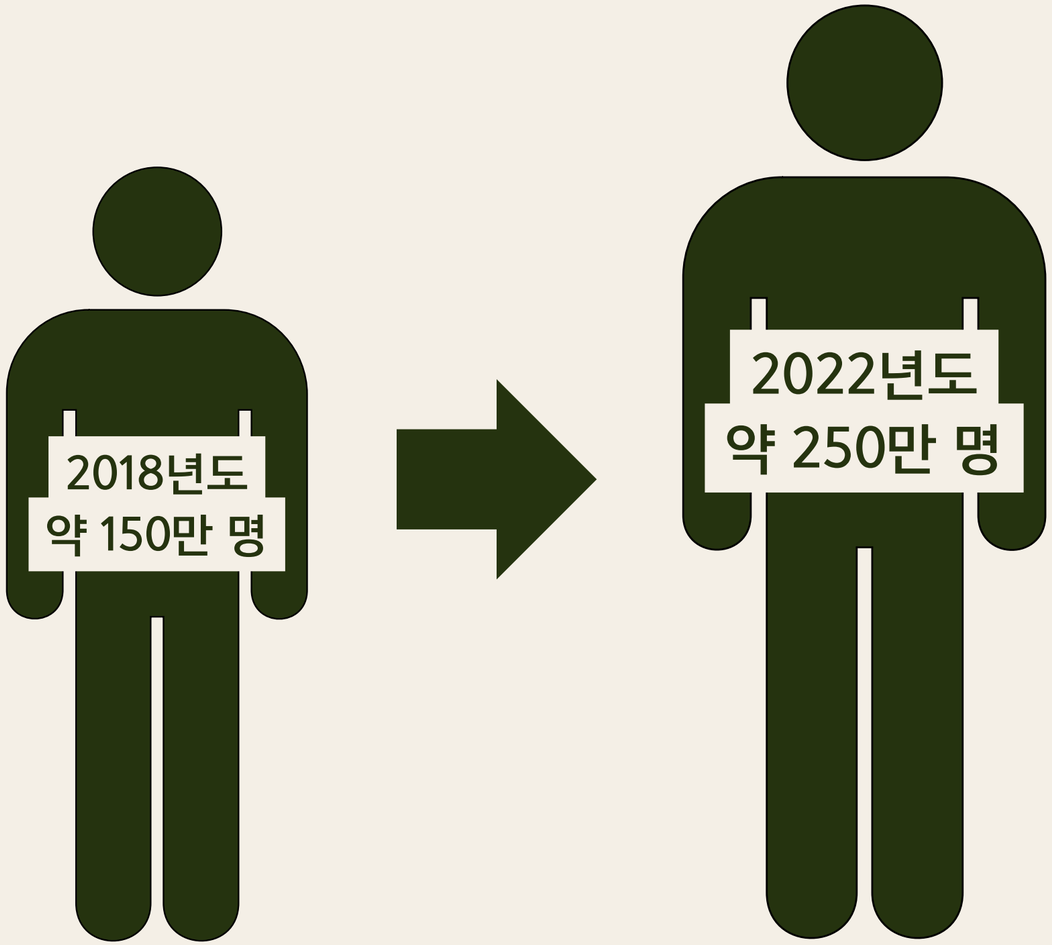
개인형 맞춤 비건 레시피 추천

Final Proposal
2021111735 정보경
2022111731 김채연
2022111741 성경선
2022111750 이나경

목차

주제 선정



[트렌드] 채식인구 250만시대…식품업계 비건 '바람'

건강 생각하는 MZ 세대… 비건(Vegan) 인구 10배 증가

“풀 먹는 게 비건이 아네요”…환경에 꽂힌 250만 ‘유연한 채식생활’

주제 선정

1 야채와 채소만 먹는
극단적인 비건식은 하고 싶지 않음.

2 외식이 쉽지 않아 집에서 요리를 할 때
레시피의 고민이 있음.

3 아이들의 채소 편식으로
맛있는 비건 식단을 만들어주고 싶음.

>>>

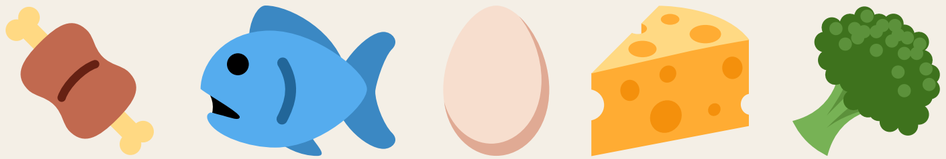
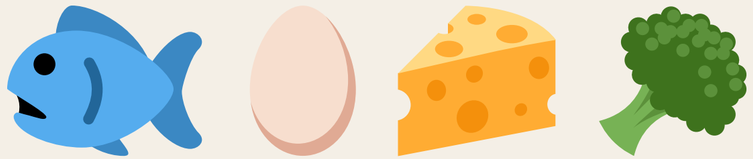
**개인형 맞춤
비건 레시피
추천 시스템**

주제 선정

먹는 음식의 종류에 따른

10가지 비건 유형

주제 선정

Vegetarian 	Pesco Vegetarian 
Lacto(ovo) Vegetarian 	Vegan 

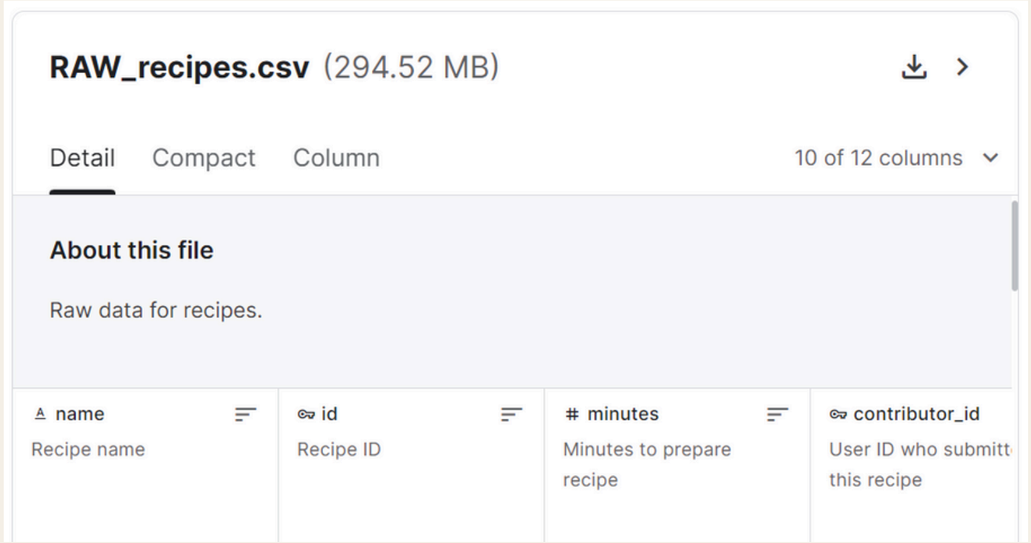
데이터 설명

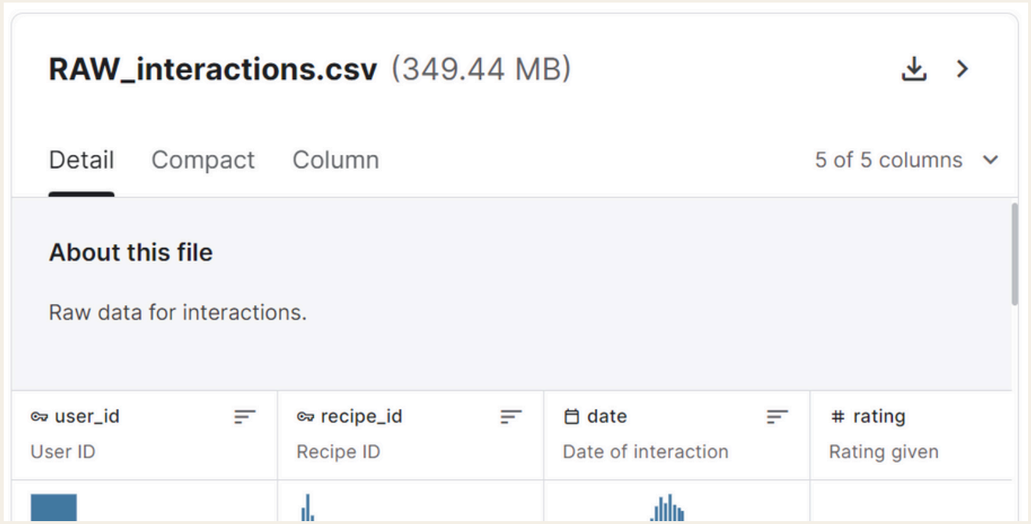
RAW_recipes.csv

음식 레시피에 대한 데이터
음식 ID, 재료, 요리 단계, 걸리는 시간 등의
컬럼이 있음.

RAW_interactions.csv

Interaction에 대한 데이터
유저 ID, 음식 ID, 평점, 리뷰 등의
컬럼이 있음.





데이터 설명

$$Y = f(X)$$

X

recipe에 관한 데이터 활용
vegan type 추가

Y

추천된
비건요리

f

Recommendation

SVD 모델(MachineBase)

KNN 모델(MemoryBase)

전처리 진행

filtered_recipes.csv

‘veg_type’ column 추가

컬럼 추가하여 **filtered_recipes.csv** 파일 제작

```
[ ]  # 비건 제외하고 페스코, 락토, 베지테리언(그냥 베지테리언 레시피 다 먹을 수 있는 사용자층을 위해) 분류함
     filtered_recipes = df[df['vegetarian'] == True]

     # vegan 열이 False인 경우, veg_type을 vegetarian으로 설정
     filtered_recipes.loc[filtered_recipes['vegan'] == False, 'veg_type'] = 'vegetarian'

     # vegan 열이 True인 경우, veg_type을 vegan으로 설정
     filtered_recipes.loc[filtered_recipes['vegan'] == True, 'veg_type'] = 'vegan'
```

```
[ ]  seafood_list = ["Anchovies", "Anglerfish", "Barracuda", "Basa", "Bass", "Black cod", "Bluefish", "Bombay duck", "Bonito", "Bream", "Brill", "Burbot
     dairy_list = ['milk', 'cheese', 'butter', 'cream', 'yogurt', 'custard']
     egg_list = ['egg']

     def determine_veg_type(row):
         # 예외 단어 제거
         ingredients_lower = row['ingredients'].lower().replace('eggplant', '')

         contains_seafood = any(seafood.lower() in ingredients_lower for seafood in seafood_list)
         contains_dairy = any(dairy in ingredients_lower for dairy in dairy_list)
         contains_egg = any(egg in ingredients_lower for egg in egg_list)

         if row['vegan']:
             return 'Vegan'
         elif contains_dairy:
             return 'Lacto'
         elif contains_seafood or contains_dairy or contains_egg:
             return 'Pesco'
         else:
             return 'Vegetarian'

     filtered_recipes['veg_type'] = filtered_recipes.apply(determine_veg_type, axis=1)
     filtered_recipes
```

전처리 진행 filtered_recipes.csv

불필요한 column **drop** 사용하여 삭제

헷갈리는 'id' column **'recipe_id'**로 수정

```
filter_recipe = filter_recipe.drop(columns=['minutes', 'contributor_id', 'submitted', 'tags', '
filter_recipe.head()
```

	Unnamed: 0	name	id	nut
0	0	arriba baked winter squash mexican style	137739	[51.5, 0.0, 13.0, 0.0, 2.0, 0.
1	1	amish tomato ketchup for canning	44061	[352.9, 1.0, 337.0, 23.0, 3.0, 0.0
2	2	aww marinated olives	25274	[380.7, 53.0, 7.0, 24.0, 6.0, 24.
3	3	chile rellenos	43026	[94.0, 10.0, 0.0, 11.0, 11.0, 21.
4	4	cream of cauliflower soup vegan	23850	[174.2, 4.0, 24.0, 1.0, 15.0, 1.0

```
#date컬럼 drop
interaction.drop('date', axis = 1, inplace = True)
interaction.head()

### inplace=True: 명령어를 실행한 후 메소드가 적용된 데이터 프레임으로 반환한다.
### 즉, 삭제 메소드를 실행했다면 반환값은 컬럼이 삭제된 Dataframe이 반환한다.
### axis = 1: 열, axis = 0 : 행을 따라 동작합니다.
```

	user_id	recipe_id	rating	review
0	38094	40893	4	Great with a salad. Cooked on top of stove for
1	1293707	40		
2	8937	44		
3	126440	85		
4	57222	85009	5	Made the cheddar bacon topping, adding a sprin...

```
### 'id' 열을 'recipe_id' 열로 변경
filter_recipe = filter_recipe.rename(columns={'id': 'recipe_id'})
```

전처리 진행

merged_df.csv

‘filtered recipe‘ 데이터 프레임과 ‘interaction‘ 데이터 프레임을

‘recipe_id‘ 열 기준으로 merge

	Unnamed: 0	name	recipe_id	nutrition	ingredients	veg_type	user_id	rating	review
0	0	arriba baked winter squash mexican style	137739	[51.5, 0.0, 13.0, 0.0, 2.0, 0.0, 4.0]	['winter squash', 'mexican seasoning', 'mixed ...	Lacto	4470	5	I used an acorn squash and recipe#137681 Swee...
1	0	arriba baked winter squash mexican style	137739	[51.5, 0.0, 13.0, 0.0, 2.0, 0.0, 4.0]	['winter squash', 'mexican seasoning', 'mixed ...	Lacto	593927	5	This was a nice change. I used butternut squas...
2	0	arriba baked winter squash mexican style	137739	[51.5, 0.0, 13.0, 0.0, 2.0, 0.0, 4.0]	['winter squash', 'mexican seasoning', 'mixed ...	Lacto	178427	5	Excellent recipe! I used butternut squash and ...
3	1	amish tomato ketchup for canning	44061	[352.9, 1.0, 337.0, 23.0, 3.0, 0.0, 28.0]	['tomato juice', 'apple cider vinegar', 'sugar...	Vegetarian	1310146	5	I wasn't sure how this was going to turn out, ...
4	2	aww marinated olives	25274	[380.7, 53.0, 7.0, 24.0, 6.0, 24.0, 6.0]	['fennel seeds', 'green olives', 'ripe olives'...	Vegan	198228	2	The fennel and garlic were a bit overpowering,...
...	...	...	...	...	...	...	...	...	...
178845	35647	zuring sorrel	423672	[127.7, 13.0, 49.0, 2.0, 0.0, 27.0, 4.0]	['sorrel', 'butter', 'sugar', 'raisins']	Lacto	424680	5	Wasn't sure I'd care for this since I'm not mu...
178846	35648	zwieback	60148	[130.9, 8.0, 0.0, 4.0, 5.0, 17.0, 5.0]	['milk', 'butter', 'dry yeast', 'water', 'salt...	Lacto	149363	5	My DH is from a Mennonite background, and we w...
178847	35648	zwieback	60148	[130.9, 8.0, 0.0, 4.0, 5.0, 17.0, 5.0]	['milk', 'butter', 'dry yeast', 'water', 'salt...	Lacto	1803409913	5	My husband is also from a Mennonite background...
178848	35649	zwiebeln salat swiss onion salad	455209	[113.5, 11.0, 17.0, 19.0, 2.0, 24.0, 3.0]	['butter', 'onions', 'flour', 'salt', 'vinegar']	Lacto	169430	5	I made this and served it hot on top of steak ...
178849	35650	zydeco spice mix	493372	[14.8, 0.0, 2.0, 58.0, 1.0, 0.0, 1.0]	['paprika', 'salt', 'garlic powder', 'onion po...	Vegan	653438	5	Made for New Kids on the Block tag game and fo...

178850 rows × 9 columns

전처리 진행 merged_df.csv

불필요한 column **drop** 사용하여 삭제

사용자(user_id) 순으로 정렬

‘merged_df.csv’ 생성

```
[ ] merged_df=merged_df.drop(columns=['recipe_id', 'nutrition', 'review'])
    merged_df.head()
```

	Unnamed: 0	name	in
0	0	arriba baked winter squash mexican style	['winter squash', 'mexican seasoning
1	0	arriba baked winter squash mexican style	['winter squash', 'mexican seasoning
2	0	arriba baked winter squash mexican style	['winter squash', 'mexican seasoning
3	1	amish tomato ketchup for canning	['tomato juice', 'apple cider vinega…
4	2	aww marinated olives	['fennel seeds', 'green olives', 'ripe olives'…

```
[ ] # 사용자 순으로 정렬 합니다. 기준이 사용자로 바뀝니다.

    merged_df.sort_values(by="user_id", ascending=True)
```

```
[ ] merged_df.to_csv('merged_df.csv')
```

전처리 진행

merged_df.csv

column (merged_df.csv)

name: 음식 메뉴 이름

ingerdients: 음식 재료

veg_type: 비건 타입

user_id: 유저 ID

rating: 평점

review: 리뷰

모델 구축

SVD 모델 – 품목 추천

pivot table 생성

사용자 기준에서 레시피 기준
전치 행렬 전환

```
[ ]  merged_df_rating = merged_df.pivot_table('rating', index = 'user_id', columns='name').fillna(0)
```

```
[ ]  merged_df_rating.shape
     ### 사용자수 : 51031명, 레시피개수 : 35614개

     (51031, 35614)
```

```
merged_df_rating.head()
```

user_id	name	0 fat chunky watermelon salsa	0 point soup ww	0 point soup crock pot	1 000 artichoke hearts	1 1 2 ingredient fiber crust	1 2 3 4 coconut cake	1 2 3 granola	1 2 3 hash browns pie k	1 2 3 peanut butter cookies	1 asian noodle salad	...	zuni caf scones my version	zuppa inglese della nonna	zuppa sarda sardinian cheese and egg soup with croutons	zuppanitz soup of nothing	zurie s holey rustic olive and cheddar bread	zurie s overnight no knead bread	zuring sorrel	zwieback	zwiebeln salat swiss onion salad	zydeco spice mix
1533		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1535		0.0	5.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1634		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1676		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1792		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

```
[ ]  ## 행이 레시피, 열이 사용자
     merged_df_ratingt = merged_df_rating.values.T
     merged_df_ratingt.shape
     ### https://rfriend.tistory.com/289

     (35614, 51031)

[ ]  type(merged_df_ratingt)

     numpy.ndarray
```

모델 구축

SVD 모델 – 품목 추천

```
[ ]  SVD = TruncatedSVD(n_components=12)
     matrix = SVD.fit_transform(merged_df_ratingt) ##  51031*35614 :레시피 * 사용자 점수
     matrix.shape

     ### merged_df_ratingt = merged_df_rating.values.T
     ### 가로: recipes, 세로: 사용자
```

```
(35614, 12)
```

```
[ ]  matrix[0]
```

```
array([ 0.01333043,  0.00427467,  0.02198551, -0.00161873, -0.02931364,
        0.00423055, -0.01642024,  0.01201064,  0.00608518, -0.00964589,
       -0.01203368, -0.00026612])
```

```
[ ]  # Check for missing values
     missing_values = np.isnan(matrix)

     # Count missing values
     missing_count = np.sum(missing_values)

     print("Number of missing values:", missing_count)
```

```
Number of missing values: 0
```

12개의 component로
차원을 축소

모델 구축

SVD 모델 - 품목 추천

```
corr = np.corrcoef(matrix)
corr.shape
```

```
/usr/local/lib/python3.10/dist-packages/numpy/lib/function_base.py:2897: RuntimeWarning: divide by zero encountered in divide
  c /= stddev[:, None]
/usr/local/lib/python3.10/dist-packages/numpy/lib/function_base.py:2897: RuntimeWarning: invalid value encountered in divide
  c /= stddev[:, None]
/usr/local/lib/python3.10/dist-packages/numpy/lib/function_base.py:2898: RuntimeWarning: invalid value encountered in divide
  c /= stddev[None, :]
(35614, 35614)
```

```
corr2 = corr[:200, :200]
corr2.shape
```

```
(200, 200)
```

```
corr3 = corr[:5, :5]
corr3.shape
```

```
(5, 5)
```

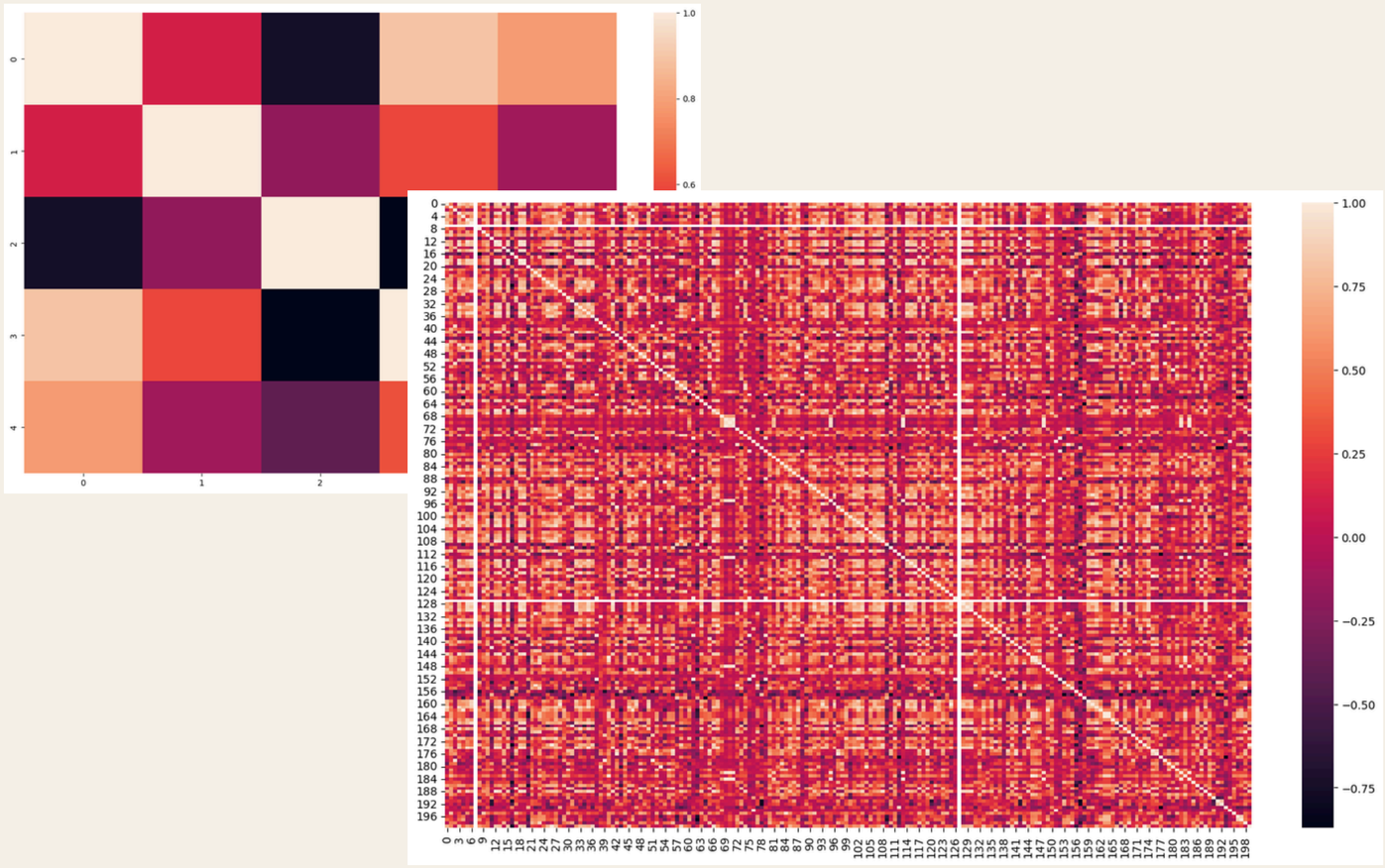
```
corr4= corr[:15,:15]
corr4.shape
```

```
(15, 15)
```

피어슨 상관계수
계산 및 확인

모델 구축

SVD 모델 – 품목 추천



레시피 간의
상관 관계 파악 가능

모델 구축

SVD 모델 - 품목 추천

```
recipe_name = merged_df_rating.columns
recipe_name_list = list(recipe_name)
coffey_hands = recipe_name_list.index("3 ingredients coco
coffey_hands
```

```
92
```

해석)

"3 ingredients coconut milk powder burfi"는 92번째 있습니다.

```
recipe_name = merged_df_rating.columns
recipe_name_list = list(recipe_name)
```

```
recipe_name
```

```
Index(['0 fat chunky watermelon salsa', '0 point soup   ww
       '0 point soup  crock pot', 'l 000 artichoke hearts',
       'l l 2 ingredient fiber crust', 'l 2 3 4 coconut cake', '
       'l 2 3 hash browns pie   k', 'l 2 3 peanut butter cookie
       'l asian noodle salad',
       ...
       'zuni caf scones  my version', 'zuppa inglese della nonr
       'zuppa sarda  sardinian cheese and egg soup with crou
       'zuppanitz  soup of nothing',
       'zurie s holey rustic olive and cheddar bread',
       'zurie s overnight no knead bread', 'zuring  sorrel', 'zw
       'zwiebeln salat  swiss onion salad', 'zydeco spice mix'],
      dtype='object', name='name', length=356 l 4)
```

```
recipe_name_list[0:20]
### 처음 20개의 메뉴를 출력합니다.
```

```
['0 fat chunky watermelon salsa',
 '0 point soup   ww',
 '0 point soup  crock pot',
 'l 000 artichoke hearts',
 'l l 2 ingredient fiber crust',
 'l 2 3 4 coconut cake',
 'l 2 3 granola',
 'l 2 3 hash browns pie   k',
 'l 2 3 peanut butter cookies',
 'l asian noodle salad',
 'l dish italian 5 cheese pizza bake',
 'l minute blueberries   cream',
 'l minute chili cheese burritos',
 'l pan fudge cake',
 'l point plus   roasted asparagus with lemon and chives',
 'l pot curried rotini with currants  peas and red peppers',
 'l0  bars',
 'l0 minute  fat free  veggie soup for one',
 'l0 minute cream of mushroom soup',
 'l0 minute creamed spinach']
```

```
recipe_name_list[92:97]
```

```
['3 ingredients coconut milk powder burfi',
 '3 layer chocolate peanut butter bars',
 '3 minute microwave brownies',
 '3 onion  mushroom and garlic soup',
 '3 p s  salad   peas  pickle  peanut']
```

```
corr_coffey_hands  = corr[coffey_hands]
### list(recipe_name[(corr_coffey_hands >= 0.9)])[:50]
list(recipe_name[(corr_coffey_hands >= 0.8)])[:10]
```

```
['3 ingredients coconut milk powder burfi',
 'all bran banana bread',
 'banana and semolina pudding  sheera',
 'banana tahini malted',
 'bananas on toast',
 'bizarre but tasty tofu tomato sandwich  and good for you too',
 'burn rice',
 'chocolate banana shake',
 'chocolate cherry creams',
 'chocolate mousse  foolproof version']
```

'3 ingredients coconut milk powder burfi'
기준으로 비슷한 레시피 10가지

'banana and semolina pudding sheera'
'banana tahini malted'
'bananas on toast' 등

모델 구축

SVD 모델 – 개인 맞춤 추천

```
np.array(df_user_recipe_ratings)
```

```
array([[0., 0., 0., ..., 0., 0., 0.],
       [0., 5., 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., ..., 0., 0., 0.]])
```

```
# df_user_recipe_ratings DataFrame을 numpy 배열로 변환
matrix = df_user_recipe_ratings.to_numpy()

# 각 사용자가 평가한 레시피 평점의 평균을 계산 (axis=1: 각 사용자별로 계산)
# 사용자1이 모든 레시피에 매긴 점수의 평균, 사용자2가 모든 레시피에 매긴 점수의 평균, ...
user_ratings_mean = np.mean(matrix, axis=1)

# 사용자-레시피 매트릭스에서 각 사용자의 평점 평균을 뺀 값으로 변환
# 사용자가 각 레시피에 대해 매긴 점수에서 해당 사용자가 모든 레시피에 매긴 점수의 평균을 뺀 값
# 예: 사용자1의 레시피1에 대한 평점 - 사용자1의 모든 레시피에 대한 평점 평균
matrix_user_mean = matrix - user_ratings_mean.reshape(-1, 1)
```

```
matrix
```

```
array([[0., 0., 0., ..., 0., 0., 0.],
       [0., 5., 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., ..., 0., 0., 0.]])
```

```
matrix.shape
### 사용자별 레시피의 점수
```

```
(51031, 35614)
```

```
user_ratings_mean.shape
```

```
(51031,)
```

```
user_ratings_mean
```

```
array([0.0029202 , 0.01344977, 0.0003931 , ..., 0.        , 0.00014039,
       0.00014039])
```

```
len(user_ratings_mean)
```

```
51031
```

유저가 평가한 레시피 평점의 평균 계산

평점에서 레시피의 평균값을 뺀 값으로 변환

모델 구축

SVD 모델 – 개인 맞춤 추천

```
[ ]  ### scipy에서 제공해주는 SVD
     ### SVD(Singular Value Decomposion), 특이값 분해:  m x n 크기의 데이터 행를 차수를 줄여 간소화 하는 방법 중 한개 입니다.
     # U 행렬, sigma 행렬, V 전치 행렬을 반환.

     U, sigma, Vt = svds(matrix_user_mean, k = 8)
```

```
[ ]  print(U.shape)
     print(sigma.shape)
     print(Vt.shape)
```

```
(51031, 8)
(8,)
(8, 35614)
```

```
[ ]  sigma = np.diag(sigma)
```

```
[ ]  sigma.shape
```

```
(8, 8)
```

```
[ ]  sigma[0]
```

```
array([124.39831637,   0.      ,   0.      ,   0.      ,
         0.      ,   0.      ,   0.      ,   0.      ])
```

```
[ ]  sigma[1]
```

```
array([  0.      , 127.02329199,   0.      ,   0.      ,
         0.      ,   0.      ,   0.      ,   0.      ])
```

데이터 행 차수를 줄여 간소화

U 행렬, Sigma 행렬, V 전치 행렬 반환

모델 구축

SVD 모델 – 개인 맞춤 추천

```
[ ] # U, Sigma, Vt의 내적을 수행하면, 다시 원본 행렬로 복원이 된다.
    # 거기에 + 사용자 평균 rating을 적용한다.
    svd_user_predicted_ratings = np.dot(np.dot(U, sigma), Vt) + user_ratings_mean.reshape(-1, 1)
```

```
[ ] df_svd_preds = pd.DataFrame(svd_user_predicted_ratings, columns = df_user_recipe_ratings.columns)
    df_svd_preds.head()
```

name	0 fat chunky watermelon salsa	0 point soup ww	0 point soup crock pot	1 000 artichoke hearts	1 1 2 ingredient fiber crust	1 2 3 4 coconut cake	1 2 3 granola	1 2 3 hash browns pie k	1 2 3 peanut butter cookies	1 asian noodle salad	...	zuni caf scones my version	zuppa inglese della nonna	zuppa sarda sardinian cheese and egg soup with croutons	zuppanitz soup of nothing	zurie s holey rustic olive and cheddar bread	zurie s overnight no knead bread	zuring sorrel	zwieback	zwiebeln salat swiss onion salad	zydeco spice mix
0	0.003153	0.003721	0.000054	0.003397	0.003709	0.003113	0.003356	0.003097	0.003097	0.003163	...	-0.001167	0.002682	0.003136	0.003142	0.003283	0.003812	0.000036	0.003092	-0.000752	0.002928
1	0.008501	0.034560	0.025554	0.019621	0.028663	0.008159	0.017671	0.007142	0.007141	0.014646	...	0.044512	0.009359	0.008157	0.009223	0.016626	0.046950	0.006708	0.009326	0.042295	0.009610
2	0.000507	0.000220	-0.000028	0.000501	0.000497	0.000506	0.000498	0.000508	0.000508	0.000439	...	0.000190	0.000418	0.000509	0.000494	0.000501	0.000339	0.000186	0.000465	0.000280	0.000458
3	-0.000143	0.002172	0.008006	0.000223	0.000858	-0.000190	0.000248	-0.000215	-0.000216	0.000077	...	0.006368	0.000231	-0.000186	-0.000090	0.000118	0.001597	-0.001159	-0.000058	0.005922	-0.000140
4	0.000005	0.001833	-0.000965	0.000790	0.001493	-0.000030	0.000669	-0.000102	-0.000102	0.000485	...	0.000031	-0.000157	-0.000014	0.000041	0.000574	0.002538	-0.000185	0.000076	0.000086	-0.000020

5 rows × 35614 columns

내적 수행 -> 원본 행렬 복원,
사용자 평균 rating 적용

모델 구축

SVD 모델 – 개인 맞춤 추천

```
[ ]  def recommend_recipes(df_svd_preds, user_id, df_user_recipe_ratings, ori_interaction_df, veg_type, num_recommendations=5):
       # 사용자 ID에 해당하는 인덱스 찾기 (0부터 시작)
       user_row_number = user_id - 1

       # 최종적으로 만든(전처리된) sorted_user_predictions에서 사용자 index(df_svd_preds.iloc[user_row_number])에 따라 레시피 데이터 정렬
       sorted_user_predictions = df_svd_preds.iloc[user_row_number].sort_values(ascending=False)

       # 원본 상호작용 데이터에서 사용자가 평가한 데이터를 뽑아냄
       user_data = ori_interaction_df[ori_interaction_df.user_id == user_id]

       # 사용자가 상호작용한 레시피 데이터와 레시피 정보 데이터를 합침
       user_history = user_data.merge(df_recipe, left_on='recipe_id',right_on='id')

       # 추천 대상 레시피 중에서 사용자가 평가하지 않은 레시피 추출
       recommendations = df_recipe[~df_recipe['name'].isin(user_history['name'])]

       # 해당 채식 타입의 레시피 추출
       recommendations = recommendations[recommendations['veg_type'] == veg_type]

       # 추천 대상 레시피 중에서 사용자의 레시피 평점이 높은 순으로 정렬된 데이터와 병합
       recommendations = recommendations.merge(pd.DataFrame(sorted_user_predictions).reset_index(), on='name')

       # 컬럼 이름을 변경하고 정렬하여 반환
       recommendations = recommendations.rename(columns={user_row_number: 'Predictions'}).sort_values('Predictions', ascending=False).iloc[:num_recommendations]

       return recommendations
```

추천 함수 제작

전처리 진행

SVD 모델 – 개인 맞춤 추천

```
[ ]  # 사용자 ID와 추천할 레시피의 수 지정
     user_id = 330
     veg_type = 'Lacto'
     num_recommendations = 10

     # 레시피 추천 함수 호출
     recommendations = recommend_recipes(df_svd_preds, user_id, df_user_recipe_ratings, df_user, veg_type, num_recommendations)

     print(f"¥n사용자에게 추천하는 레시피:")
     print(recommendations)
```

사용자가 평가한 레시피 평점 반영

개인별 비건 타입에 따른
레시피 필터링

전처리 진행

SVD 모델 – 개인 맞춤 추천

```
[ ]  # 레시피 추천 함수 호출
     recommendations = recommend_recipes(df_svd_preds, 400, df_recipe, df_user,"Lacto", 10)
     recommendations
```

	Unnamed: 0	id	name	minutes	contributor_id	submitted	tags	nutrition	n_steps	steps	description	ingredients	n_ingredients	vegetarian	vegan	veg_type	Predictions
12809	25296	29679	reeses squares 5 ingredients no bake reese s	15	37305	2002-05-29	['15-minutes-or-less', 'time-to-make', 'course...	[222.8, 21.0, 77.0, 4.0, 7.0, 30.0, 7.0]	6	['combine graham crumbs , sugar and peanut but...	these bars are extremely rich and not for peop...	['graham cracker crumbs', "confectioners' suga...	5	True	False	Lacto	0.242314
6473	12377	83524	frizzled cabbage	25	60694	2004-02-10	['30-minutes-or-less', 'time-to-make', 'course...	[130.2, 17.0, 14.0, 5.0, 3.0, 36.0, 2.0]	8	['core and very thinly slice the cabbage', 'me...	raise the lowly cabbage to something extraordi...	['green cabbage', 'butter', 'salt and pepper']	3	True	False	Lacto	0.127821
8576	16860	66596	kittencal s famous greek salad	10	89831	2003-07-14	['15-minutes-or-less', 'time-to-make', 'course...	[489.7, 72.0, 23.0, 33.0, 15.0, 55.0, 4.0]	8	['for the dressing', 'in a processor or use a ...	be prepared for the best greek salad on the pl...	['olive oil', 'lemon, juice of', 'dried oregan...	16	True	False	Lacto	0.117497
11043	21948	49387	oven fried eggplant aubergine	35	37077	2002-12-19	['60-minutes-or-less', 'time-to-make', 'course...	[122.0, 6.0, 22.0, 18.0, 11.0, 8.0, 5.0]	8	['combine first 2 ingredients , stir well', 's...	this recipe appeared in "cooking light" magazi...	['fat-free mayonnaise', 'onion', 'eggplant', '...	7	True	False	Lacto	0.098549
14806	29557	121490	strawberries cream bread strawberry or blue...	75	169969	2005-05-10	['time-to-make', 'course', 'main-ingredient', ...	[283.7, 19.0, 87.0, 11.0, 7.0, 37.0, 13.0]	13	['combine flour , baking powder , baking soda ...	a wonderful recipe using fresh strawberries fr...	['flour', 'baking powder', 'baking soda', 'sal...	13	True	False	Lacto	0.077939
2550	4998	18816	cabbage for those who dislike cabbage	40	20371	2002-02-04	['60-minutes-or-less', 'time-to-make', 'course...	[89.3, 9.0, 20.0, 2.0, 2.0, 13.0, 2.0]	7	['in a large skillet , heat butter and oil ove...	this is so much nicer than plain steamed or bo...	['butter', 'canola oil', 'green cabbage', 'bro...	8	True	False	Lacto	0.076117
8147	15841	18914	incredibly delicious cheese garlic bread spread	30	27381	2002-02-05	['30-minutes-or-less', '15-minutes-or-less', '...	[928.4, 138.0, 2.0, 59.0, 52.0, 156.0, 1.0]	5	['microwave margarine in medium glass bowl for...	easy, cheesy, savory spread to transform regul...	['margarine', 'garlic', 'garlic powder', 'blac...	6	True	False	Lacto	0.075437
4086	7848	26306	copycat green giant niblets corn in butter sauce	20	37305	2002-04-25	['30-minutes-or-less', 'time-to-make', 'course...	[164.5, 15.0, 1.0, 22.0, 5.0, 29.0, 6.0]	6	['add corn to large sauce pan along with all i...	i had to come up with this quick, every thanks...	['frozen corn', 'salt', 'butter', 'sugar', 'wa...	6	True	False	Lacto	0.075203
15668	315(																
1764	357																

```
[ ]  recommendations = recommend_recipes(df_svd_preds, 4470, df_recipe, df_user,"Lacto", 10)
     recommendations
```

	Unnamed: 0	id	name	minutes	contributor_id	submitted	tags	nutrition	n_steps	steps	description	ingredients	n_ingredients	vegetarian	vegan	veg_type	Predictions
45	95	32204	whatever floats your boat brownies	35	37305	2002-06-25	['60-minutes-or-less', 'time-to-make', 'course...	[390.7, 30.0, 161.0, 7.0, 12.0, 50.0, 17.0]	14	['preheat oven to 350f', 'grease an 8 inch squ...	these are absolutely the chewiest, moistest, f...	['butter', 'unsweetened cocoa', 'sugar', 'eggs...	14	True	False	Lacto	0.000210
15277	30983	62181	tarator bulgarian cold cucumber soup	20	70536	2003-05-15	['30-minutes-or-less', 'time-to-make', 'course...	[136.2, 8.0, 44.0, 3.0, 14.0, 17.0, 5.0]	7	['cut the cucumbers into cubes and put them in...	this cold soup is among bulgarians favorite fo...	['cucumbers', 'plain yogurt', 'garlic cloves',...	8	True	False	Lacto	0.000186
6153	11887	148015	florentines sandwich cookies	55	49304	2005-12-12	['60-minutes-or-less', 'time-to-make', 'course...	[104.3, 11.0, 27.0, 1.0, 3.0, 14.0, 2.0]	15	['position the rack in the center of oven and ...	these are a very easy to make, great christmas...	['sliced almonds', 'flour', 'orange zest', 'su...	8	True	False	Lacto	0.000185
769	1693	195188	aubergine eggplant fritters	10	322548	2006-11-12	['15-minutes-or-less', 'time-to-make', 'course...	[186.7, 5.0, 26.0, 8.0, 16.0, 5.0, 10.0]	5	['make four "sandwiches" using the aubergine a...	crispy little fritters. a treat for two or a f...	['aubergine', 'halloumi cheese', 'seasoned flo...	6	True	False	Lacto	0.000185
16854	34893	94564	williamsburg cheese biscuits	18	55380	2004-06-28	['30-minutes-or-less', 'time-to-make', 'course...	[70.3, 8.0, 0.0, 3.0, 3.0, 16.0, 1.0]	10	['cream the cheese', 'beat in butter', 'add re...	buttery cheese biscuits from colonial williams...	['sharp cheddar cheese', 'butter', 'flour', 's...	6	True	False	Lacto	0.000185
7092	13774	269563	greek salsa	135	118648	2007-12-03	['time-to-make', 'course', 'cuisine', 'prepara...	[367.3, 50.0, 21.0, 33.0, 20.0, 59.0, 3.0]	6	['combine first 6 ingredients in a large bowl'...	a great and different twist on the ol' chips a...	['cucumber', 'tomatoes', 'green onions', 'blac...	11	True	False	Lacto	0.000185
10370	20837	33322	nigella lawson turkish delight syllabub	15	27678	2002-07-07	['15-minutes-or-less', 'time-to-make', 'course...	[328.8, 44.0, 51.0, 1.0, 4.0, 88.0, 6.0]	7	['mix the cointreau , lemon juice and sugar in...	posted in response to a request on the message...	['cointreau liqueur', 'lemons', 'caster sugar',...	7	True	False	Lacto	0.000185
20	48	261296	no harm eggplant parm ww	70	431867	2007-10-25	['time-to-make', 'course', 'main-ingredient', ...	[141.2, 1.0, 26.0, 30.0, 31.0, 0.0, 8.0]	15	['preheat oven to 375', 'slice ends off of egg...	this is from the hungry girl newsletter. i hav...	['eggplant', 'egg white', 'fiber one cereal', ...	10	True	False	Lacto	0.000185
3477	6854	119063	chocolate birthday cake and double chocolate s...	60	43642	2005-04-25	['60-minutes-or-less', 'time-to-make', 'course...	[969.9, 85.0, 314.0, 17.0, 27.0, 152.0, 35.0]	23	['preheat the oven to 325f', 'grease and flour...	this makes 2 little miniature cakes, using 14-...	['all-purpose flour', 'buttermilk', 'egg yolk'...	12	True	False	Lacto	0.000185
14978	30232	149576	super simple blender chocolate mousse	55	102058	2005-12-28	['60-minutes-or-less', 'time-to-make', 'course...	[309.4, 24.0, 143.0, 1.0, 10.0, 44.0, 13.0]	4	['in blender , combine sugar , chocolate chips...	my family and guests love this really easy des...	['granulated sugar', 'semi-sweet chocolate chi...	6	True	False	Lacto	0.000185

사용자 별로 다르게 추천

veg_type은
지정된 ‘Lacto’로 적용

모델 구축

KNN 모델

```
# NaN 값 처리 (NaN을 빈 문자열로 대체)
VeganRecipesData = VeganRecipesData.fillna('')

# 'Unnamed: 0.1' 및 'Unnamed: 0' 컬럼 드롭
VeganRecipesData = VeganRecipesData.drop(columns=['Unnamed: 0.1', 'Unnamed: 0'])

# 동일한 name을 가진 레시피의 텍스트 필드 합치기
VeganRecipesData = VeganRecipesData.groupby('name').agg({
    'ingredients': 'first',
    'veg_type': 'first',
    'review': ' '.join
}).reset_index()
```

동일한 name을 가진
레시피의 텍스트 필드 합치기

	name	ingredients	veg_type	review
0	0 fat chunky watermelon salsa	['lime', 'watermelon', 'cucumber', 'green onio...	Vegetarian	Awsome salas Kitten. Can I give this 10 stars!...
1	0 point soup ww	['garlic cloves', 'onion', 'carrots', 'red bel...	Vegetarian	This is wonderful soup. It is very filling and...
2	0 point soup crock pot	['spinach', 'carrots', 'celery ribs', 'onion',...	Vegetarian	What a wonderful soup!!!!\nEllie, this really ...
3	1 000 artichoke hearts	['artichoke hearts', 'egg', 'unseasoned breadc...	Lacto	My, my, what a wonderful mouthful of flavors!!...
4	1 1 2 ingredient fiber crust	['all-bran cereal', 'water']	Vegan	It was absolutely wonderful! I used this crust...

모델 구축

KNN 모델

‘review’와 **‘ingerdients’** column

TF-IDF 벡터화 하여 텍스트를 수치화 함

```
# 텍스트 칼럼 결합
VeganRecipesData['text'] = VeganRecipesData['review'] + ' ' + VeganRecipesData['ingredients']


# TF-IDF 벡터화
vectorizer = TfidfVectorizer(stop_words='english')
X = vectorizer.fit_transform(VeganRecipesData['text'])
```

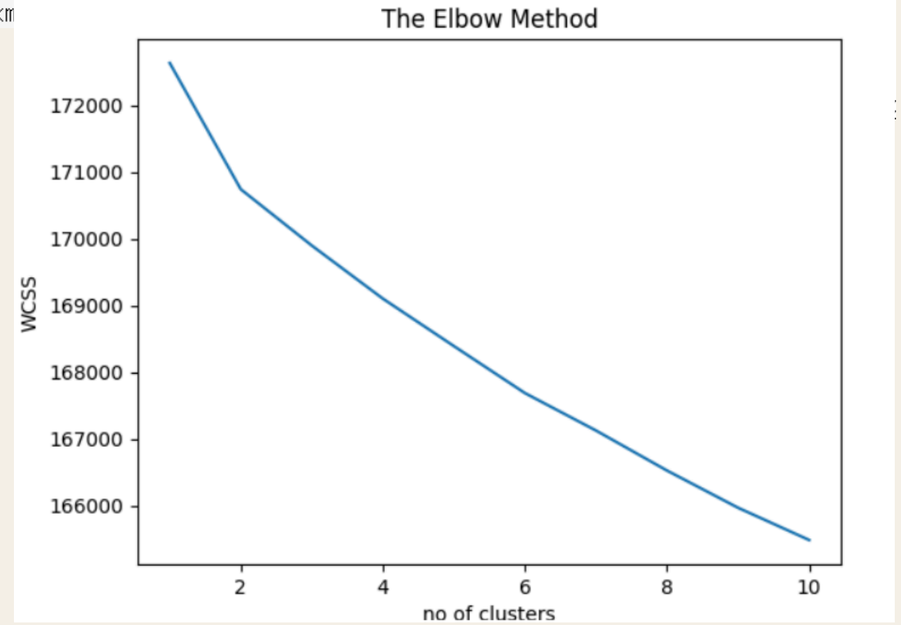
모델 구축

KNN 모델

```
from sklearn.cluster import KMeans
WCSS=[]

for i in range (1,11):
    kmeans = KMeans(n_clusters=i, init='k-means++', ran
    kmeans.fit(X)
    interia=kmeans.inertia_
    #### Cluster 간의 거리의 합을 나타내는 inertia(=관성
    #### 이 지점의 K 값을 군집의 개수로 사용 inertia_속
    print('k:', i, 'inertia:', interia)
    WCSS.append(km
```

```
k: 1 inertia: 172630.54718454232
k: 2 inertia: 170738.67125913128
k: 3 inertia: 169894.7779562148
k: 4 inertia: 169099.52801923588
k: 5 inertia: 168388.45387377663
k: 6 inertia: 167684.1188678149
```



k=3, k=4에서 감소폭 완화

모델의 복잡성을 줄이고
과적합을 막기 위해
k 값으로 3 선택

모델 구축

KNN 모델

```
# KNN 모델 구축
knn = NearestNeighbors(n_neighbors=3, metric='cosine')
knn.fit(X)

def recommend_recipes(name, veg_type, n_recommendations=3):
    # 주어진 채식 타입에 맞는 데이터 필터링
    filtered_data = VeganRecipesData[VeganRecipesData['veg_type'] == veg_type]

    if filtered_data.empty:
        print(f"No recipes found for veg_type: {veg_type}")
        return pd.DataFrame(columns=VeganRecipesData.columns)

    # 필터링된 데이터에 대해 TF-IDF 벡터화
    filtered_X = vectorizer.transform(filtered_data['text'])

    # 필터링된 데이터에 대해 KNN 모델 구축
    filtered_knn = NearestNeighbors(n_neighbors=n_recommendations+1, metric='cosine')
    filtered_knn.fit(filtered_X)

    # 입력된 레시피의 인덱스를 찾고 추천 수행
    idx = VeganRecipesData.index[VeganRecipesData['name'] == name][0]
    if VeganRecipesData.at[idx, 'veg_type'] != veg_type:
        print(f"Recipe '{name}' does not match the veg_type '{veg_type}'")
        return pd.DataFrame(columns=VeganRecipesData.columns)

    distances, indices = filtered_knn.kneighbors(filtered_X[filtered_data.index.get_loc(idx)], n_neighbors=n_recommendations+1)

    recommended_indices = indices.flatten()[1:]  # 자기 자신 제외
    return filtered_data.iloc[recommended_indices]
```

KNN 모델 학습

모델 구축

KNN 모델

```
# 예시: 'arriba   baked winter squash mexican style'와 유사한 레시피 추천
user_veg_type = 'Lacto'  # 사용자가 입력한 채식 타입
recommendations = recommend_recipes('arriba   baked winter squash mexican style', user_veg_type)
print(recommendations[['name','veg_type']])
```

```
                                                 name veg_type
9301                         d s roasted butternut squash    Lacto
2024  baked butternut squash and parmesan cheese gratin    Lacto
4841              butternut squash with onions and pecans    Lacto
```

‘arriba baked winter squash mexican style’
과 유사한 레시피 추천

‘d s roasted butternut squash’
‘baked butternut squash and
parmesan cheese gratin’
‘butternut squash with onions and pecans’

결과 및 소감

SVD 모델 – 품목 추천

```
recipe_name_list[0:20]
### 처음 20개의 메뉴를 출력합니다.
```

```
['0 fat chunky watermelon salsa',
 '0 point soup  ww',
 '0 point soup  crock pot',
 'I 000 artichoke hearts',
 'I I 2 ingredient fiber crust',
 'I 2 3 4 coconut cake',
 'I 2 3 granola',
 'I 2 3 hash browns pie  k',
 'I 2 3 peanut butter cookies',
 'I asian noodle salad',
 'I dish italian 5 cheese pizza bake',
 'I minute blueberries  cream',
 'I minute chili cheese burritos',
 'I pan fudge cake',
 'I point plus  roasted asparagus with lemon and chives',
 'I pot curried rotini with currants  peas and red peppers',
 'I0  bars',
 'I0 minute  fat free  veggie soup for one',
 'I0 minute cream of mushroom soup',
 'I0 minute creamed spinach']
```

```
recipe_name_list[92:97]
```

```
['3 ingredients coconut milk powder burfi',
 '3 layer chocolate peanut butter bars',
 '3 minute microwave brownies',
 '3 onion  mushroom and garlic soup',
 '3 p s  salad  peas  pickle  peanut']
```

```
corr_coffey_hands  = corr[coffey_hands]
### list(recipe_name[(corr_coffey_hands >= 0.9)])[:50]
list(recipe_name[(corr_coffey_hands >= 0.8)])[:10]
```

```
['3 ingredients coconut milk powder burfi',
 'all bran banana bread',
 'banana and semolina pudding  sheera',
 'banana tahini malted',
 'bananas on toast',
 'bizarre but tasty tofu tomato sandwich  and good for you too',
 'burn rice',
 'chocolate banana shake',
 'chocolate cherry creams',
 'chocolate mousse  foolproof version']
```

SVD 모델 – 개인 맞춤 추천

```
recommendations = recommend_recipes(df_svd_preds, 4470, df_recipe, df_user,"Lacto", 10)
recommendations
```

	Unnamed: 0	name	id	minutes	contributor_id	submitted	tags	nutrition	n_steps	steps	description	ingredients	n_ingredients	vegetarian	vegan	veg_type	Predictions
45	95	whatever floats your boat brownies	32204	35	37305	2002-06-25	['60-minutes-or-less', 'time-to-make', 'course...	[390.7, 30.0, 161.0, 7.0, 12.0, 50.0, 17.0]	14	['preheat oven to 350f', 'grease an 8 inch squ...	these are absolutely the chewiest, moistest, f...	['butter', 'unsweetened cocoa', 'sugar', 'eggs...	14	True	False	Lacto	0.000210
15277	30983	tarator bulgarian cold cucumber soup	62181	20	70536	2003-05-15	['30-minutes-or-less', 'time-to-make', 'course...	[136.2, 8.0, 44.0, 3.0, 14.0, 17.0, 5.0]	7	['cut the cucumbers into cubes and put them in...	this cold soup is among bulgarians favorite fo...	['cucumbers', 'plain yogurt', 'garlic cloves',...	8	True	False	Lacto	0.000186
6153	11887	florentines sandwich cookies	148015	55	49304	2005-12-12	['60-minutes-or-less', 'time-to-make', 'course...	[104.3, 11.0, 27.0, 1.0, 3.0, 14.0, 2.0]	15	['position the rack in the center of oven and ...	these are a very easy to make, great christmas...	['sliced almonds', 'flour', 'orange zest', 'su...	8	True	False	Lacto	0.000185
769	1693	aubergine eggplant fritters	195188	10	322548	2006-11-12	['15-minutes-or-less', 'time-to-make', 'course...	[186.7, 5.0, 26.0, 8.0, 16.0, 5.0, 10.0]	5	['make four "sandwiches" using the aubergine a...	crispy little fritters. a treat for two or a f...	['aubergine', 'halloumi cheese', 'seasoned flo...	6	True	False	Lacto	0.000185
16854	34893	williamsburg cheese bi															
7092	13774	greek															
10370	20837	nigella lawson turkish d syl															
20	48	no harm eggplant pan															
3477	6854	chocolate birthday cak double chocola															
14978	30232	super simple bl chocolate m															

```
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16854	34893	williamsburg cheese biscuits	94564	18	55380	2004-06-28	['30-minutes-or-less', 'time-to-make', 'course...	[70.3, 8.0, 0.0, 3.0, 3.0, 16.0, 1.0]	10	['cream the cheese', 'beat in butter', 'add re...	buttery cheese biscuits from colonial williams...	['sharp cheddar cheese', 'butter', 'flour', 's...	6	True	False	Lacto	0.000185
7092	13774	greek salsa	269563	135	118648	2007-12-03	['time-to-make', 'course', 'cuisine', 'prepara...	[367.3, 50.0, 21.0, 33.0, 20.0, 59.0, 3.0]	6	['combine first 6 ingredients in a large bowl'...	a great and different twist on the ol' chips a...	['cucumber', 'tomatoes', 'green onions', 'blac...	11	True	False	Lacto	0.000185
10370	20837	nigella lawson turkish delight syllabub	33322	15	27678	2002-07-07	['15-minutes-or-less', 'time-to-make', 'course...	[328.8, 44.0, 51.0, 1.0, 4.0, 88.0, 6.0]	7	['mix the cointreau , lemon juice and sugar in...	posted in response to a request on the message...	['cointreau liqueur', 'lemons', 'caster sugar'...	7	True	False	Lacto	0.000185
20	48	no harm eggplant parm ww	261296	70	431867	2007-10-25	['time-to-make', 'course', 'main-ingredient',...	[141.2, 1.0, 26.0, 30.0, 31.0, 0.0, 8.0]	15	['preheat oven to 375', 'slice ends off of egg...	this is from the hungry girl newsletter. i hav...	['eggplant', 'egg white', 'fiber one cereal', ...	10	True	False	Lacto	0.000185
3477	6854	chocolate birthday cake and double chocolate s...	119063	60	43642	2005-04-25	['60-minutes-or-less', 'time-to-make', 'course...	[969.9, 85.0, 314.0, 17.0, 27.0, 152.0, 35.0]	23	['preheat the oven to 325f', 'grease and flour...	this makes 2 little miniature cakes, using 14-...	['all-purpose flour', 'buttermilk', 'egg yolk'...	12	True	False	Lacto	0.000185
14978	30232	super simple blender chocolate mousse	149576	55	102058	2005-12-28	['60-minutes-or-less', 'time-to-make', 'course...	[309.4, 24.0, 143.0, 1.0, 10.0, 44.0, 13.0]	4	['in blender , combine sugar , chocolate chips...	my family and guests love this really easy des...	['granulated sugar', 'semi-sweet chocolate chi...	6	True	False	Lacto	0.000185

KNN 모델

```
# 예시: 'arriba   baked winter squash mexican style'와 유사한 레시피 추천
user_veg_type = 'Lacto'  # 사용자가 입력한 채식 타입
recommendations = recommend_recipes('arriba   baked winter squash mexican style', user_veg_type)
print(recommendations[['name','veg_type']])
```

```
                                                 name veg_type
9301                        d s roasted butternut squash    Lacto
2024  baked butternut squash and parmesan cheese gratin    Lacto
4841              butternut squash with onions and pecans    Lacto
```

출처

https://www.seoulfn.com/news/articleView.html?idxno=472014
https://www.casenews.co.kr/news/articleView.html?idxno=4186
https://www.joongang.co.kr/article/24107917#home
https://lulinali.tistory.com/64
https://www.careet.net/855
https://www.kaggle.com/code/seifip/food-com-vegetarian-analysis/input

감사합니다

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