### Motivation and Background

Hailed as the “fastest-growing category globally,” skincare has taken over makeup with its increasing sale each year. In the past, consumers depended on best-sellers or in-store recommendations from the counter. However, everyone has different skin conditions, so these are not effective methods to judge compatibility between a product and a user.

To address this problem, this study designed a skincare product recommendation system based on the user’s skin type and ingredient composition of a product.

- Content-based filtering takes into account the descriptions of the items as well as user preferences
- This method is suitable for making personalized recommendations and doesn’t involve other users
- Short names CBF and IF-IPF were used to represent content-based filtering and ingredient frequency-inverse product frequency

### Methods

#### Data Collection and Ingredient Extraction

An existing dataset on cosmetics from Jeong’s project was used. Ingredients were tokenized to create a document term matrix that indicates the existence of ingredients in each product.

#### Content-based Filtering

A user provides his or her skin type and selects a product from one of six categories (moisturizing cream, facial treatments, cleanser, face mask, eye treatment, and sun protection). The cosine similarity values are calculated for each product and ranked across all six categories.

#### IF-IPF Filtering

A user chooses his or her desired beauty effect from anti aging, moisturizing, oil control, acne treatment, redness control, and reduced pores along with skin type. Then, the Ingredient Frequency-Inverse Product Frequency values are obtained to identify the most important ingredient for each effect and the products containing it.

### Validation

As part of the evaluation process, ratings of recommended products were filtered by the skin types of participants. Then, the number of reviews with recommended tags were divided by the total number of reviews as recorded in the table:

<table>
<thead>
<tr>
<th>Product type</th>
<th>Normal (%)</th>
<th>IF-IPF (%)</th>
<th>Normal (%)</th>
<th>IF-IPF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisturizer</td>
<td>86.96</td>
<td>72.00</td>
<td>85.71</td>
<td>80.47</td>
</tr>
<tr>
<td>Cleanser</td>
<td>77.14</td>
<td>85.11</td>
<td>52.94</td>
<td>85.65</td>
</tr>
<tr>
<td>Treatment</td>
<td>81.82</td>
<td>100.00</td>
<td>91.10</td>
<td>70.08</td>
</tr>
<tr>
<td>Face Mask</td>
<td>91.30</td>
<td>83.33</td>
<td>89.33</td>
<td>100.00</td>
</tr>
<tr>
<td>Eye Cream</td>
<td>75.55</td>
<td>81.25</td>
<td>76.19</td>
<td>93.13</td>
</tr>
<tr>
<td>Sun Protect</td>
<td>82.76</td>
<td>73.91</td>
<td>70.00</td>
<td>52.78</td>
</tr>
</tbody>
</table>

#### Project Framework

- User
  - Skin type
    - Product type
  - Desired effect
    - IF-IPF Filtering
    - Top k recommendations
      - Yes
      - No

- Data Processing
  - Sephora Data
  - Ingredient extraction

- Recommender System
  - Content-based filtering
    - Product type 1 recommendation
    - Product type 2
    - …

- Recommendations for Moisturizer
  - Crème de la Mer
  - The Moisturizing Soft Cream
  - Crème de la Mer Mini

### Future Work

In the future, one could improve the system by incorporating brand preferences or price while making recommendations. With an appropriate data set, one could also try to implement the hybrid recommender system.

### Acknowledgements

I would like to thank Dr. Xunfei Jiang for guiding me in all aspects of the project. I would also like to thank students who provided inputs for the filtering methods.

### References

This poster is based on work described in “A Content-based Skincare Product Recommendation System”, Gyeongeun Lee, available at https://portfolios.cs.earlham.edu/index.php/author/klee16/.