

# Introduction

Nowadays, society is not only demanding to be more modern in terms of appearance but also to be more aware of the importance of facial skincare. Appearance is no longer just about wearing fashionable clothes and matching accessories. Having clean and healthy facial skin has also become one of the ways to enhance maximum appearance. Having clean and healthy facial skin has become a trend among people today, especially among women. This is because visual perception can influence self-judgment toward others [1], [2]. In maintaining the health of facial skin, many people now rely on skincare products as an important part of their personal care routine. Skincare is a term that encompasses various skin care products designed to cleanse, maintain, and improve the condition of the skin. Skincare itself includes various skin care products such as facial cleansers, moisturizers, serums, toners, and sunscreens, each of which has a specific role in maintaining and improving skin quality [3], [4].

Choosing skincare products should be done carefully because every skin type has different needs. Using products that are not suitable can cause irritation or even allergies. Individuals need to recognize their skin type before choosing skincare products. One common mistake is not paying enough attention to the skin type and the skin issues being experienced [5], [6]. To address this, a recommender system can help find products that are suitable for individual needs and preferences.

Recommender systems offer a promising solution to this challenge. Some researchers have developed recommender systems for skincare using various approaches. Solanki et al. [7] employed a Deep Neural Network (DNN) based approach to analyze and understand the relationship between skincare products and various skin types to generate accurate recommendations. However, this study only focused on two types of skin, namely dry and normal skin, and did not consider various skin issues that users may have. Adebo et al. [8] also utilized an approach in developing a skincare recommender system aiming to provide more personalized and accurate recommendations to users. In their research, they combined two main methods, namely content-based and collaborative filtering, to create a more accurate model for providing recommendations. Despite the good results of their research, this study did not consider temporal aspects of user preferences. For instance, users may have different skincare product preferences when they have different skin issues. In a series of research studies focusing on recommender systems with various methods, He et al. [9] developed an innovative model that combines collaborative filtering with deep neural networks to address the challenge of item cold start, known as Neural Collaborative Filtering (NCF). Despite using different datasets, this model has been successfully adopted by other researchers, including Wei et al. [10] and Martins et al. [11], demonstrating its promising potential and relevance in various research contexts.

This study proposes the use of the NCF method as an innovative approach to develop a more advanced and effective skincare recommender system. NCF integrates deep neural network architecture with collaborative filtering techniques, which have the potential to enhance the quality and accuracy of recommendations [9]. The selection of this approach is based on the ability of NCF to generate more accurate recommendations compared to traditional collaborative filtering methods that rely solely on latent factors [9], [10], [11]. Additionally, NCF excels in overcoming the cold start problem, where the recommender system faces challenges in providing recommendations for new items that are unfamiliar to users [12]. The importance of personal interaction in the user experience is not overlooked; hence, we leverage the preferences obtained from conversational interactions with the chatbot to enhance the presented recommendations. Our chatbot implementation is carried out through the Telegram platform, allowing users to interact directly and easily with the recommender system. By utilizing the preference data collected during the conversation, the chatbot can provide more relevant and tailored recommendations based on the user's skincare needs and preferences.