

<b>Thesis Title</b>	Leveraging Cosmetic Ingredient Profiles and Skin-Related Features for Cosmetic Products Recommendation
<b>Author</b>	Theint Zar Lwin Kyaw
<b>Degree</b>	Master of Science (Digital Transformation Technology)
<b>Advisor</b>	Assistant Professor Surapong Uttama, Ph. D.
<b>Co-Advisor</b>	Patcharaporn Panwong, Ph. D.

### **ABSTRACT**

This research investigates the integration of cosmetic ingredient profiles and skin-related features to improve product recommendations utilizing machine learning and deep learning approaches. The core objective is to create comprehensive recommendations that tailor skincare product suggestions based on ingredient-focused machine learning algorithms, while lipstick recommendations with skin undertone and user preferences are made by utilizing deep learning techniques. The dataset for this research comprises three main components: Skincare product data, collected from a cosmetic website, this dataset includes detailed ingredient compositions, product features (product type, skincare ingredients). These characteristics serve as the foundation for content-based skincare recommendation. Skin Undertone Data, include wrist vein images, obtained from a public dataset, were used to classify skin undertones (cool, warm, neutral). These images were labeled with an expert and processed for deep learning input. Lipstick product data, collected from the e-commerce platform, contains lipstick finishes (matte, glossy, satin), benefit, ethical preferences and price. These features are critical for matching user preferences and harmonizing selections with skin undertone classification.

The research employs a two-part recommendation in cosmetic categories: Skincare recommendation with content-based filtering, and lipstick recommendation with deep learning and machine learning algorithms. In skincare product recommendation, ingredient compositions were used to recommend suitable skincare products for the user based on content-based filtering. In lipstick product recommendation, a convolutional neural network (CNN), Mobile Net V2, and

DenseNet121 architectures were trained to classify wrist vein images into skin undertone categories. Once undertone was identified, lipstick preferences (such as finish or benefit) were matched using clustering and content-based recommendation that maps product features to undertone-compatible options. For skincare recommendation, content-based filtering using cosine similarity and Jaccard similarity applied to structured ingredient data achieved accuracy of 80% in two skincare categories. The deep learning model for undertone classification achieved an accuracy of 84%, showing superior performance in handling vein color subtleties. In the lipstick recommendation, user preferences and product attributes were mapped against classified skin undertones with accuracy of 83% with content-based filtering.

Collectively, this research demonstrates the effectiveness of combining ingredient-based analysis for skincare products and image-based skin tone classification for lipstick products to deliver precise and personalized cosmetic product recommendations. By leveraging multimodal data sources and tailored algorithmic strategies, this research bridges technical rigor with cosmetic industry. The proposed framework offers valuable potential for intelligent beauty advisory recommendation approach, promoting data-driven decision-making in skincare and makeup personalization.

**Keywords:** Cosmetic Product Recommendation, Content-based Filtering, Machine Learning, Deep Learning