Thermal-Based Nutritional Recommendations: AquaVitae System

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Abstract. In this article, we introduce an innovative recommendation system designed to assist nutritionists in creating personalized and effective nutritional plans for their clients. The system gathers data on user preferences, dietary restrictions, and nutritional needs, providing a variety of meal options tailored to each individual. Continuous diet monitoring of patients and prioritizing thermogenic foods are additional features that enhance efficiency and user experience.

Keywords: Recommendation System · Thermal-Based · Nutritional Plan.

1 Introduction

This paper introduces a recommendation system designed to improve the interaction between nutritionists and patients, offering access to customizable nutritional plans and tracking of meals. As part of the Aquae Vitae Research Project, the system emphasizes thermal-based foods in meal suggestions to foster balanced nutrition.

Our approach to developing this system combines rule-based and scoring methodologies, as informed by key resources [1], [2], and [3]. This approach takes into account user preferences, dietary restrictions, and nutritional plan rules to generate accurate recommendations.

By selecting this system, we aim to meet the specific needs of the clients while enhancing the overall experience for both patients and nutritionists, leveraging insights from pivotal research in recommendation systems.

2 Development and Tests of the Recommendation System

Our dietary recommendation system creates personalized plans considering user's preferences, consumption history, and nutritional restrictions. The system follows two key steps: food ranking and nutritional plan formulation.

During food ranking, scores are assigned to foods based on user preference, food category, and consumption frequency. For instance, liked foods and those similar to liked ones score higher, while overly-consumed foods score lower to promote dietary variety.

For the nutritional plan formulation, meal types and permitted items are gathered, and meal items are then ranked based on their composite food scores. The meals are divided into three groups according to their scores, with one item from each group chosen for the plan based on the user's nutritional needs.

This system creates diverse and suitable dietary plans tailored to user's needs and preferences. Figure 1 provides a detailed depiction of this recommendation process, from user data analysis to personalized plan generation.

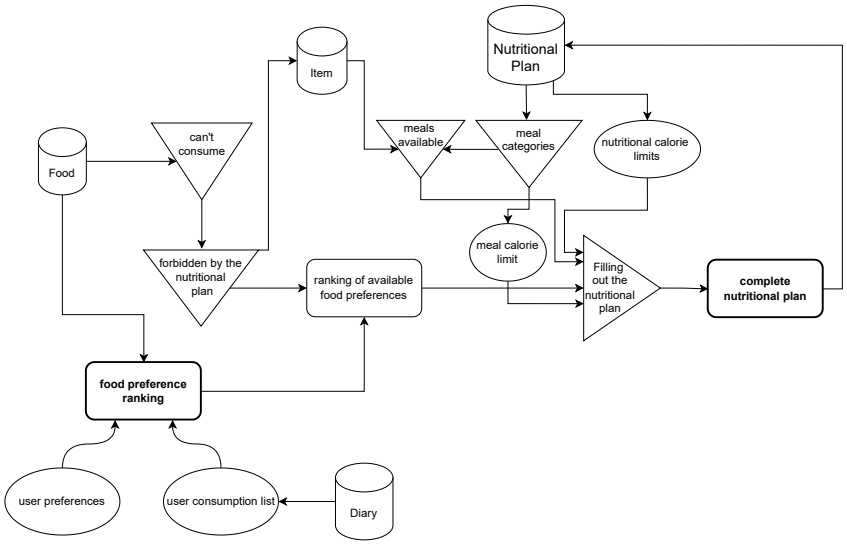

Fig. 1. Recommendation System process overview.

Comprehensive endpoint testing was performed on the complete system, encompassing both the nutritional plan management and recommendation subsystems. These tests confirmed the functionality and performance of the integrated system, achieving an impressive 96% code coverage and maintaining median response times of less than 20 ms.

Additionally, meal plan creation was tested, demonstrating the system's ability to provide varied meal suggestions tailored to user preferences and needs. This adaptability was evident across four different scenarios with varying inputs. Figure 2 illustrates an example of a full day meal plan generated using only daily caloric intake data.

meal_date	meal_description	meal_start_time	meal_end_time	food_description	amount
2023-04-21	Ao acordar	09:00:00+00	09:30:00+00	Chá de hortelã	0,5
				Limonada com gengibre	0,5
				Suco de melancia com hortelã	0,5
	Pequeno-almoço	10:30:00+00	11:00:00+00	Sanduíche natural com queijo e peito de peru	0,5
				Biscoitos integrais com geleia de frutas sem açúcar e queij	0,5
				Salada de frutas com iogurte e coco ralado	0,5
	Meio da Manhã	11:30:00+00	12:00:00+00	Sanduíche de frango desfiado com cenoura e alface	0,5
				Biscoitos integrais com geleia de frutas sem açúcar e queij	0,5
				Smoothie de morango e banana	0,5
	Almoço	13:00:00+00	14:00:00+00	Sanduíche de pão sírio com pasta de grão-de-bico e legum	1
				Omelete de legumes com macarrão de abobrinha e salada	0,5
				Bife de alcatra ao molho de cogumelos com arroz selvager	0,5
	Lanche da tarde	16:00:00+00	16:30:00+00	Sanduíche integral com atum e salada	0,5
				Salada de grão-de-bico com atum e vegetais	0,5
				Biscoitos integrais com geleia de frutas sem açúcar e queij	0,5
	Jantar	21:00:00+00	22:00:00+00	Tofu grelhado com purê de mandioquinha e brócolis no va	1
				Salada de grão-de-bico com atum e vegetais	1
				Torrada integral com queijo quark e frutas	2,5
	Ceia	23:30:00+00	00:00:00+00	Biscoitos integrais com geleia de frutas sem açúcar e queij	0,5
				Sanduíche integral com atum e salada	0,5
				Bowl de frutas com chia e mel	0,5

Fig. 2. Nutritional plan without any input.

3 Conclusion & Future Work

We developed a recommendation system to aid nutritionists and enhance patients' dietary experiences, showing promising early results. Future plans include system automation for meal importation, leveraging machine learning for improved scoring metrics, and professional validation for aligning recommendations with expert judgement, thereby promoting variety and better catering to user needs.

References

1. Kardan, A.A., Ebrahimi, M.: A novel approach to hybrid recommendation systems based on association rules mining for content recommendation in asynchronous discussion groups. Information Sciences **219**, 93–110 (2013)
2. Song, H., Zhang, H., Xing, Z.: Research on personalized recommendation system based on association rules. In: Journal of Physics: Conference Series. vol. 1961, p. 012027. IOP Publishing (2021)
3. Zhang, S., Yao, L., Sun, A., Tay, Y.: Deep learning based recommender system: A survey and new perspectives. ACM Comput. Surv. **52**(1) (February 2019). https://doi.org/10.1145/3285029, https://doi-org.ez48.periodicos.capes.gov.br/10.1145/3285029