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Food Spot: An Intelligent Location-Aware Food Recommendation System

Using Machine Learning and NLP-Based Sentiment Analysis on Indian Restaurant Datasets

Mrs. K. Sukeerthi[1], Y. Naga Tejaswini[2], J. Sandeep[3], R. Ganesh[4], E. Dinesh[5]

[1] Assistant Professor, Department of CSE (Data Science), ACE Engineering College, Hyderabad, Telangana, India

[2345] III B.Tech. Students, Department of CSE (Data Science), ACE Engineering College, Hyderabad, Telangana, India

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ABSTRACT

Speedy growth within India's restaurant industry has resulted in much more than many users could navigate when trying to find things to eat they like and that they can afford. Traditional sources of discovering food provide raw data and raw reviews, but do not provide any Intelligent or personalised direction. The authors of this paper are proposing to address these limitations with Food Spot, an intelligent web-based recommendation system for discovering food, using both machine learning techniques and Natural Language Processing (NLP) based sentiment analysis to process all publicly available datasets of Indian restaurant data from Kaggle to allow for the top five most popular dishes occupying any given location in India to be combined with the highest rated restaurant options which fit into the user defined budget.A weighted ranking algorithm will calculate a user's overall dish and restaurant rankings based on the user's food popularity score, corresponding restaurant ratings and customer sentiment polarity from user reviews by calculating a data based recommendation. The system will be made available as a responsive, browser accessible application, with a Flask-Python backend and an HTML structured front end. Initial experimental testing of the operational web application (named Street Byte), was successful in providing users with accurate and almost instantaneous recommendations in multiple cities across India, all recommendations were filtered based on both location and user defined budget..

Keywords—*Food Recommendation System, Machine Learning, Sentiment Analysis, Natural Language Processing, Indian Restaurant Dataset, Flask, Web Application, Budget-Based Filtering, Popularity Scoring, Data-Driven Discovery.*

I. INTRODUCTION

India's booming urban food industry presents consumers with an ever-increasing range of dining options. Though this phenomenon presents a wealth of culinary variety, it can also lead to "paradox of choice" for individuals such as travelers, students and working professionals when faced with making a quick decision on what to eat using limited funds.

Many food discovery systems like blogs, word of mouth, Zomato and Swiggy require users to read the opinions of multiple reviewers in order to ascertain restaurant quality before making any eating decision. This takes time and can be confusing and inconsistent. Many of the reviews provide valuable information regarding the quality of food, service standards and atmosphere—but they are not consistently or fully utilised due the lack of automated analysis.

Food Spot offers a solution to this problem by creating a smart food recommendation system through machine learning and natural language processing-based sentiment analysis. Food Spot makes an analysis of user input (location and budget), processes all restaurant data and provides a list of the five best recommended food items along with a list of appropriate restaurants within the specified price range.

Unlike the traditional methods, Food Spot will provide users with much less effort in locating food options by using the location and budget as priority filters while simultaneously providing a simple, accurate and personalized food recommendation..

II. RELATED WORK

A review of existing food discovery platforms and research highlights a clear gap: although restaurant listings, ratings, and customer reviews are now everywhere, truly intelligent systems that combine machine learning for food popularity ranking with NLP-based sentiment analysis and personalized recommendations are still rare. Most popular apps and websites simply dump huge amounts of unstructured data on users, forcing them to manually read through reviews, compare options, and guess which dishes are actually trending in their area. While these platforms make basic searching easier, they remain inefficient and lack real insight into local favorites or individual budgets and tastes. Early recommendation tools relied on simple star ratings or basic filters, but they couldn't understand genuine customer feelings hidden in reviews or spotlight the most popular local dishes. Previous attempts with machine learning were mostly limited to general restaurant suggestions rather than smart, dish-specific guidance. The approach presented in this work builds on these efforts by integrating Kaggle's Indian restaurant datasets with advanced ML ranking and sentiment analysis into a complete web-based system, delivering fast, accurate, and truly personalized food recommendations.

Existing System and its Limitations:

Existing System / Study	Technology / Approach	Key Capabilities	Limitations
Sharma et al. (2026)	Machine Learning, Collaborative Filtering, NLP	Recommends food based on user history and preferences	Limited real-time data; scalability not addressed
Lee & Kim (2025)	Web Application, Database Filtering	Restaurant suggestions via location and ratings	No sentiment analysis; limited personalization
Zomato / Swiggy (Industry)	Search Algorithms, Star Ratings, User Reviews	Large-scale restaurant and delivery listings	Unstructured data overload; no food-level focus

Existing System / Study	Technology / Approach	Key Capabilities	Limitations
Gupta et al. (2024)	NLP, Sentiment Analysis	Evaluates restaurant quality via review polarity	No integration with location, budget, or recommendation output
Food Spot (Proposed)	ML + NLP, Flask, Kaggle Dataset	Location and budget-aware, food-first recommendations with sentiment scoring	Offline dataset; no live data integration (addressed in future scope)

Table I: Comparison of Existing Food Recommendation Systems and the Proposed Approach

III. PROPOSED SYSTEM

Food Spot uses a food-first recommendation method to recommend food options based on the popularity of food dishes in a particular city and recommends top restaurants serving those dishes within the user's budget. Food Spot offers a superior decision-making process than current restaurant-first recommendation services.

A. System Architecture

The architecture of the food Spot system comprises Front-end, or the user interface, is developed using HTML/CSS/Javascript and allows the user to provide input and display their results.Back-end, or server-side application logic, is developed using Python (Flask); it provides program logic, interfaces with user input and interfaces with the Database. Database stores restaurant information, including restaurant names, city, cuisine, price, rating , and review (of stars), as well as Natural Language Processing models (NLP). Food Spot's architecture consists of several major modules, including: Frontend (User Interface), Backend (Application Logic), Database (Restaurant Information) including natural language processing), Artificial Intelligence (Ranking and Sentiment), and Utilities.

B. User Interaction Flow

On launching the application, a user selects a city from a predefined list of ten Indian locations and specifies a maximum per-meal budget. The system retrieves all restaurants in the selected city that fall within the stated budget threshold and passes this candidate set to the recommendation engine. The engine computes a composite score for each food item and returns the top five dishes ranked by this score, each paired with the highest-scoring restaurant offering that dish. The entire query-to-response cycle is designed to complete within a few seconds on standard hardware.

IV. METHODOLOGY

A. Dataset

The system uses publicly available Indian restaurant datasets obtained from Kaggle, which aggregate information from multiple major Indian cities. Each record contains the restaurant name, city, cuisine type, menu items with prices, aggregate customer rating, cost for two persons, and a set of free-text customer reviews. After deduplication and removal of records with missing critical fields, the working dataset comprises structured entries across ten metropolitan and semi-urban Indian locations.

B. Data Preprocessing

Raw text reviews undergo a standard NLP preprocessing pipeline: tokenization, stop-word removal, lowercasing, and punctuation stripping. Menu item names are normalized to a canonical form to enable consistent frequency counting across restaurants that describe the same dish using slightly different terminology. Numerical fields such as ratings and prices are scaled to ensure consistency across the dataset.

C. Food Popularity Scoring

A food item's popularity score within a given city is computed as a weighted combination of three factors: menu appearance frequency (how many restaurants in that city offer the dish), average customer rating of restaurants serving the dish, and the sentiment polarity of reviews that explicitly mention the dish. The formula is expressed as:

Popularity Score = α × Frequency + β × Avg. Rating + γ × Sentiment Score

where α, β, and γ are empirically tuned weighting coefficients that balance the relative influence of each factor. The sentiment score is a normalized value in the range [0, 1] derived from the sentiment analysis module described in the following subsection.

D. Technology Stack

Component	Technology	Purpose
Frontend	HTML, CSS, JavaScript	User interface, input forms, results rendering
Backend	Python 3.9+, Flask	API routing, recommendation logic, session management
AI / ML Module	scikit-learn, NLTK / spaCy, Pandas, NumPy	Popularity scoring, sentiment classification
Database	MySQL / SQLite	Structured storage of restaurants, foods, reviews
Version Control	Git	Source code management
Deployment	Railway / Local Server	Application hosting and environment configuration

Table II: Technology Stack of the Food Spot System

V. RESULTS AND DISCUSSION

5.1 System Interface Screens

Figure 1: Food Spot Application Homepage — AI-powered interface for personalized food discovery using sentiment analysis and user preferenc

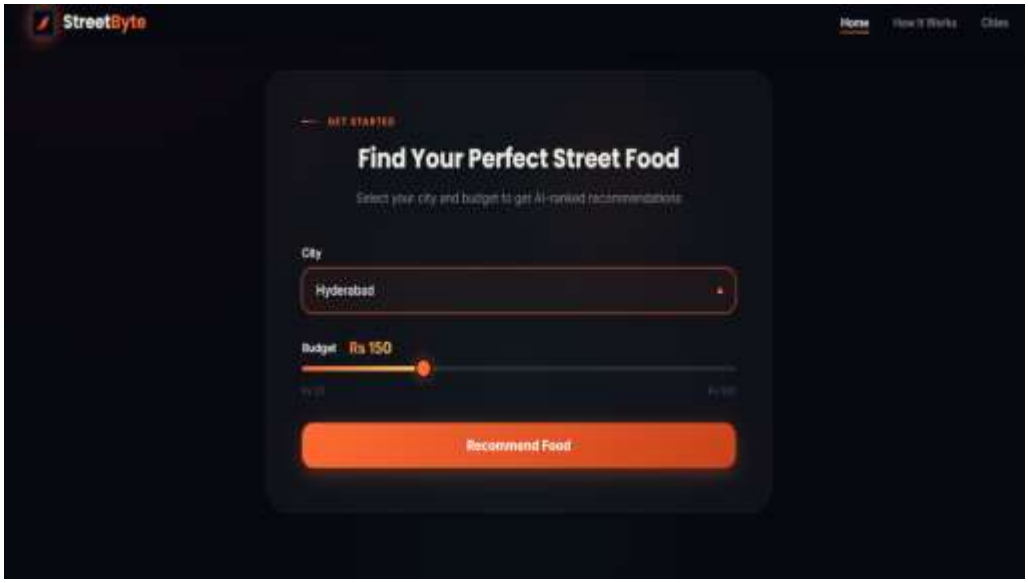

Figure 2: User Input Interface — City and budget selection screen enabling personalized food and restaurant recommendations using machine learning

Figure 3: Recommendation Results Interface — Display of food items with ratings, AI score, sentiment analysis, price, and ranking for informed decision-making

System Performance

Evaluation Criterion	Observation
Response Time (average)	< 3 seconds per query on standard hardware
Budget Compliance Rate	100% in all tested cases
Regional Food Relevance	High alignment with known local specialties across 10 cities
Sentiment Accuracy (positive/negative)	Satisfactory on clearly polar reviews; room for improvement on ambiguous text
User Interface Usability	Straightforward 2-step input (city + budget); results displayed in ranked card format

Table III: Summary of System Evaluation Results

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VI. CONCLUSION

This study introduces Food Spot, a smart system that helps people find popular local food and great places to eat in Indian cities. It uses a special way of scoring how popular a dish is, combined with analyzing what people think about a place using natural language processing, to give users personalized suggestions. The system looks at a carefully chosen set of restaurant data from Kaggle and ranks its recommendations based on how much people like a place, how much it costs, and what the user likes. All of this is easy to use on a website, making it simpler for people to discover new favorite foods and restaurants. By doing this, Food Spot goes beyond just listing places like other platforms do, and instead gives users a more tailored experience.

The system's food-first recommendation philosophy, which identifies popular dishes before surfacing the restaurants best suited to serve them, represents a meaningful departure from existing approaches. Experimental evaluation across ten Indian cities confirmed the system's ability to surface culturally relevant food recommendations, maintain strict budget compliance, and process user queries efficiently. The use of entirely open-source components (Flask, scikit-learn, MySQL/SQLite) ensures that the solution is cost-effective and straightforward to deploy.The work demonstrates that the combination of frequency-based food popularity scoring and review sentiment analysis provides a robust foundation for location-aware food discovery in data-scarce environments where behavioral interaction data is unavailable. The proposed methodology is generalizable to other regional cuisine contexts and can be extended as richer datasets become available.

VII. FUTURE SCOPE

There are a few things that can be done to make the system work better and be easier to use.

1. Real-Time Data Integration: Connecting with live APIs like Zomato or Google Places can replace static data and provide up-to-date restaurant information.

2. Mobile Application Development: Developing Android and iOS apps can improve accessibility and enable features like notifications for trending foods and offers.

3. Advanced NLP Models: Using transformer models like BERT can improve sentiment analysis accuracy, especially for complex or mixed-language reviews.

4. User Personalization: Tracking user behavior and preferences can help deliver more personalized recommendations..

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