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Personalized Clothing and Food Recommendation System Based on Emotions and Weather

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ABSTRACT

In the era of the 4th industrial revolution, we are living in a flood of information. It is very difficult and complicated to find the information people need in such an environment. Therefore, in the flood of information, a recommendation system is essential. Among these recommendation systems, many studies have been conducted on each recommendation system for movies, music, food, and clothes. To date, most personalized recommendation systems have recommended clothes, books, or movies by checking individual tendencies such as age, genre, region, and gender. Future generations will want to be recommended clothes, books, and movies at once by checking age, genre, region, and gender. In this paper, we propose a recommendation system that recommends personalized clothes and food at once according to the user's emotions and weather. We obtained user data from Twitter of social media and analyzed this data as user's basic emotion according to Paul Eckman's theory. The basic emotions obtained in this way were converted into colors by applying Hayashi's Quantification Method III, and these colors were expressed as recommended clothes colors. Also, the type of clothing is recommended using the weather information of the visualcrossing.com API. In addition, various foods are recommended according to the contents of comfort food according to emotions.

Keywords : Recommendation System, Emotion, Clothing, Food, Weather, SNS

감정과 날씨에 따른 개인 맞춤형 옷 및 음식 추천 시스템

Sadriddinov Ilkhomjon Rovshan Ugli† · 박 두 순††

요 약

4차 산업혁명 시대를 맞아 우리는 정보의 홍수 속에 살고 있다. 이런 환경에서 우리에게 필요한 정보를 찾기란 매우 어렵고 복잡하다. 따라서 정보의 홍수 속에서 추천 시스템은 필수적이다. 이러한 추천 시스템 중 영화, 음악, 음식, 의류의 각각에 대한 추천 시스템들은 많은 연구가 진행되어 왔다. 현재까지 대부분의 개인화 추천 시스템들은 개인의 성향인 나이, 장르, 지역, 성별 등을 체크해서 옷들을 추천한다던가, 책들을 추천한다던가, 영화들을 추천해왔다. 미래 세대에서는 나이, 장르, 지역, 성별 등을 체크해서 옷, 책, 영화들을 한꺼번에 추천 받기를 원할 것이다. 본 논문에서는 사용자의 감정과 날씨에 따라 개인 맞춤형 옷과 음식을 한꺼번에 추천하는 추천 시스템을 제안한다. 소셜미디어인 트위터에서 사용자의 데이터를 얻었고, 트윗을 기반으로 감정 분석을 해서 Paul Eckman 이론에 따라 사람의 6 가지의 기본 감정으로 분류했다. 이렇게 얻어진 기본 감정을 Hayashi의 Quantification Method III를 적용하여 색깔로 변환하였으며, 이러한 색깔은 추천하는 옷의 색상으로 표현하였다. 또한, visualcrossing.com API의 날씨 정보를 이용하여 의류의 종류를 추천한다. 그리고 감정에 따른 컴포트 푸드의 내용에 따라 다양한 음식을 추천한다.

키워드 : 추천 시스템, 감정, 옷, 음식, 날씨, 소셜네트워크 서비스

1. Introduction

In the era of the 4th industrial revolution, we are living in a flood of information. The Global Digital 2021 report has illustrated that there are 4.20 billion social media users worldwide, currently[1]. As many new users start being involved in social media day by day, it is expected that more data will be produced. However, there are many ways where an abundance of information could come from apart from this emanation of information. Due to this reason, the contemporary state of data overflow is unpredictably high. It is very difficult and complicated to find the information people need in such an environment. Therefore, in the ocean of information, recommendation systems play an essential role in finding a list

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of preferred items. Recommender systems can be defined as any system that guides a user in a personalized way to interesting or useful objects in a large space of possible options, or that produces such objects as output[2]. This system is an interdisciplinary subject of many various domains such as Artificial Intelligence, Machine Learning, Big Data, Data Mining, Business Analytics, and more. Initially, recommendation systems were considered as a tool that can help users choose the appropriate item among plenty of available ones. Nevertheless, contemporary systems are actively taking part in the process of item selection in such a way as if users are "blindly" following the recommended list in most cases. This phenomenon stems from the developments and the sequence of improvements in this sphere. Many studies have been conducted on each recommendation system for movies, music, food, and clothes.

Moreover, recommendation algorithms are really important in the recommendation system[3]. Among recommendation methods, Collaborative filtering, Content-based and Hybrid recommendation algorithms are the most common[4]. These methods are being frequently applied to personalized recommendation systems[5]. In particular, personalized recommendation systems can shorten much time to find information and boost the accuracy of recommended items. Through this, many items can be sold on e-commerce and increase profit. To enhance the efficiency of such personalized recommendation systems, continuous efforts are being made. The most noticeable one among such algorithms is the context-aware recommendation system that is most suitable for future developments [6,7].

In our approach, the emotions of users derived from their content in social media were taken as a vital attribute to recommend food and clothing.

Further discussions about our method in more depth as follows: Chapter 2 described related works related to this paper. In Chapter 3, we designed the proposed method, and in Chapter 4, the implementation and performance of the proposed method were described. Chapter 5 presented a conclusion.

2. Manuscript Preparation

2.1 SNS Analysis

As the amount of social network usage increases rapidly, the amount of information generated is also increasing significantly. As the amount of information increases to big data, research on the field of analyzing information is also being actively conducted. In particular, Twitter [8], Facebook [9], and Instagram [10] are social networks with the largest number of users worldwide.

Research areas in social networks include research on location information of users and location-based services using social network services, real-time search methods using social content within social services, and processing of data within social networks, and places of visit [11].

In addition, the most representative methods in a personalized recommendation system that recommends information that suits you among a lot of information include Content-based Approach that analyzes and recommends the contents of the item and Collaborative Filtering Approach that analyzes the user's evaluation details. The Collaborative Filtering method has good performance and is an appropriate recommendation method according to the user's behavior pattern. However, the large amount of information collected produces good results. If the amount of information is small, good results may not come out, which is called cold start. There is a content-based method used to provide customers with similar tastes with cross-recommend products that have not yet been purchased or to recommend related products according to the taste or lifestyle of classified customers. Good recommendations are possible with just a little information. However, the accuracy varies greatly depending on the modeling method, and the recommended range is limited as it can only be recommended between similar items. New algorithms based on deep learning technology, which have recently attracted attention, will be applicable in several fields. In addition, the preference of the item to be recommended is calculated based on a similar tendency. Pearson similarity, Cosine similarity, Euclidean sililarity, and Jaccard similarity are being used.

2.2 Emotional Analysis

Emotion, a complex and multifaceted attribute, which reproduces the behavioural features of people and their personalities. Numerous circumstances, situations, people, and ambient atmosphere; moreover, even each trivial thing exerts its impact on persons' emotions. There are different means of expressing their emotions to others. For instance, facial expressions and speech can be taken as examples for conveying emotions [12]. Researchers from different do-

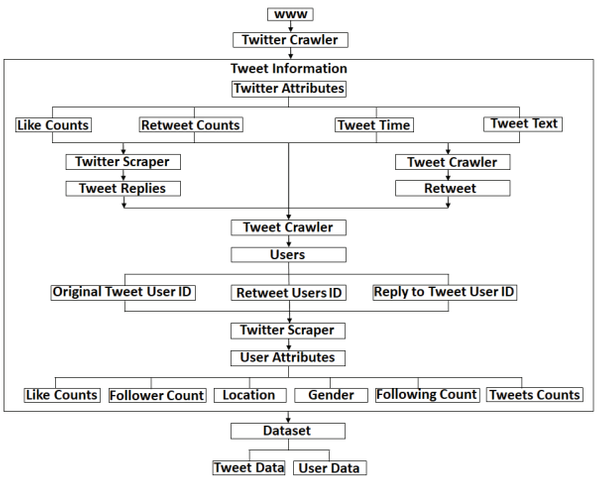

Fig. 1. Dataset Creation Workflow

mains have been working on the recognition and classification of emotions from texts derived from various sources. It is still hard to lift the burden of analyzing emotion clearly and accurately owing to the intricacy of emotions [12]. Fig. 1. represents a dataset creation workflow [12].

In its most general sense, the term 'emotion' itself is a sentiment or reflection that is shaped by a specific circumstance. 'Trust', 'Joy', 'Disgust', 'Surprise' are some of the instances of emotions that can be revealed by someone.

Emotional analysis is the way of detecting human senses, feelings, moreover emotions from the input textual data [13]. Experts from related domains performed various methods for emotion recognition on pieces of text. 'Lexicon-based', 'Keyword-based', 'Hybrid', 'Machine-learning' are the most well-known methods in emotion analysis. A few experts explored linguistic rule-based methods, natural language processing, case-based reasoning, and others were explored to detect emotion by a few experts. Keyword-based, the most common and simple method, which is frequently used in the textual emotional analysis [14]. For Keyword-based methods, concordance among words within a text and specific keywords related to emotion is imperative. On the other hand, the emotion lexicon is applied for emotion detection in lexicon-based methods [15]. In addition, supervised and unsupervised learning algorithms from machine learning methods are actively used in emotion detection. Lastly, hybrid methods intermingle the approaches that we discussed above to detect emotions [12].

Each available emotion model can be classified into 'Categorical' or 'Dimensional' methods [12]. In order to categorize basic emotions, so many longitudinal experiments and analytical theories have been presented [16]. Ekman's model [17] classified all human emotions into several main classes(anger, disgust, fear, joy, love, etc.) as the categorical emotion model of Shaver and Oatley. Haewoon et al. [18] analyzed Twitter and did quantitative research on it as a pioneer. In July 2009, they crawled Twitter and got more than 41 million users' information, including follower, and following relationships. They calculated the distribution of Twitter information, user, follower, following people, recent trends and homophily. Their analysis showed a noticeable difference between Twitter and other social networks. Joshi et al. [19] trained the Twitter dataset to classify emotion by applying machine learning algorithms. Paul Eckman avoided existing inconsistent and contradictorily arbitrary judgments or classifications in interpreting emotional expressions on the face with his colleagues and attempted his research. They first determined the 6 main emotions of a human. There are joy, fear, disgust, anger, sadness [20].

Anger can be noticed when the shrunk and low eyebrow, no eyebrow angle on the face. Moreover, the lower eyelids become tight. The lips tend to be tense or open as if shouting. In surprise emotion, eyebrow height tends to be raised and turns into a round shape. The skin under the eyebrows is straightened. The eyes are expanded. In sadness, the outer side of the eye tilts downward at an angle. If the triangular eyebrow skin lips face downward, the lips may shake. Fear increases the height of the eyebrows and contracts, and the upper and lower eyelids go up. Lips get thinner. Sometimes the mouth opens. Joy raises the cheekbones and pulls the corners of the lips back up. There are wrinkles on the skin under the lower eyelid and wrinkles between the nose and upper lips and outside the eyes. Hate raises the upper lip. In general, wrinkles are caught on the tip of the asymmetric nose and the forehead near the upper lip. The cheekbones rise, and wrinkles form on the lower eyelid.

2.3 Quantification Method III [21]

Quantification theory came to the world by Guttman's assumptions and was well-spread by Japanese Ph.D. Hayashi Chiko as a creative idea. This theory is used in the analysis of main components and factors. It is an analysis method that clarifies the internal

structure and relationship from the attributes and transformation of the object and is called a “technical model” compared to the “prediction model” with external criteria such as mediastinal and discriminant analysis. Hayashi's Quantification Method III is a method of maximizing the correlation coefficient between two-dimensional magnetism to classify two-dimensional data. Quantification Method III allows two-dimensional data to be clustered while automatically changing rows and columns. Quantification Theory III draws more objective and reasonable conclusions based on correlation by using structured information formed according to the relationship between images and the elements of emotional words, which are emotional information generated there. In addition, colors can be matched according to emotions.

3. Design of clothing-recommendation system

Fig. 2 is an architecture of the recommendation system proposed in this paper.

First of all, we scrape data from Twitter. By using its API for developers, we were able to get tweets from different users in accordance with the given tags. After finishing this step, the texts from each tweet were analyzed, and emotion types were given as a result. NRC Emotion Dictionary was used as a source to analyze the sentiment of each tweet. Then using the Quantification Method III Color of clothing were matched with an appropriate type of emotion. Afterward, we extracted temperature information based on the day when each specific tweet was posted. Sets of food were matched with types of emotion, while we matched clothing type with the temperature. Finally, the appropriate type of food and clothing were recommended to a user.

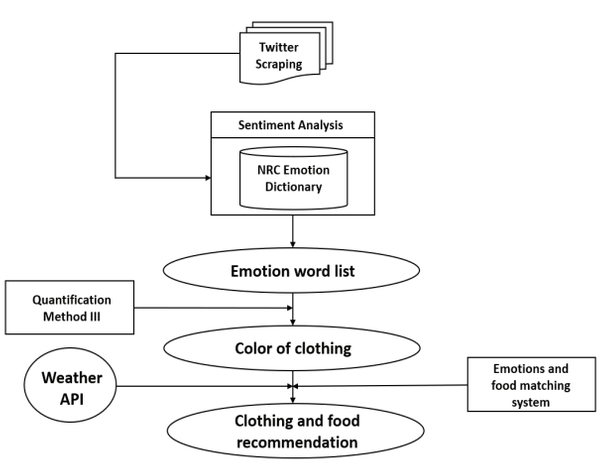

Fig. 2. Architecture of the Recommendation

Algorithm 1. Clothing and food recommendation system

1: Input: Scraping data from Twitter
2: Preprocessing input data frame
3: Finding a type of emotion of each user based on NRC sentiment analysis of users' tweets
4: Matching emotions and colors
5: Extracting weather information of corresponding day when tweets were posted
6: Creating 8 distinct temperature intervals
7: Matching temperature intervals and sets of clothing
8: Matching sets of food and emotions
9: Output: List of recommended food and clothing with color.

The process of our approach shown in Fig. 2 can be explained by Algorithm 1.

Line 1 in algorithm 1 gets an input data by scraping data. Line 2 does data pre-processing and cleans from unnecessary data to do further experiment. Line 3 analyzes sentiment of each tweet. And next line matches emotions and colors. 5-7 lines handle weather information and matches temperature interval with sets of clothing. In line 8 emotions and sets of food are matched. Finally, line 9 generates list of recommended food and clothing with color.

3.1 Collecting and Analyzing Twitter Data.

In this paper, data was collected using Twitter, and emotion analysis was performed based on the collected tweets. There were several limitations in the process of collecting data. The “visonSML” library in the R programming language was used to scrap data on Twitter. Its advantage is that it delivers keys and tokens, including search terms to scratch data within a certain period of time, and generates data frames containing 90 variables. We used only three of the 90 variables: user ID, tweet, and generation time. We used emotion tags to search for tweets in the Twitter database. There are “#anger”, “#surprise”, “#fear”, “#disgust”, “#sadness”, and “happiness”. After Twitter scraping, all tweets were preprocessed before emotional analysis to organize unnecessary data and data sets. We repeatedly removed duplicate tweets and scraped them until we received enough tweets to collect 13,000 tweets. Finally, after deleting records containing non-English characters in each tweet again, we finally got about 11,000 records.

3.2 Sentiment Analysis

In this paper, the library “syuzhet” function was applied to analyze emotions. This library contains several an emotional dictionaries such as “nrc”, “bing”, and “affin”. In this paper, NRC emotion analysis was

Table 1. Emotions and Color

Anger	Black
Disgust	Purple
Fear	Brown
Joy	Yellow
Sadness	Blue
Surprise	Orange

used. The NRC dictionary provides eight human emotions, including anger, surprise, fear, disgust, sadness, joy, expectation, and trust, as well as positivity and denial. They create this emotional vocabulary using a cross-sourcing platform known as Amazon's Mechanical Turk. It was made by Saif M and D. Turney [22]. They automatically created a word selection problem using the Macquarie Thesaurus [23] to create emotional vocabulary. They made the last 8 questions directly related to 8 different emotions.

Quantification method III was applied to match the color and corresponding emotions. Table 1 shows which color belongs to emotions.

3.3 Weather Information and Matching Food

Weather information was obtained using the visualcrossing.com website. This website provides a user-friendly interface and can easily extract weather information for a specific area or period. And we converted the temperature from Fahrenheit to Celsius. Table 2 shows [24] clothing by temperature.

The relationship between food and emotion is one of the undiscovered research. In this approach, we actively used “The Influence of the Consumption of Comfort Food on Eating Behavior”[25]. In this thesis, Korean populations who live in the capital city were surveyed. The main purpose of this work was the concept of comfort food that is still lacking in Korea. They investigated the effect of food on eating behavior above. For example, the products which produce serotonin are connected with joy; furthermore, if somebody feels sadness, may consume the products that pertain the sugar. If you eat any food that contains vitamin A, C, E, it facilitates blood circulation. It is obvious that food preferences can be affected not only by emotions. There a huge list of properties which can change the options for food. For example, the geological location, culture, money, health, gender, age, and so on. However, in our method, we only focused on emotions because our main aim was a recommendation based on emotions.

Table 2. Outfit by Temperature

27°C~	Sleeveless, shorts, one-piece dress
23°C~26°C	Short-sleeved and thin shirt, long-sleeved shorts, cotton pants.
20°C~22°C	Long sleeves, cardigan, hoodie, cotton pants, slacks, skinny jeans.
17°C~19°C	Knitwear, cardigan, hoodie, sweatshirt, jeans, cotton pants.
12°C~16°C	Jacket, shirt, cardigan, bomber jacket, skin-coloured stockings.
10°C~11°C	Trench coats, bomber jackets, wearing many layers.
6°C~9°C	Coat, leather jacket.
-5°C	Winter clothes, chilly weather goods

Table 3. Emotions and Food

Anger	Green tea, spicy food, chocolate
Fear	Herb tea, lavender tea, chamomile tea, sage tea, black tea, banana
Disgust	Onion, walnut, sesame, pumpkin seeds, sunflower seeds, ginkgo seeds
Sadness	Banana, chocolate, cake, candy
Joy	Milk, yoghurt, banana, pumpkin seeds, meat, chicken, pizza, ice-cream

In this paper, we only took 5 basic emotions out of 6. Because there was no connection between surprise and food found. And we recommended many kinds of food to every 5 specific emotions. You can see Table 3 [26,27].

4. Implementation and Evaluation

Table 4 represents the environment that was used to do our experiment.

4.1 Implementation

The data used in this paper was used after erasing duplicated text and non-English characters from the Twitter data set. Dimension of This data set is 11674 by 3. It has 11674 raws and 3 columns.

Table 4. Experimental Environment

Division	Detailed contents
CPU	Intel(R) Core(TM) i5-7500 CPU @ 3.40GHz
RAM	8GB
HDD	128GB
OS	Windows 10 Pro 64bit
DEV.TOOL	R version 4.0.3 (2020-10-10) RStudio Version 1.3.1093

anger	anticipation	disgust	fear	joy	sadness	surprise	trust	negative	positive
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	1	1	1
0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	1	0	0	1	0
0	0	0	1	0	1	0	0	0	0
0	0	0	0	0	2	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	1	0	0	1	0	0	2	1
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	2	0	0	1	0
0	0	0	0	0	0	0	0	0	0
0	2	0	0	1	0	0	1	0	1

Fig. 3. Analysed Sentiment on Twitter Dataset

user_id	created_at	text	emotion	color1	color2	word_count	temp	temp_interval	recc_clothe	food
7.180621e+17	2021-10-05	<U+27A1><U+FE0F> ¡Aquí tenéis nuestra participación en ...	joy	yellow	orange	8	27	1	sleeveless, shorts, one-piece dress	milk, yoghurt, banana, pumpkin seeds, meat, chicken, pizza, ...
2.607315e+08	2021-10-05	Chrysler. Crazy to think how far cars have come in my fathe...	sadness	blue	black	16	27	1	sleeveless, shorts, one-piece dress	banana, chocolate, cake, candy
1.357622e+18	2021-10-05	In #April, the first #Wuling "small convertible"-Hongguang ...	anticipation			16	27	1	sleeveless, shorts, one-piece dress	green tea, spicy food, chocolate
1.059652e+18	2021-10-05	Do You Have A Passion for Cars and Drawing them? Check o...	anticipation			1	27	1	sleeveless, shorts, one-piece dress	green tea, spicy food, chocolate
1.345587e+08	2021-10-05	Car sharing fleet and the demand for used #cars in the #GC...	anger	black		12	27	1	sleeveless, shorts, one-piece dress	green tea, spicy food, chocolate
1.345587e+08	2021-10-05	Car sharing fleet and the demand for used #cars in the #GC...	anger	black		12	27	1	sleeveless, shorts, one-piece dress	green tea, spicy food, chocolate
1.345587e+08	2021-10-05	Car sharing fleet and the demand for used #cars in the #GC...	anger	black		12	27	1	sleeveless, shorts, one-piece dress	green tea, spicy food, chocolate
1.014410e+18	2021-10-05	Every day is #Ferrari day here at Woodham Mortimer. This F...	joy	yellow	black	25	27	1	sleeveless, shorts, one-piece dress	milk, yoghurt, banana, pumpkin seeds, meat, chicken, pizza, ...
9.308454e+17	2021-10-05	Pioneering Blueprint for Next Generation Electric Sports Car...	joy	yellow	orange	25	27	1	sleeveless, shorts, one-piece dress	milk, yoghurt, banana, pumpkin seeds, meat, chicken, pizza, ...
1.345008e+18	2021-10-05	if your apart of these communities that love brands and sho...	joy	yellow		15	27	1	sleeveless, shorts, one-piece dress	milk, yoghurt, banana, pumpkin seeds, meat, chicken, pizza, ...
1.345008e+18	2021-10-05	if your apart of these communities that love brands and sho...	anticipation			15	27	1	sleeveless, shorts, one-piece dress	green tea, spicy food, chocolate
3.061150e+09	2021-10-05	#KarlLagerfeld's estate is to be sold by @Sothebys. The #fas...	anticipation			13	27	1	sleeveless, shorts, one-piece dress	green tea, spicy food, chocolate
1.327522e+18	2021-10-06	I begin and keep on being confident all over my games. #g...	joy	yellow		9	22	3	Long sleeves, cardigan, hoodie, cotton pants, slacks, skinny j...	milk, yoghurt, banana, pumpkin seeds, meat, chicken, pizza, ...
1.327522e+18	2021-09-28	I get started and stay confident in the course of my games. ...	joy	yellow		18	24	3	Long sleeves, cardigan, hoodie, cotton pants, slacks, skinny j...	milk, yoghurt, banana, pumpkin seeds, meat, chicken, pizza, ...
1.327522e+18	2021-10-01	I start and stay confident all through my games. #golfing #g...	anticipation			22	28	1	sleeveless, shorts, one-piece dress	green tea, spicy food, chocolate
1.327522e+18	2021-09-29	I begin and remain confident all over my games. #golfing #...	joy	yellow		10	21	3	Long sleeves, cardigan, hoodie, cotton pants, slacks, skinny j...	milk, yoghurt, banana, pumpkin seeds, meat, chicken, pizza, ...

Fig. 4. Final Result

After passing tweet contents into sentiment analyzer, that function gave us the following data set with the 10 columns. Fig. 3 is analyzed sentiment on the dataset.

Then, six emotions were converted into colors to recommend the color of the clothes using Quantification Method III.

After allocating the temperature and temperature interval, we recommended clothes and food after having all the necessary characteristics. Fig. 4 is the final result.

Let's look at the 10th line of Fig. 4. The Twitter content for it is as follows. if your apart of these communities that love brands and shows support for those in need then we at Study Buddy are here for you. Let's engage! What's your favorite type of thing to do. I like to Game. He is talking about games and interesting engagements. Therefore, the result of this paper was analyzed as emotion "joy". There are 15 words that can be found in the NRC dictionary. And according to temperature, "sleeveless, shorts, one-piece dress" are recommended. The color of each piece of clothing was labeled as yellow. Also, we recommend yogurt, banana, pumpkin seeds, meat, chicken, pizza, and ice cream based on milk.

On the other hand, let's look at the 7th line of Fig. 4. The Twitter content for it is as follows. "Car sharing fleet and the demand for used #cars in the #GCC region are on the rise, according to @Frost_Sullivan." It is talking about demand for used cars. From our sentiment analysis, it is predicted that this is "anger". And the color is black, which actually must be matched with anger. Based on the temperature of 27°C - sleeveless, shorts, one-piece dress - that are all black in color were recommended. And because of his anger, green tea, spicy food, chocolate is recommended that may ease his/her anger. Finally, let's look at the second line of Fig. 4. The Twitter content for it is as follows. "Chrysler. Crazy to think how far cars have come in my fathers lifetime". This explains why his father came so far in a Chrysler car. The sentiment analyzer predicted the emotion as "sadness". And the first color is the blue and the second one is black. This is because anger also has the same weight as sadness. And in this system, because of the hot temperature, sleeveless shirts, shorts, and dresses are recommended for clothes. In conclusion, this system recommends blue or black sleeveless shirts, shorts, and dresses clothes. And the food is banana, chocolate, cake, and candy.

4.2 Evaluation

In this section, personalized clothes and food according to emotions and weather proposed in this paper are recommended, and tweet emotion analysis performance evaluation is performed.

The experiment applied Equations (1) and (2) to obtain the precision and recall rate of tweets divided into emotional words within individual tweets for the outputs calculated at each stage of collection-analysis-classification.

$$\text{precision} = \frac{\text{number of tweets that were exactly classified}}{\text{number of tweets that were classified using sentiment analysis}} \quad (1)$$

$$\text{recall} = \frac{\text{number of tweets that were exactly classified}}{\text{number of tweets that contain the emotion-words}} \quad (2)$$

In order to analyze the user's Twitter, an API provided by Twitter was used to collect tweets from 21th of December to 28th of December in 2021. The collected tweets were classified into six emotions. The number of tweets used for emotional analysis was 9,675, the number of tweets accurately classified was 7277, and the number of tweets containing emotional

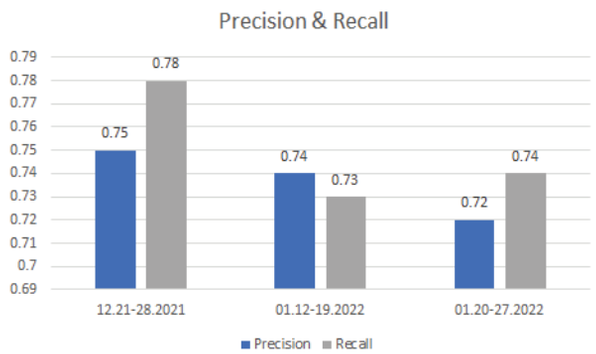

Fig. 5. Representation of Precision and Recall Within Different Period of Time

words was 9,355. Accordingly, the precision is 0.75 at 7277/9675, and the reproduction rate is 0.78 at 7277/9355.

The same process was done for another two different periods from 12th of January to 19th of January and from 20th of January to 27th of January, respectively, in 2022. Fig. 5 represents precision and recall for these three different periods of time. There is a slight difference among them, though.

Through precision and reproduction rate, it can be confirmed that the emotional analysis was well done.

5. Conclusion

In this paper, users' emotions were analyzed using social media Twitter comments. The results of emotions were classified into 6 emotions according to Paul Ekman's method. Those emotions were converted into colors by applying Hayashi's Quantification Method III, and these colors were expressed as recommended clothes colors. and color matched. Also, the type of clothing is recommended using the weather information of the visualcrossing.com API. In addition, various foods were recommended according to the contents of comfort food according to emotions. We got around 0.74 for precision and 0.75 for recall in the evaluation of sentiment analysis during three different periods.

In the future, we will expand the size of the dataset and do more experiments to see how the precision and recall will be varied. Furthermore, we will apply the image classification method that detects color in the fashion image data set, the clothing recommendation method, and the food recommendation method in more detail, and study the recommended contents more personalized.

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