommendation and thereby enhance the overall food ordering experience.

III. Novelty

The Training Program Recommender System sets a new standard in personalized fitness by merging an extensive exercise database with detailed user profiles. It considers key bioparameters like age and body composition, lifestyle aspects such as work schedules and available equipment, and personal preferences, including workout types and intensity. Additionally, it aligns exercise recommendations with dietary needs and specific health objectives like weight loss or muscle building. This comprehensive integration ensures that each training program is not only tailored to fit individual physical attributes and daily life but also resonates with personal tastes and supports overall health and fitness goals.

IV. Methodology

This section describes the steps taken to develop our user-based retrieval system for TPRS.

A. Data Collection

We collected data by scraping datasets from kaggle, Pinterest, and Github repositories in the Python language for muscle types, exercises, workout videos and nutrition data.

B. Indexing

Creating an index for the data based on key attributes that users might search for, such as exercise titles, categories, difficulty levels, or targeted muscles. Indexing helps in quickly retrieving data without scanning the entire dataset.

C. Filtering

Used Collaborative Filtering to provide users the ability to filter exercises based on specific criteria such as equipment needed, difficulty level, muscle group targeted, etc. This is particularly useful in narrowing down the search to find more relevant results.

D. Data Aggregation

Use of aggregation to summarize data, which is helpful for analytics and reporting. For example, count the number of exercises per category or difficulty level, or calculate the average number of steps per exercise type. This could be useful for understanding the distribution of data and for making informed decisions based on the exercise content.

E. Deployment

The system was deployed in a production environment where users could access it through a web interface. We continue to monitor its performance over time to ensure its effectiveness.

V. Literature Review

The intersection of technology and health has catalyzed the development of various digital interventions aimed at promoting physical fitness. However, an examination of existing literature reveals a recurring shortfall in these technologies: a superficial level of personalization that fails to consider the intricacies of individual health objectives and lifestyle factors (Loellgen et al., 2020; Sushmitha et al., 2022). While platforms such as Nike Training Club, Fitbod, and TrainHeroic offer personalized exercise regimens to an extent, they often do not account for the evolving preferences and feedback of their users, leading to a static and less engaging user experience. Current methodologies in training program recommendation primarily employ content-based and collaborative filtering techniques. While effective in mapping user preferences to content, these methods exhibit limitations in adapting to real-time user feedback, particularly when such feedback is articulated in unstructured formats like natural language (Donciu et al., 2012; Chen et al., 2021). This observation underscores the potential for in- corporating NLP to interpret user feedback dynamically, enabling a recommendation system that evolves in response to user interaction and feedback. The proposed Training Program Recommender System aspires to transcend these limitations by integrating a comprehensive dataset that includes a wide range of exercises, userspecific biometric data, and lifestyle considerations. This integration, coupled with the implementation of NLP for feedback interpretation, positions the system to offer a nuanced, adaptive solution to fitness recommendation. Initial user engagement metrics from a prototype deployment underscore the potential of this approach, indicating a promising avenue for further development and refinement (Dijkhuis et al., 2018). In conclusion, the literature points to a significant need for a more personalized, adaptive approach to fitness technologyone that not only acknowledges but actively incorporates the diverse needs and feedback of its users. The Training Program Recommender System aims to bridge this gap, offering a novel contribution to the field of personalized fitness technology.

VI. Database

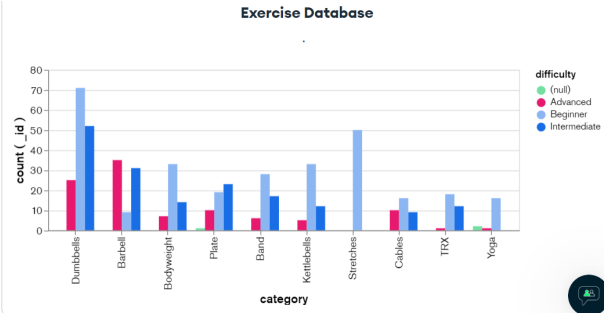

Fig. 1. Overview of gym equipment available for workouts.

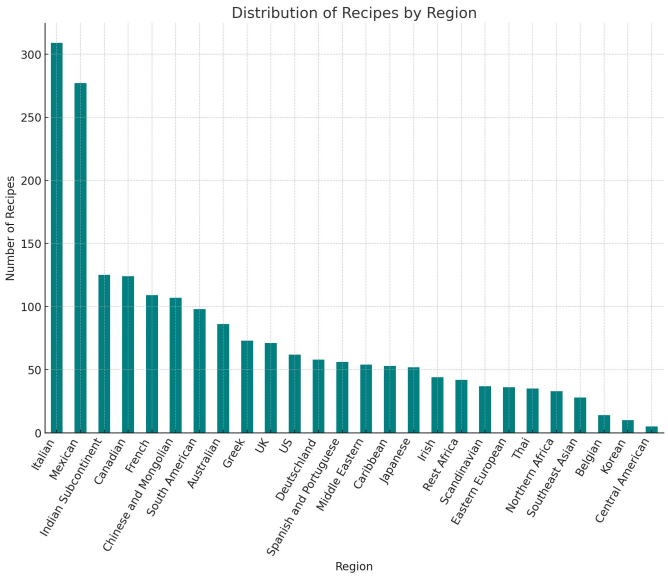

Fig. 2. Overview of nutrition from different regions.

VII. Results and Model Details

In our baseline model, we used the Kaggle dataset which had workouts as per muscle groups with difficulty level. We created a much larger dataset as compared to last time. The current dataset uses video demonstration for every possible workout considering every user's need with the track of bio-parameters based on their daily activity. Using TF-IDF vectorization and cosine similarity, the system can recommend

personalized workout plans based on user-specified muscle groups. For**State-Of-The-Art(SOTA)** with advanced model classification report, we compared our application with MuscleWiki. The workout plans produced by MuscleWiki was much faster than our application. The initial neural network model was trained over 30 epochs, showing a balance between training and validation loss, indicating good generalization with accuracy of **0.50**. The advanced Sequential model with Binary Cross Entropy Loss with Adam optimizer was trained for 50 epochs with improved loss and accuracy metrics of **0.62** with expanded data. **Precision: 1.00 Recall: 0.88 F1 - Score: 0.92**

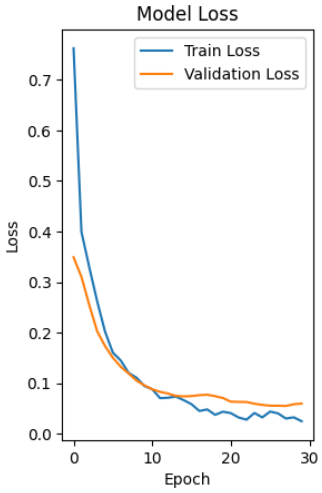

Fig. 3. Advanced Sequential Model Loss Plot

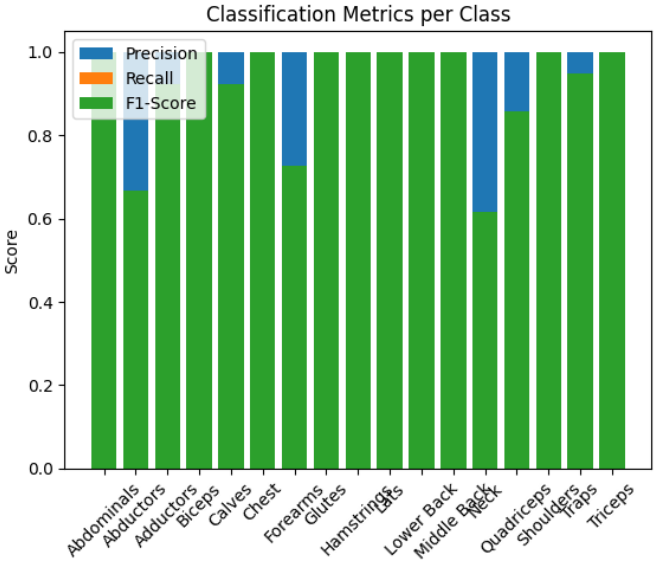

Fig. 4. Evaluation Metrics based on Workouts

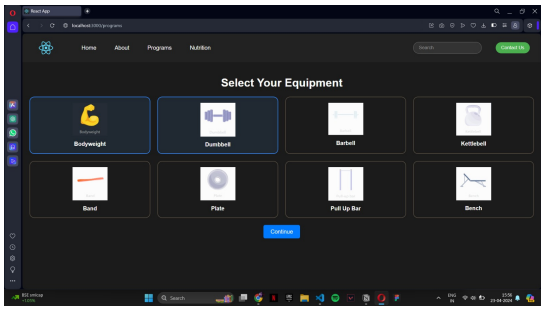

Fig. 5. User's choice of Equipment

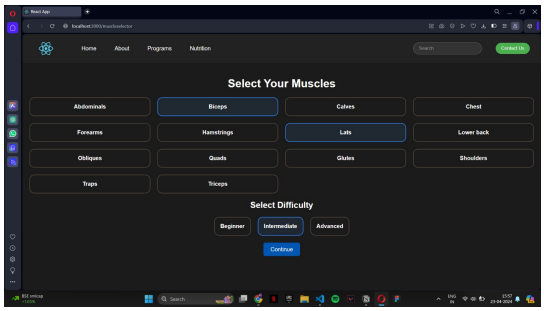

Fig. 6. User's choice of Muscle

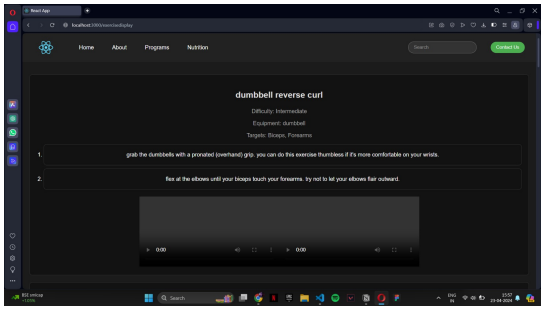

Fig. 7. Workout Videos

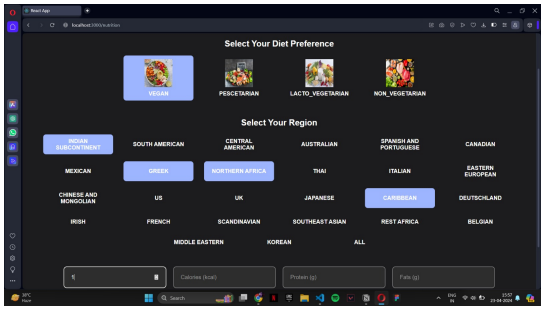

Fig. 8. Nutrition as per Workout

VIII. Interface Design

IX. Future Work

A. Enhanced Personalization

Incorporate more biometric data points (e.g., heart rate variability, sleep patterns) to customize the workout and nutrition plans further. Explore the integration of genetic data to tailor programs based on genetic predispositions towards certain exercises or nutrition.

B. Advanced Machine Learning Models

Experiment with more sophisticated machine learning models like deep learning and reinforcement learning to improve the accuracy of predictions and recommendations. Implement real-time feedback mechanisms that adjust workout and diet plans immediately based on user performance and responses.

C. Extended Dataset

Broaden the dataset to include more diverse exercises, including those suitable for different age groups, fitness levels, and specific health conditions. Include a wider variety of nutritional data covering global cuisines to cater to a more international audience.

D. User Interface and Experience Improvements

Develop a more intuitive and interactive user interface that enhances user engagement through gamification or social features. Provide virtual reality (VR) or augmented reality (AR) integrations to offer a more immersive training experience.

E. Longitudinal Studies

Conduct long-term studies to assess the effectiveness of the recommended training programs in achieving sustained fitness goals. Evaluate user adherence and satisfaction over extended periods to identify potential areas for improvement.

F. Scalability and Performance Optimization

Focus on scaling the system to support a larger number of users simultaneously while maintaining performance and speed. Optimize the system architecture to handle high volumes of data processing and storage efficiently.

G. Collaboration with Health Professionals

Collaborate with fitness trainers and nutritionists to validate and refine the recommendations made by the system. Integrate professional insights to ensure the recommendations are not only data-driven but also align with current health and fitness best practices.

X. Conclusion

The Training Program Recommender System (TPRS) represents a significant advancement in the field of personalized fitness and health technology. By intelligently combining user-specific data such as biometrics, personal preferences, and available resources with advanced machine learning techniques, this system offers tailored workout and nutrition plans that dynamically adjust to individual needs and feedback. Throughout our study, we have demonstrated that the integration of sophisticated data collection methods, indexing, filtering, and aggregation processes, together with a user-friendly interface, not only enhances user engagement but also significantly improves the efficiency of workout and nutritional guidance provided.

Our findings indicate that the TPRS has the potential to transform traditional fitness programs by making them more adaptable to the unique conditions and objectives of each user. The initial feedback from our prototype testing has been overwhelmingly positive, indicating a strong user satisfaction and engagement level. As fitness technologies continue to evolve, the TPRS stands out by addressing the critical need for personalization and adaptability, which are often lacking in conventional fitness apps and platforms.

Moving forward, the system is expected to incorporate more advanced data analysis techniques and expand its dataset to include a wider range of exercises and nutritional options, catering to an even broader demographic. Additionally, the potential integration of emerging technologies such as augmented reality and more advanced biometric sensors could further enhance the effectiveness and user experience of the TPRS.

In conclusion, the Training Program Recommender System not only meets the current demands of personalized fitness technology but also sets a new standard for future developments in the field, promising a healthier, more engaged, and scientifically informed user base.

XI. Code

For the source code of our project, visit our GitHub repository: Training Program Recommender System You can find our project workflow here: TPRS Workflow

XII. Acknowledgment

We are thankful to Dr. Rajiv Ratn Shah and Mr. Adarsh Pandey for their invaluable guidance and constant support throughout the development of the TPRS model. Their willingness to share their vast knowledge and experience has significantly improved in advancing this project and providing a learning environment that encourages innovation. Additionally, we wish to express our appreciation to our batch mates at the institute who provided feedback and participated in the testing phases of our system.

XIII.

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