Integration of Transformer-Based NLP Architecture and K-Nearest Neighbors for Clothing Recommendation: An Outfit Matching Decision Support System

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ABSTRACT

The rapid development of the digital fashion industry has increased the demand for clothing recommendation systems that are more personalized and adaptive. However, existing recommendation systems generally focus on visual similarity or user preferences without considering users' physical characteristics, such as body proportions and skin tone. This study proposes an Artificial Intelligence (AI)-based outfit recommendation system by integrating the Multimodal Transformer model (OpenAI CLIP), the K-Nearest Neighbors (KNN) algorithm, and an Expert System. The CLIP model is utilized to extract visual and semantic features, while KNN is employed to retrieve outfit candidates with the highest similarity. Furthermore, the Expert System incorporates Body Mass Index (BMI) and skin tone categories based on the Individual Typology Angle (ITA) concept to generate more personalized outfit recommendations. The dataset used in this study consists of 12,500 filtered outfit samples from the Polyvore Dataset. The evaluation results show that the CLIP model achieved a classification accuracy of 60% across four fashion style categories: Casual, Formal, Smart Casual, and Sporty. The proposed system is capable of generating the top five outfit recommendations along with styling suggestions tailored to the user's physical characteristics.

Keywords: *Hybrid Recommendation System, OpenAI CLIP, K-Nearest Neighbors, Expert System, Body Mass Index, Individual Typology Angle, Gradio SDK.*