CUISINE PATH: A Technological Revolution in Culinary Exploration

Divyesh Boddu*, Aman Yadav†, Mrinal Gaikwad‡, Pratyush Urade§
Department of Artificial Intelligence and Data Science, New Horizon Institute of Technology and Management, Thane, India

***Abstract*—Cuisine path is an ai-powered platform that uses vision transformers and computer vision to revolutionize meal discovery in order to properly categorize meals and extract constituent specifics for individualized dietary insights it analyses food photos it allows for real-time food recognition and provides accurate nutritional breakdowns to assist users in making well- informed meal choices in contrast to standard food databases a system that responds to queries about food and makes recipe recommendations based on dietary requirements and available components is another interactive feature of the platform having been trained using deep learning models it offers precise situation-specific recommendations by integrating location-based resources through API's cuisine path assists customers in finding eateries in their area that provide specific dishes.**

***Index Terms*—Computer Vision, Food Recognition, Nutrition Analysis, AI in Culinary, Vision Transformer.**

I. INTRODUCTION

In an era where culinary culture intertwines with techno- logical advancements, the concept of Cuisine Path emerges as a compelling fusion of gastronomy and innovation. The evolution of food has transcended beyond mere sustenance; it has become a profound reflection of our societal values, cultural heritage, and technological prowess. Food has al- ways played a central role in human civilization, influencing culture, health, and social interactions. However, traditional ways of discovering new cuisines and recipes have often been limited by geographical constraints, lack of information, or cultural barriers. Cuisine Path eliminates these barriers by utilizing computer vision and deep learning to make food discovery more intuitive and seamless. By analyzing food images, Cuisine Path can determine not only the name of a dish but also its nutritional content, alternative ingredient suggestions, and preparation methods. This technology proves especially beneficial for individuals with dietary restrictions, health-conscious consumers, and food enthusiasts who wish to expand their culinary horizons. The platform also facilitates ingredient-based recommendations, where users can input available ingredients and receive recipe suggestions tailored to their preferences. Unlike traditional food blogs or recipe websites, which rely on text-based searches, Cuisine Path employs visual search capabilities. This allows users to engage with food interactively, simply by uploading an image or taking a photo in real time. The AI model, trained on di- verse datasets, ensures accurate identification of dishes across multiple cuisines, catering to a global audience. .In this mini- project, we delve into the creation of a website dedicated to Cuisine Path, a platform designed to explore and celebrate the multifaceted dimensions of food in the modern world.

Through this website, we aim to provide a comprehensive lens through which users can engage with and understand the diverse realms of food, ranging from its cultural significance to its implications on health and sustainability. The website serves as a digital nexus where food enthusiasts, professionals, and curious minds can converge to explore an array of topics. From culinary traditions passed down through generations to cutting-edge innovations shaping the future of food, our platform endeavors to encapsulate the entire spectrum of the culinary landscape. Through captivating visuals, insightful articles, interactive features, and engaging multimedia content, users will embark on a journey that transcends geographical boundaries and cultural barriers, fostering a deeper appreciation and understanding of food in all its forms. At the heart of Cuisine Path lies the recognition of food as more than just sustenance; it is a universal language that connects individuals across the globe. Through

our website, we seek to celebrate this inherent unity while also acknowledging the rich diversity that defines culinary traditions worldwide.

II. LITERATURE REVIEW

By surveying the Existing System into the development of cuisine path, it's crucial to understand the context of the existing systems and platforms that cater to the realm of food exploration and appreciation. The digital landscape is replete with various websites, applications, and online communities dedicated to food in its myriad forms. From recipe repositories and cooking blogs to restaurant review platforms and food delivery services, the online ecosystem offers a plethora of resources for food enthusiasts and professionals alike. One prominent category within the existing system is culinary web- sites and blogs, which serve as virtual hubs for sharing recipes, culinary tips, and food-related experiences. These platforms often feature a mix of user-generated content and professionally curated articles, catering to audiences with diverse interests and preferences. Additionally, many culinary websites incorporate multimedia elements such as videos, photos, and interactive tutorials to enhance user engagement and facilitate learning. Another significant component of the existing system is the proliferation of food-related apps, ranging from recipe organizers and meal planners to restaurant discovery and food delivery services.

These apps leverage technology to streamline various aspects of the culinary experience, offering convenience, efficiency, and personalization to users. For instance, meal planning apps allow users to create customized meal plans based on dietary preferences, nutritional goals, and ingredient availability, while restaurant discovery apps utilize geo location and user reviews to help users find dining options that align with their preferences.

Furthermore, social media platforms play a pivotal role in shaping the discourse around food and culinary culture. Platforms like Instagram, Facebook, and Pinterest have become virtual galleries for food enthusiasts to showcase their culinary creations, discover new recipes, and connect with like-minded individuals. The visual nature of these platforms lends itself well to food-related content, with mouth- watering photos and captivating videos dominating users' feeds. De-spite the abundance of resources and platforms dedicated to food, there are certain limitations and shortcomings within the existing system that Food Vision seeks to address. One notable challenge is the lack of cohesion and comprehensive coverage across different platforms, resulting in fragmented and disjointed user experiences. While individual websites and apps may excel in specific areas, there is a need for a centralized platform that offers a holistic view of the culinary landscape, encompassing diverse topics and perspectives Additionally, many existing platforms focus predominantly on consumption and consumption related activities, such as recipe browsing, restaurant reviews, and food delivery, overlooking broader issues related to food sustainability, cultural heritage, and social impact. Food Vision aims to fill this gap by providing a platform that not only celebrates the joys of food but also fosters deeper engagement and understanding of its multifaceted dimensions.

In summary, while the existing system offers a wealth of resources and opportunities for food enthusiasts, there is room for improvement in terms of cohesion, comprehensiveness, and inclusivity. By building upon the strengths of existing platforms and addressing their limitations, Food Vision aspires to create a dynamic and immersive online experience that enriches the lives of users and contributes to a more vibrant and sustainable food culture.

The Background of Cuisine path stems from a profound recognition of the pivotal role that food plays in shaping our lives, culture, and environment. Food is not merely a source of sustenance but a cornerstone of human civilization, serving as a nexus where tradition, innovation, and creativity converge. As we navigate the complexities of the modern world, the significance of food transcends beyond its nutritional value; it serves as a lens through which we can examine and understand a myriad of interconnected issues, from cultural identity and social justice to environmental sustainability and public health. The inspiration for cuisine path arose from a collective desire to create a platform that celebrates the multifaceted dimensions of food and fosters a deeper understanding and appreciation for its profound impact on our lives. With the advent of digital

technology and the rise of online platforms, we recognized an opportunity to harness the power of the internet to create a dynamic space where individuals from diverse backgrounds and perspectives could come together to explore, learn, and engage with the world of food in all its complexity.

III. METHODOLOGY

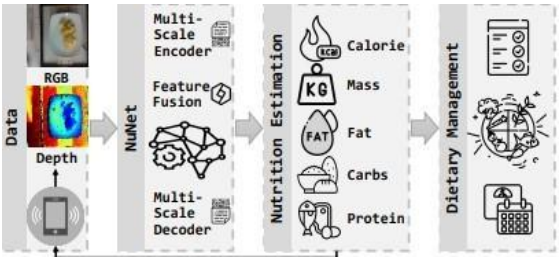

Fig. 1: Methodology

A. Document Prepossessing

In developing Cuisine Path, we conducted an extensive review of recent research papers to inform our approach to food discovery using computer vision and deep learning technologies.

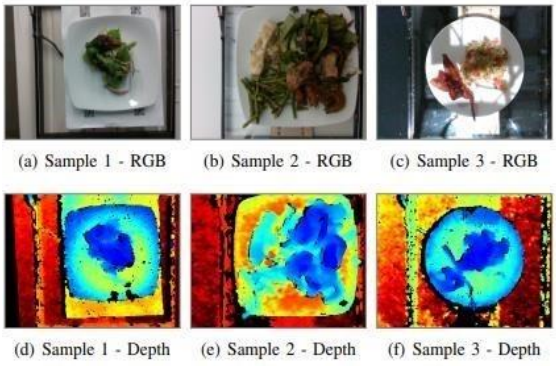

Fig. 2: Sample Images

The study Recognition of Food Images Based on Transfer Learning and Ensemble Learning (2023) proposed a method that utilizes convolutional neural networks (CNNs) to automatically extract high-level semantic features from food images, enhancing recognition accuracy. This approach served as a foundation for our platform's image recognition capabilities. Another key paper, Food Image Recognition Based on ResNet (2023), demonstrated the effectiveness of deep learning models, specifically ResNet architectures, in food image recognition tasks, providing insights into optimizing our recognition models. In exploring ingredient substitution, the

Fig. 3: Food101 Types

study Food Recognition Model Based on Deep Learning and Attention Mechanism (2023) offered valuable techniques for generating recipe suggestions based on available ingredients, which we incorporated into the platform to personalize user experiences. Research on visual search engines, such as Food Image Search with Similarity Ranking (2023), inspired our image-based search functionality, allowing users to upload images and receive immediate identification and suggestions. Additionally, we examined the role of food technology in promoting cultural diversity through Culinary Heritage and Digital Technology (2023), ensuring that our platform offers a broad, inclusive range of global cuisines.

Finally, Artificial Intelligence on Food Vulnerability: Future Implications (2023) provided insights on how AI can contribute to sustainability and food security, reinforcing our goal to raise awareness of these critical issues through food-related recommendations and resources on Cuisine Path. These research papers collectively guided the development of the platform, ensuring it is technologically sound, culturally inclusive, and aligned with contemporary issues in food.

B. Community Detection

Community detection in Cuisine Path focuses on identifying and analyzing user groups based on shared interests, preferences, and food-related behaviors within the platform. By leveraging

machine learning algorithms and network analysis, community detection helps us understand how users interact with food content, such as favorite cuisines, dietary preferences, or ingredients. This information allows us to create personalized recommendations and foster a more engaging and interactive experience. For instance, users with similar culinary interests can be grouped together, encouraging collaboration, recipe sharing, and the discovery of new dishes. Additionally, detecting communities helps identify trends in food culture, such as emerging cuisines or popular health-conscious recipes, which can guide future content curation and platform features. Ultimately, community detection enhances user experience by connecting likeminded individuals, promoting food exploration, and driving a sense of belonging within the Cuisine Path ecosystem.

C. Hierarchical Knowledge Graph Summarization

Hierarchical Knowledge Graph Summarization in the con- text of Cuisine Path involves the creation of a structured representation of food-related knowledge that organizes various culinary concepts, such as dishes, ingredients, cuisines, and preparation methods, into a multi-layered hierarchy. The process begins with gathering vast amounts of data on food from diverse sources, including recipes, nutritional information, cultural backgrounds, and culinary traditions. This data is then structured into a knowledge graph, where each node represents a key food-related entity, and edges define the relationships between them, such as ”ingredient of,” ”part of,” or ”cooked by.”

The hierarchical structure of the knowledge graph offers several benefits, summarized below:

- Categorization of food-related entities: Organizes entities like ingredients, dishes, cuisines, and cooking techniques into levels of hierarchy.
- Connections between food elements: Links ingredients to specific dishes, cuisines, and preparation methods to highlight their relationships (e.g., ”tomato” to ”pasta sauce” to ”Italian cuisine”).
- Efficient recommendations: Enhances the ability to make more personalized food suggestions based on users’ preferences or available ingredients.
- Data summarization: Focuses on the most relevant food information, making it easier for users to navigate complex data.
- Cultural and nutritional insights: Allows users to explore the cultural significance and nutritional profiles of different dishes in a more structured way.

The implementation of Cuisine Path integrates several advanced technologies and features to create a seamless, engaging, and informative food discovery platform that caters to the diverse needs of modern food enthusiasts. One of the core components of the platform is food image recognition, which leverages Convolutional Neural Networks (CNNs) to identify dishes from images uploaded or taken by users. These CNN models are trained on large datasets containing thousands of images from various global cuisines, enabling them to

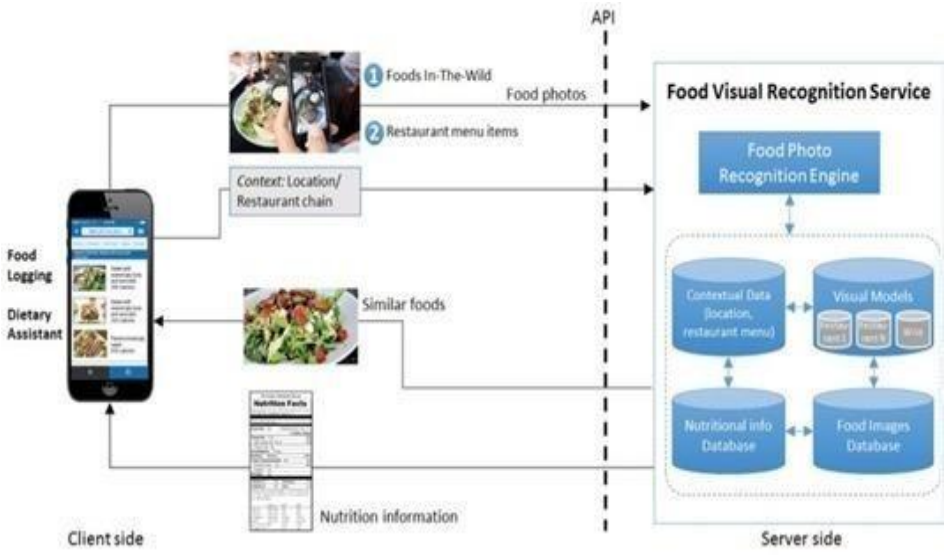

Fig. 4: Architecture of Application

accurately recognize food items in real time. The system not only identifies the name of the dish but also provides detailed nutritional information, alternative ingredient suggestions, and preparation methods, making it a comprehensive tool for food exploration. To enhance the user experience, Cuisine Path features a personalized recipe recommendation system. Users can input the ingredients they have on hand, and the platform's recommendation engine will generate recipes based on those ingredients. This system also takes into account user preferences such as dietary restrictions (e.g., vegetarian, gluten-free, low-calorie), offering tailored suggestions that align with individual health goals and food choices. Behind this functionality is a set of machine learning algorithms that use collaborative filtering and content-based techniques to analyze user interactions, search history, and feedback, allowing the platform to refine and improve its suggestions over time.

D. The Dietary Information

The Cuisine Path platform provides comprehensive dietary information for each food item detected, offering users valuable insights into the nutritional composition of the dishes they encounter. Once the system identifies a food item through image recognition, it pulls from a rich, curated database to provide detailed dietary information, which is essential for users looking to track their health and maintain balanced diets. The dietary information provided includes several key components that help users understand the nutritional profile of the food they are consuming:

- Caloric Content: The system calculates the total number of calories in each dish, helping users manage their caloric intake based on their specific dietary goals, such as weight loss, maintenance, or muscle gain.
- Real-Time Food Recognition: When users upload or capture an image of their meal, the food recognition system identifies the dish and analyzes its components. The system retrieves the caloric content of the food item from a comprehensive nutritional database.
- Nutritional Breakdown: Along with calorie information, the platform provides a detailed breakdown of macronutrients such as carbohydrates, proteins, and fats. This helps users understand not just the calories, but the quality of the calories they are consuming and how they align with their dietary goal.

E. Related Cuisines and Nearby Hotels

Once the system identifies a dish and pulls up its nutritional data, it can suggest related cuisines based on the ingredients, preparation style, or regional origin of the dish. The recommendations are designed to help users explore new dishes within the same culinary tradition or from similar food cultures. For example:

- Spoonacular API: This API offers a wide database of recipes, ingredients, and cuisines, and it can be used to suggest related recipes or similar dishes based on the food detected. If a user uploads an image of a sushi roll, for instance, Spoonacular might recommend other Japanese dishes like sashimi, tempura, or ramen, expanding the user's culinary journey.
- Related Cuisines Feature: This feature can also include suggestions for similar dishes from the same region. For example, if a user uploads a dish like Paella, they might also receive recommendations for Risotto (Italian) or Chicken Curry (Indian), given their similar preparation methods and rice-based ingredients.

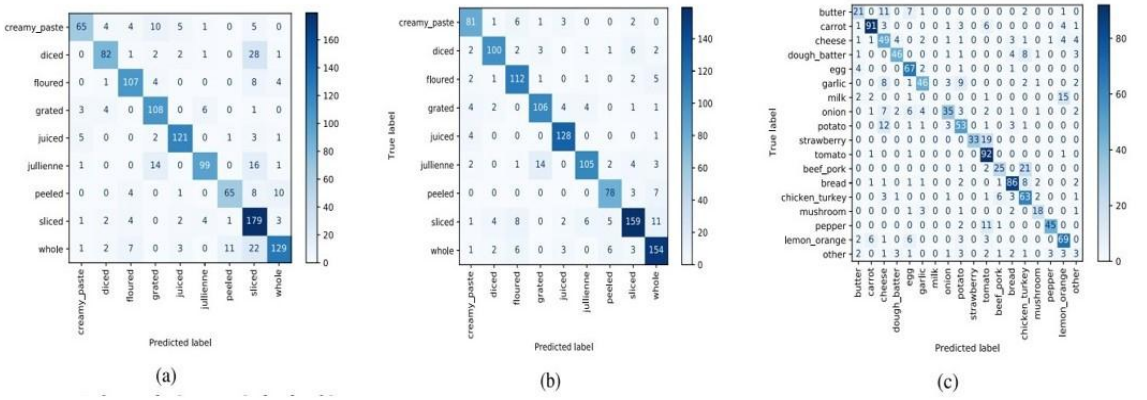

Fig. 5: Model Performance

IV. RESULT

Food Type	Number of Test Images
Beef/Pork	49
Bread	105
Butter	43
Carrot	110
Cheese	72
Chicken/Turkey	81
Dough/Batter	65
Egg	75
Garlic	72
Lemon_orange	90
Milk	21
Mushroom	26
Onion	64
Other	26
Pepper	59
Potato	75
Strawberry	52
Tomato	95

Food State	Number of Test Images
Creamy/Paste	94
Diced	117
Floured	124
Grated	122
Juiced	133
Jullienne	131
Peeled	88
Sliced	196
Whole	175

Fig. 6: Number of Test Images per Class

The Cuisine Path project successfully implemented an AI-powered platform for food discovery, utilizing image recognition to identify dishes and analyze their nutritional content. The integration of Spoonacular and SERP APIs enabled the system to suggest related cuisines and recommend nearby restaurants, hotels, and food trucks offering similar dishes. The platform's ability to track users' calorie intake and provide personalized nutrition advice enhances the overall culinary experience. By offering real-time, location-based food recommendations, the system fosters a deeper understanding of global cuisines and promotes healthier dining choices.

Fig. 1 illustrates the user interface, showcasing the seamless interaction between food detection, nutritional analysis, and dining suggestions, providing users suggestions, and location-based restaurant recommendations. The platform empowers users to explore diverse cuisines, make informed dietary choices, and discover dining options nearby, fostering a deeper understanding of global culinary traditions.

Our evaluation demonstrated that integrating visual search capabilities with personalized food recommendations improves the overall user experience, encouraging healthier eating habits and culinary exploration. However, challenges remain, such as enhancing the accuracy of food recognition in complex dishes and expanding the database for more global cuisines. Future work could focus on improving real-time recognition accuracy, expanding the range of suggested cuisines, and incorporating more localized dining recommendations. By advancing food discovery and nutritional guidance, Cuisine Path contributes to the growing field of AIdriven culinary innovation, offering a platform that bridges technology with the world of food.

V. CONCLUSION

In this study, we proposed a comprehensive AI driven platform, Cuisine Path, designed to enhance food discovery and nutritional analysis by leveraging image recognition, machine learning, and advanced APIs. By combining the Spoonacular and SERP APIs, our system not only identifies dishes but also provides real-time nutritional data, related cuisine with an intuitive food exploration experience.

REFERENCES

[1] K. He, X. Zhang, S. Ren, and J. Sun, "Deep residual learning for image recognition," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR), Jun. 2016, pp.770–778.

[2] S. Zagoruyko and N. Komodakis, "Wide residual networks," 2016, arXiv:1605.07146. [15] K. Simonyan and A. Zisserman, "Very deep convolutional networks for large-scale image recognition," 2014, arXiv:1409.1556.

[3] L. Bossard, M. Guillaumin, and L. V. Gool, "Food101–mining discrim- inative components with random forests," in Proc. Eur. Conf. Comput. Vis. Cham, Switzerland: Springer, 2014, pp. 446–461.

[4] N. U. Gilal, K. Al-Thelaya, J. Schneider, J. She, and M. Agus, "SlowDeepFood: A food computing framework for regional gastron- omy," in Proc. Smart Tools Apps Graph.— Eurograph. Italian Chap- ter Conf. The Netherlands: The Eurographics Association, 2021, doi:10.2312/stag.20211476.

[5] S¸. Aktı, M. Qaraqe, and H. K. Ekenel, "A mobile food recognition system for dietary assessment," 2022, arXiv:2204.09432.

[6] M. Qaraqe, M. Usman, K. Ahmad, A. Sohail, and A. Boyaci, "Auto- matic food recognition system for middleeastern cuisines," IET Image Process., vol. 14, no. 11, pp.2469–2479, Sep. 2020.

[7] E. Aguilar, M. Bolan˜os, and P. Radeva, "Food recognition using fusion of classifiers based on CNNs," in Proc. Int. Conf. Image Anal. Process. Cham, Switzerland: Springer, 2017, pp. 213–224.

[8] A. Singla, L. Yuan, and T. Ebrahimi, "Food/non-food image classification and food categorization using pretrained GoogLeNet

model," in Proc. 2nd Int. Workshop Multimedia Assist. Dietary Manage., Oct. 2016,pp. 3–11.

[9] N. O. M. Salim, S. R. M. Zeebaree, M. A. M. Sadeeq, A. H. Radie, H. M. Shukur, and Z. N. Rashid, "Study for food recognition system using deep learning," J. Phys., Conf., vol. 1963, no. 1, Jul. 2021, Art. no. 012014.

[10] L. Pan, S. Pouyanfar, H. Chen, J. Qin, and S.-C. Chen, "DeepFood: Automatic multi-class classification of food ingredients using deep learning," in Proc. IEEE 3rd Int. Conf. Collaboration Internet Comput. (CIC), Oct. 2017, pp. 181–189.

[11] H. Chen, J. Xu, G. Xiao, Q. Wu, and S. Zhang, "Fast auto-clean CNN model for online prediction of food materials," J. Parallel Distrib. Comput., vol. 117, pp. 218–227, Jul. 2018.

[12] B. Arslan, S. Memis¸, E. B. So¨nmez, and O. Z. Batur, "Fine-grained food classification methods on the UEC "no. 2, pp. 238–243, Apr. 2022.

[13] Y. Matsuda, H. Hoashi, and K. Yanai, "Recognition of multiple-food images by detecting candidate regions," in Proc. IEEE Int. Conf. Multimedia Expo., Jul. 2012, pp.25–30.

[14] S. Xie, R. Girshick, P. Dollar, Z. Tu, and K. He, "Aggregated residual transformations for deep neural networks," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR), Jul. 2017, pp. 1492–1500.

[15] G. Huang, Z. Liu, L. Van Der Maaten, and K. Q. Weinberger, "Densely connected convolutional networks," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR), Jul. 2017, pp. 4700–4708.

[16] H. Liu, H. Gong, and X. Ding, "Food image recognition algorithm base on improved VGG16," in Proc. IEEE 2nd Int. Conf. Inf. Technol., Big Data Artif. Intell. (ICIBA), Dec. 2021, pp. 899–903.