

# Product Recommendation using Deep Learning in Computer Vision

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**Abstract**— Recently, recommendation models have gained popularity due to their effectiveness in improving customer satisfaction and deriving sales. However, current product recommendation models have a drawback: they lack personalized and targeted advertisements for individual users. Consequently, the recommendations provided are random and not tailored to users' preferences. This limitation negatively impacts the system's ability to deliver relevant and personalized advertisements, leading to reduced user engagement and potentially lower conversion rates. Moreover, the absence of personalized advertisements can result in user dissatisfaction as they may receive recommendations that are irrelevant or not aligned with their interests and needs. To address these challenges, this study proposed a targeted product recommendation model using Deep Learning (DL) techniques in computer vision. The study utilizes the dataset of human images obtained from the Kaggle website, which includes details such as gender, class, and age. Findings of the study demonstrated a high level of accuracy in product recommendations, indicating the potential for significant improvements in addressing the issues. In conclusion, the proposed method achieves good accuracy in predicting the gender and age, and provides appropriate product recommendations based on these features.

**Keywords**—Deep Learning, Computer vision, machine learning, Multi-task Cascaded Convolutional Networks, Targeted recommendation.

## I. INTRODUCTION

For over two decades, recommendation systems have been in existence and have found applications across various domains. These systems have successfully provided users with recommendations on a wide range of information and items, including movies, books, food, music, news, and more. The advancement of information and item recommendations is closely tied to the research and development of core technology recommendation algorithms within recommendation systems. Both domestic and international researchers have been continuously exploring the field of recommendation systems since the 1990s, demonstrating the ongoing efforts and interest in this area [1].

As the digital economy continue to flourish, personalized recommendations have undergone a

remarkable evolution, establishing themselves as an indispensable component of the online shopping journey. By leveraging advanced algorithms and user data, e-commerce providers seamlessly integrate personalized recommendations into their platform, enhancing the overall shopping experience for customers. These tailored suggestions not only help users discover relevant products or services but also foster a sense of trust and loyalty, driving customer satisfaction and ultimately contributing to the success of these online businesses [2][3].

Advertising or product recommendation is a significant marketing strategy employed to introduce or promote events, products, and brands to the public. However, conventional advertisements used in shopping stores often consist of static posters or digital displays that are generic and not tailored to specific customers. In malls, digital advertisement screens typically operate in a slideshow mode, where various products and brands are displayed in a looping sequence. This approach lacks personalization and can lead to inappropriate advertisements being shown to viewers, such as displaying makeup products to a 10-year-old child. Consequently, the effectiveness of these advertisements is limited unless viewers patiently wait for items of interest to be displayed, resulting in inefficiency. To capture the attention of customers and optimize advertising impact, it is crucial to tailor the advertisements according to the viewer's age and gender, displaying products and brands that are relevant and appealing to them.

Moreover, advertising costs pose a significant financial burden for both small and large businesses. According to the Gartner 2022 CMO Spend and Strategy Survey, marketing spend has increased from 6.4% to 9.5% of company revenue across various industries. In the first quarter of 2022, a net balance of 14.1% of companies increased their marketing budgets [4]. In Malaysia, the total investment in advertising expenditure reached approximately 4.36 billion Malaysian ringgit in 2021 and 4.78 billion Malaysian ringgit in 2022 [5]. Additionally, traditional advertising methods such as static posters, electronic posters, and billboards in Malaysia cost hundreds to thousands of ringgits per day, while digital