

**ONTOLOGY BASED MACHINE LEARNING
APPROACH FOR FACIAL SKINCARE PRODUCTS
RECOMMENDATION**

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Degree of Master of Science in Artificial Intelligence

Department of Computational Mathematics
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DECLARATION

I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature:

Date:

The above candidate has carried out research for the PhD/MPhil/Masters thesis/dissertation under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor:

Dr. Thushari Silva

Signature of the Supervisor:

Date:

DEDICATION

I would like to dedicate this thesis to my beloved parents, teachers and lecturers who have helped me and guided me throughout the journey of life.

ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to my supervisor Dr. Thushari Silva for providing guidance, comments, feedback, and vital support throughout the entire research in order to make it a success.

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ABSTRACT

The need to maintain facial skin health and improve attractiveness has become more widespread in the modern world. There has been competition among skincare companies to research and create novel products. The dynamic skincare market creates a wide range of skincare products. Therefore, selecting the best skincare products suitable for a consumer's skin type and condition can be quite challenging. Consumers tend to seek suggestions from their friends or favorite bloggers and frequently purchase expensive products that don't deliver the desired results. Skin impairments could worsen if products are utilized that contain ingredients that are inappropriate for the user's skin type. In this study, we describe a unique system architecture for recommending facial skincare products that combine ontological and machine learning benefits. The ML engine is developed for facial skin condition identification, which was selected as acne severity prediction since it is one of the most common skin issues dermatologists treat. A CNN model was developed to identify acne severity based on the user's facial image. An ontology was constructed using the Protégé ontology editor, which included hierarchical relationships between user profiles, skincare information, and skincare product information. The semantic similarity between these concepts mapped by the Protégé tool was considered in the skincare product recommendation engine. The system UI takes inputs for customization and recommendation of facial care products based on key factors such as the user's skin type, concerns, acne severity level, and allergy ingredients. Users can provide feedback and ratings for the products recommended. The developed system had an accuracy of 87.5% based on a survey conducted with 24 participants who tested the system. Additionally, medical experts reviewed the system's knowledge base to ensure reliable performance. Therefore, the proposed ontology-based ML approach is effective and accurate for facial skincare product recommendations.

Keywords: Ontology, ML, CNN, facial skincare products

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LIST OF ABBREVIATIONS

Abbreviation	Description
AHA	Alpha Hydroxy Acid
AI	Artificial Intelligence
BHA	Beta Hydroxy Acid
BSTS	Baumann Skin Typing System
CBF	Content Based Filtering
CF	Collaborative Filtering
CNN	Convolutional Neural Network
ES	Expert System
GPU	Graphics Processing Unit
GUI	Graphical User Interface
IDE	Integrated Development Environment
ML	Machine Learning
OTC	Over The Counter
OWL	Web Ontology Language
PHP	Hypertext Preprocessor
ResNet	Residual Neural Network
TF-IDF	Term Frequency – Inverse Document Frequency
UI	User Interface
UV	Ultraviolet