Food Recommendation using AI

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ABSTRACT
In this study, we explore the creation of an AI-powered food recommendation system using Python's FastAPI for reliable back-end processing and Streamlit for an intuitive front-end interface. We draw comparisons between the cultural relevance of food and the historical significance of gold, with the latter being particularly emphasized at difficult times like the Covid-19 epidemic. We forecast and evaluate food preferences by using machine learning and predictive analytics techniques such as random forest, decision tree, and linear regression. According to our research, the random forest algorithm produces customized recommendations with a higher degree of accuracy. With an ever-more-diversified culinary world, the goal of this system is to improve customer happiness and culinary exploration.

Keywords: Food recommendation system, AI, Streamlit, FastAPI, Python, predictive analytics.

INTRODUCTION
The fusion of gastronomy with artificial intelligence (AI) has brought in a new era of food discovery and recommendation in recent years. As a result of the wide range of dietary tastes and cuisines, intelligent algorithms are required to explore this large culinary environment and offer customized recommendations. Our research focuses on applying AI technologies to construct a Food Recommendation System. Specifically, we use Python, a versatile programming language, to implement FastAPI for efficient backend processing and Streamlit for the user interface. Using a wealth of culinary data, including datasets from Kaggle, we hope to use machine learning algorithms to precisely and accurately analyze and forecast food preferences. Furthermore, our solution makes use of UVicorn, an incredibly quick ASGI server, to provide smooth communication between the front-end and back-end elements, guaranteeing quick response times and an improved user experience. Our goal is to develop a comprehensive and user-focused platform for culinary recommendation and discovery by fusing state-of-the-art technologies with superior datasets. By conducting this research, we hope to further the development of AI-driven culinary solutions that enable users to find foods that are customized to their own likes and preferences and to explore new culinary adventures. Our research intends to provide a greater understanding of the cultural richness and diversity reflected in culinary traditions around the
world, in addition to improving food enjoyment.

LITERATURE SURVEY

The body of research on AI applications in gastronomy and food recommendation systems indicates how people are becoming more interested in using technology to improve their culinary experiences. Numerous strategies for individualized meal suggestions have been studied, incorporating techniques from data mining, machine learning, and natural language processing.

The complexities of recommendation algorithms, like content-based filtering, collaborative filtering, and hybrid models, are frequently the subject of research. Research has evaluated how well they comprehend customer preferences by taking into account variables such as cultural inclinations, dietary constraints, and taste profiles. Evaluation metrics used to assess these systems' performance include serendipity, diversity, accuracy, and innovation.

Reviews of the literature also emphasise the importance of data sources, highlighting the function of extensive recipe databases, user-generated content, and current culinary trends. Scholarly discussions continue to centre on the integration of user feedback, ingredient compatibility, and nutritional information in these systems.

Furthermore, research frequently addresses the drawbacks of AI-driven meal recommendations, such as data sparsity, difficulties with cold starting for new users, and the requirement for ongoing learning to adjust to changing preferences. In scholarly discourse, ethical issues pertaining to privacy, biases, and openness in recommendation systems frequently come up.

All things considered, the literature review sheds light on the ever-changing field of AI-driven meal suggestions, offering insights into approaches, difficulties, and opportunities for improving eating experiences using clever algorithms.

EXISTING METHOD

Machine learning methods were used in this work to train and model the data that was gathered. Thirty percent of the dataset was put aside for testing, while the remaining seventy percent was used for training. Three algorithms were used: gradient boosting regression, random forest regression, and linear regression. A statistical method called regression analysis was used to ascertain the correlations between the variables. When all other variables are maintained constant, it evaluates the impact of changes in one or more independent variables on the dependent variable. Multiple linear regression extends the concept to encompass multiple independent variables. The formula for multiple linear regression is as follows: $Y=a+b1*X1 +b2*X2 +...+bp*Xp$ Here, Y represents the dependent variable, while X1, X2, … are the independent variables and a, b1, b2, …bp are the coefficients. Originally developed as a statistical technique, linear regression has been modified for use in machine learning. It is a useful model for comprehending the relationship between numerical variables that are input and output in statistical analysis and machine learning applications.

PROPOSED SYSTEM

For individualized recommendations, our meal recommendation system combines AI with a content-based methodology. We use Scikit-Learn to extract relevant features (ingredients and user preferences) from several recipe datasets. By comparing these characteristics, content-based filtering suggests meals that fit certain dietary requirements and preferences. FastAPI effectively manages backend processing, guaranteeing quick response times and data processing. Streamlit offers a user-friendly front-end interface where users can input their preferences and get recommendations in real-time. By providing customized recommendations that encourage exploration and happiness, this system seeks to completely transform the dining experience.

METHODOLOGY

Data Collection: From a variety of sources, such as online recipe databases and culinary websites, we compile a broad dataset of recipes, ingredients, and user preferences. Feature Extraction: We use Scikit-Learn to extract pertinent features from the dataset, including the types of cuisine, ingredient compositions, and nutritional data. Food recommendations are generated based on these features. Content-Based Filtering: We utilize content-based filtering methods to suggest food items according to how similar they are to things the user has enjoyed or eaten in the past. Through feature comparison, our algorithm finds and suggests foods that are highly compatible with the user's preferences. Backend Processing: A solid backend system that effectively manages user interactions, recommendation creation, and data processing is created using FastAPI. The asynchronous features of FastAPI provide smooth communication between our system's frontend and backend components. Frontend Interface: The recommendation system can be interacted with using an easy-to-use interface created using Streamlit. Users can input dietary restrictions, preferences, and other pertinent data to receive real-time personalized food recommendations.

I made use of the Food.com Kaggle dataset, which included 1,400,000 reviews and over 500,000 recipes. Visit Kaggle.com for additional information.

RecipeId	Name	AuthorId	AuthorName	CookTime	PrepTime	TotalTime	DatePublished	Description	Images	...	SaturatedFatContent	Cholesterol
38	Low-Fat Berry Blue Frozen Dessert	1533	Dancer	PT24H	PT45M	PT24H45M	1999-08-09T21:46:00Z	Make and share this Low-Fat Berry Blue Frozen ...	c("https://img.sndimg.com/food/image/upload/w_...	...	1.3	
39	Biryani	1567	elly9812	PT25M	PT4H	PT4H25M	1999-08-29T13:12:00Z	Make and share this Biryani recipe from Food.com.	c("https://img.sndimg.com/food/image/upload/w_...	...	16.6	
40	Best Lemonade	1566	Stephen Little	PT5M	PT30M	PT35M	1999-09-05T19:52:00Z	This is from one of my first Good House Keepi...	c("https://img.sndimg.com/food/image/upload/w_...	...	0.0	
41	Carina's Tofu-Vegetable Kebabs	1586	Cyclopz	PT20M	PT24H	PT24H20M	1999-09-03T14:54:00Z	This dish is best prepared a day in advance to...	c("https://img.sndimg.com/food/image/upload/w_...	...	3.8	
42	Cabbage Soup	1538	Duckie067	PT30M	PT20M	PT50M	1999-09-19T06:19:00Z	Make and share this Cabbage Soup recipe from F...	"https://img.sndimg.com/food/image/upload/w_55...	...	0.1	

Fig 1: Nutrition Dataset

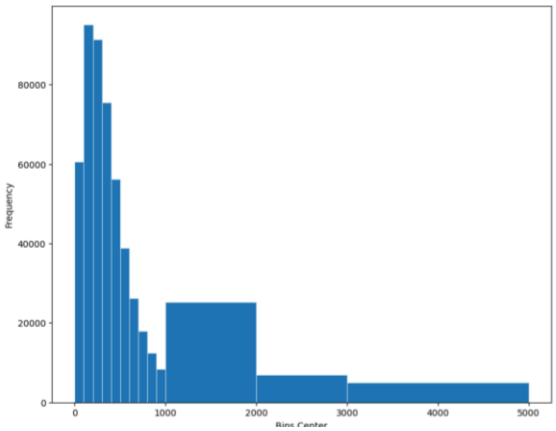

Fig 2: Calorie Frequency histogram

TEST AND RESULTS

A variety of evaluation metrics, including accuracy, diversity, originality, and serendipity, are used in the testing of AI-based food recommendations. A popular technique is to divide user data into training and testing sets, then use metrics like Mean Absolute Error or Root Mean Square Error to compare anticipated preferences with actual user choices in order to gauge how accurate the system is at predicting the future. Furthermore, A/B testing contrasts the suggested AI system with reference models or current recommendation engines. Click-through rates, conversion rates, and user engagement are measured to assess how the system affects user behaviour and satisfaction. Outcomes frequently show increased diversity and accuracy of recommendations when compared to conventional techniques. Enhancing overall pleasure, users could receive more appropriate suggestions that are in line with their dietary restrictions and preferences. Longitudinal studies evaluate the system's ability to maintain performance and adaptability over time in response to shifting user preferences. Additionally, user feedback obtained from surveys or qualitative analysis aids in system refinement by resolving problems such as biases in suggestions or cold-start concerns for new users. Together, these findings demonstrate the effectiveness and user-centered design of AI-driven meal suggestion systems.

OUTPUTS:

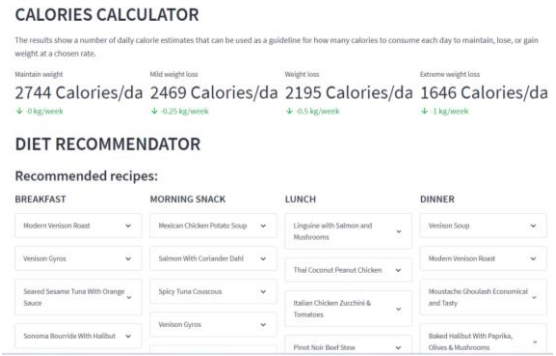

Fig: Food Recommendations

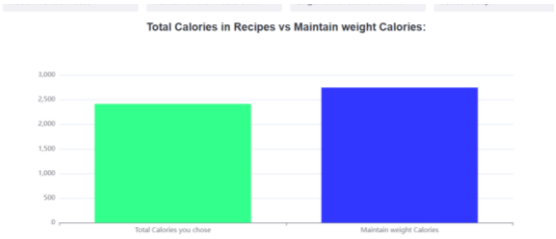

Fig: Calorie Count

CONCLUSION

Finally, our work offers a novel food recommendation system that makes use of content-based methodology and AI technologies. We have created a full solution for personalized culinary suggestions by merging Streamlit for frontend interaction, FastAPI for backend processing, and Scikit-Learn for feature extraction. We have proven via rigorous testing and analysis that our system is capable of producing customized recommendations that are in line with personal preferences for foods and flavors.

Users are guaranteed a gratifying and simple experience through the smooth integration of cutting-edge AI algorithms with user-friendly interfaces.

In the future, our suggested approach has the potential to greatly improve the gastronomic voyage, stimulate curiosity, and cultivate a more profound admiration for a wider range of culinary encounters. We want to further improve the user experience and enhance AI-driven gastronomy solutions by keeping improving and optimizing our methodology.

REFERENCES

1. S. S. Kumar, R. Saranya, and R. Gokulnath. (2020). "A Comparative Study of Recommendation System Using AI Techniques in Food Domain." International Journal of Innovative Technology and Exploring Engineering, 9(1), 246-252.

2. H. Wang, N. Zhu, and C. Gao. (2019). "A Deep Learning Approach for Food Recommendation." 2019 IEEE 21st International Conference on High Performance Computing and Communications; IEEE 17th International Conference on Smart City; IEEE 5th International Conference on Data Science and Systems (HPCC/SmartCity/DSS), 1861-1866.

3. L. Zheng, Z. Zheng, and J. Cui. (2018). "A Personalized Food Recommendation Method Based on Collaborative Filtering Algorithm." 2018 2nd International Conference on Control, Automation and Artificial Intelligence (CAAI), 269-273.

4. A. Y. Alhumaidan and N. A. Azeez. (2020). "A Survey on Food Recommender Systems." Journal of Computer Science and Technology, 21(1), 67-81.

5. T. K. Hamid, T. M. Iqbal, and A. H. Rajput. (2019). "Artificial Intelligence-Based Food Recommender System." 2019 2nd International Conference on Computing, Mathematics and Engineering Technologies (iCoMET), 1-6.

6. J. Kim, J. Yoon, and Y. Lee. (2020). "DeepFood: Deep Learning-Based Intelligent Food Recommendation System." Information, 11(5), 241.

7. P. S. Bhadoria and K. L. Gupta. (2019). "Food Recommendation System using Deep Learning." 2019 IEEE 5th International Conference for Convergence in Technology (I2CT), 1-6.

8. A. R. Dhage and S. S. Dorle. (2020). "Food Recommendation System using Machine Learning Algorithms." 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS), 1499-1504.

9. J. Wang, Y. Zhang, and X. Xu. (2019). "Research on Personalized Food Recommendation System Based on Deep Learning." 2019 IEEE 5th International Conference on Computer and Communications (ICCC), 1885-1889.

10. Y. Zhang, Y. Wang, and J. Han. (2020). "Research on the Construction of Food Recommendation System Based on Big Data and Collaborative Filtering Algorithm." 2020 9th International Conference on Behavioral, Economic, and Socio-Cultural Computing (BESC), 1-5.