

```
In [3]: # Gerekli kütüphaneleri içe aktar
import pandas as pd
import numpy as np
import nltk
from nltk.tokenize import word_tokenize
from nltk.corpus import stopwords
from nltk.stem import WordNetLemmatizer, PorterStemmer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.metrics.pairwise import cosine_similarity
from gensim.models import Word2Vec
import ast
from itertools import combinations
```

```
In [4]: # NLTK verilerini indir
nltk.download('punkt')
nltk.download('stopwords')
nltk.download('wordnet')
nltk.download('punkt_tab')
```

```
[nltk_data] Downloading package punkt to
[nltk_data] C:\Users\yaren\AppData\Roaming\nltk_data...
[nltk_data] Package punkt is already up-to-date!
[nltk_data] Downloading package stopwords to
[nltk_data] C:\Users\yaren\AppData\Roaming\nltk_data...
[nltk_data] Package stopwords is already up-to-date!
[nltk_data] Downloading package wordnet to
[nltk_data] C:\Users\yaren\AppData\Roaming\nltk_data...
[nltk_data] Package wordnet is already up-to-date!
[nltk_data] Downloading package punkt_tab to
[nltk_data] C:\Users\yaren\AppData\Roaming\nltk_data...
[nltk_data] Package punkt_tab is already up-to-date!
```

```
Out[4]: True
```

```
In [5]: # Ön işleme bağımlılıklarını tanımla
stop_words = set(stopwords.words('english'))
lemmatizer = WordNetLemmatizer()
stemmer = PorterStemmer()
```

```
In [11]: #Veri setini yükle
df = pd.read_csv("C://Users//yaren//Downloads//recipe_final (1).csv")
df
```

Out[11]:

Unnamed: 0	recipe_id	recipe_name	aver_rate	image_url	review_nums	calories	fat	carbohydrates	protein	
0	0	222388	Homemade Bacon	5.00	https://images.media-allrecipes.com/userphotos...	3	15	36	1	42
1	1	240488	Pork Loin, Apples, and Sauerkraut	4.76	https://images.media-allrecipes.com/userphotos...	29	19	18	10	73
2	2	218939	Foolproof Rosemary Chicken Wings	4.57	https://images.media-allrecipes.com/userphotos...	12	17	36	2	48
3	3	87211	Chicken Pesto Paninis	4.62	https://images.media-allrecipes.com/userphotos...	163	32	45	20	65
4	4	245714	Potato Bacon Pizza	4.50	https://images.media-allrecipes.com/userphotos...	2	8	12	5	14
...
48730	48730	222886	Grateful Dead Cocktail	3.50	https://images.media-allrecipes.com/userphotos...	4	20	1	6	1
48731	48731	25650	Cheese Filling For Pastries	4.33	https://images.media-allrecipes.com/userphotos...	3	6	14	2	4
48732	48732	23544	Peach Smoothie	3.62	https://images.media-allrecipes.com/userphotos...	21	8	7	8	10
48733	48733	170710	Double Dare Peaches	4.71	https://images.media-allrecipes.com/userphotos...	19	20	33	16	11
48734	48734	79774	All-Purpose Marinara Sauce	4.50	https://images.media-allrecipes.com/userphotos...	2	2	3	2	3

48735 rows × 14 columns



```

In [12]: #Ön işleme fonksiyonu
def preprocess_ingredients(ingredients_str):
    try:
        ingredients = ast.literal_eval(ingredients_str)
    except:
        ingredients = []
    text = ' '.join(ingredients)
    tokens = word_tokenize(text)
    filtered_tokens = [token.lower() for token in tokens if token.isalpha() and token.lower() not in stop_words]
    lemmatized_tokens = [lemmatizer.lemmatize(token) for token in filtered_tokens]
    stemmed_tokens = [stemmer.stem(token) for token in filtered_tokens]
    return lemmatized_tokens, stemmed_tokens

```

```

In [13]: #Her tarifin malzemelerini işle
tokenized_corpus_lemmatized = []
tokenized_corpus_stemmed = []
for ingredients in df['ingredients_list']:
    lemmatized, stemmed = preprocess_ingredients(ingredients)
    tokenized_corpus_lemmatized.append(lemmatized)
    tokenized_corpus_stemmed.append(stemmed)

```

```

In [14]: # TF-IDF vektörleştirme fonksiyonu
def create_tfidf_df(corpus):
    vectorizer = TfidfVectorizer()
    tfidf_matrix = vectorizer.fit_transform([' '.join(tokens) for tokens in corpus])
    feature_names = vectorizer.get_feature_names_out()
    return pd.DataFrame(tfidf_matrix.toarray(), columns=feature_names, index=df['recipe_id'], vectorizer=vectorizer)

```

```

In [15]: # Lemmatized için TF-IDF
tfidf_lemmatized_df, vectorizer = create_tfidf_df(tokenized_corpus_lemmatized)
tfidf_lemmatized_df.to_csv('tfidf_lemmatized.csv')

```

```
In [16]: # Stemmed için TF-IDF
tfidf_stemmed_df, vectorizer_stemmed = create_tfidf_df(tokenized_corpus_stemmed)
tfidf_stemmed_df.to_csv('tfidf_stemmed.csv')
```

```
In [17]: # Örnek giriş metni
ornek_giris = df['ingredients_list'].iloc[0] # İlk tarifi malzemeleri
print("Örnek Giriş Metni (Malzemeler):", ornek_giris)
```

Örnek Giriş Metni (Malzemeler): ['pork belly', 'smoked paprika', 'kosher salt', 'ground black pepper']

```
In [18]: # Örnek giriş metnini ön işle
lemmatized_giris, stemmed_giris = preprocess_ingredients(ornek_giris)
ornek_giris_text = ' '.join(lemmatized_giris)
print("Lemmatized Giriş:", lemmatized_giris)
print("Stemmed Giriş:", stemmed_giris)
print("Örnek Giriş Metni (İşlenmiş):", ornek_giris_text)
```

Lemmatized Giriş: ['pork', 'belly', 'smoked', 'paprika', 'kosher', 'salt', 'ground', 'black', 'pepper']

Stemmed Giriş: ['pork', 'belli', 'smoke', 'paprika', 'kosher', 'salt', 'ground', 'black', 'pepper']

Örnek Giriş Metni (İşlenmiş): pork belly smoked paprika kosher salt ground black pepper

```
In [19]: # TF-IDF benzerlik hesaplama fonksiyonu
def tfidf_benzerlik_hesapla(giris_text, tfidf_df, vectorizer, top_n=5):
    """
    TF-IDF vektörleri ile cosine benzerliği hesaplar ve en benzer 5 tarifi döndürür.
    """
    giris_tfidf = vectorizer.transform([giris_text])
    benzerlikler = cosine_similarity(giris_tfidf, tfidf_df.values)[0]
    top_indices = benzerlikler.argsort()[::-1][-top_n:]
    top_scores = benzerlikler[top_indices]
    return df.iloc[top_indices][['recipe_id', 'recipe_name', 'ingredients_list']].reset_index(drop=True), top_s
```

```
In [20]: # TF-IDF modelleri için benzerlik hesaplama
print("\nTF-IDF Lemmatized - En Benzer 5 Tarif:")
tfidf_lemmatized_sonuc, tfidf_lemmatized_skorlar = tfidf_benzerlik_hesapla(ornek_giris_text, tfidf_lemmatized_d
print(tfidf_lemmatized_sonuc)
print("Benzerlik Skorları:", tfidf_lemmatized_skorlar)

print("\nTF-IDF Stemmed - En Benzer 5 Tarif:")
tfidf_stemmed_sonuc, tfidf_stemmed_skorlar = tfidf_benzerlik_hesapla(' '.join(stemmed_giris), tfidf_stemmed_df,
print(tfidf_stemmed_sonuc)
print("Benzerlik Skorları:", tfidf_stemmed_skorlar)
```

TF-IDF Lemmatized - En Benzer 5 Tarif:

	recipe_id	recipe_name \
0	222388	Homemade Bacon
1	240136	Crispy Pork Belly
2	237899	Filippino Lechon Kawali
3	245887	Caramelized Pork Belly (Thit Kho)
4	228741	Split Pea Soup with Pork Belly

	ingredients_list
0	['pork belly', 'smoked paprika', 'kosher salt'...
1	['pork belly', 'smoked paprika', 'kosher salt ...
2	['pork belly', 'garlic', 'bay leaves', 'salt',...
3	['pork belly', 'white sugar', 'shallots sliced...
4	['yellow onion', 'pork belly', 'water more if ...

Benzerlik Skorları: [1. 0.95341635 0.54290444 0.46900268 0.43404008]

TF-IDF Stemmed - En Benzer 5 Tarif:

	recipe_id	recipe_name \
0	222388	Homemade Bacon
1	240136	Crispy Pork Belly
2	237899	Filippino Lechon Kawali
3	245887	Caramelized Pork Belly (Thit Kho)
4	228741	Split Pea Soup with Pork Belly

	ingredients_list
0	['pork belly', 'smoked paprika', 'kosher salt'...
1	['pork belly', 'smoked paprika', 'kosher salt ...
2	['pork belly', 'garlic', 'bay leaves', 'salt',...
3	['pork belly', 'white sugar', 'shallots sliced...
4	['yellow onion', 'pork belly', 'water more if ...

Benzerlik Skorları: [1. 0.95267861 0.55096538 0.47408999 0.43776161]

```
In [21]: # Word2Vec modellerini yükle veya oluştur
models = {}
model_configs = [
    ('lemmatized_model_cbow_window2_dim100', tokenized_corpus_lemmatized, 100, 2, 0),
    ('lemmatized_model_skipgram_window2_dim100', tokenized_corpus_lemmatized, 100, 2, 1),
    ('lemmatized_model_cbow_window4_dim100', tokenized_corpus_lemmatized, 100, 4, 0),
    ('lemmatized_model_skipgram_window4_dim100', tokenized_corpus_lemmatized, 100, 4, 1),
    ('lemmatized_model_cbow_window2_dim300', tokenized_corpus_lemmatized, 300, 2, 0),
    ('lemmatized_model_skipgram_window2_dim300', tokenized_corpus_lemmatized, 300, 2, 1),
```

```

('lemmatized_model_cbow_window4_dim300', tokenized_corpus_lemmatized, 300, 4, 0),
('lemmatized_model_skipgram_window4_dim300', tokenized_corpus_lemmatized, 300, 4, 1),
('stemmed_model_cbow_window2_dim100', tokenized_corpus_stemmed, 100, 2, 0),
('stemmed_model_skipgram_window2_dim100', tokenized_corpus_stemmed, 100, 2, 1),
('stemmed_model_cbow_window4_dim100', tokenized_corpus_stemmed, 100, 4, 0),
('stemmed_model_skipgram_window4_dim100', tokenized_corpus_stemmed, 100, 4, 1),
('stemmed_model_cbow_window2_dim300', tokenized_corpus_stemmed, 300, 2, 0),
('stemmed_model_skipgram_window2_dim300', tokenized_corpus_stemmed, 300, 2, 1),
('stemmed_model_cbow_window4_dim300', tokenized_corpus_stemmed, 300, 4, 0),
('stemmed_model_skipgram_window4_dim300', tokenized_corpus_stemmed, 300, 4, 1)
]
for model_name, corpus, vector_size, window, sg in model_configs:
    try:
        models[model_name] = Word2Vec.load(f"{model_name}.model")
        print(f"{model_name} modeli yüklendi.")
    except FileNotFoundError:
        print(f"{model_name} modeli bulunamadı, yeni model oluşturuluyor.")
        model = Word2Vec(sentences=corpus, vector_size=vector_size, window=window, min_count=1, sg=sg)
        model.save(f"{model_name}.model")
        models[model_name] = model

```

```

lemmatized_model_cbow_window2_dim100 modeli yüklendi.
lemmatized_model_skipgram_window2_dim100 modeli yüklendi.
lemmatized_model_cbow_window4_dim100 modeli yüklendi.
lemmatized_model_skipgram_window4_dim100 modeli yüklendi.
lemmatized_model_cbow_window2_dim300 modeli yüklendi.
lemmatized_model_skipgram_window2_dim300 modeli yüklendi.
lemmatized_model_cbow_window4_dim300 modeli yüklendi.
lemmatized_model_skipgram_window4_dim300 modeli yüklendi.
stemmed_model_cbow_window2_dim100 modeli yüklendi.
stemmed_model_skipgram_window2_dim100 modeli yüklendi.
stemmed_model_cbow_window4_dim100 modeli yüklendi.
stemmed_model_skipgram_window4_dim100 modeli yüklendi.
stemmed_model_cbow_window2_dim300 modeli yüklendi.
stemmed_model_skipgram_window2_dim300 modeli yüklendi.
stemmed_model_cbow_window4_dim300 modeli yüklendi.
stemmed_model_skipgram_window4_dim300 modeli yüklendi.

```

```

In [22]: # Word2Vec benzerlik hesaplama fonksiyonu
def word2vec_benzerlik_hesapla(giris_tokens, model, tfidf_df, top_n=5):
    """
    Word2Vec vektörleri ile ortalama vektör olarak cosine benzerliği hesaplar.
    """
    vectors = [model.wv[word] for word in giris_tokens if word in model.wv]
    if not vectors:
        return pd.DataFrame(), np.array([])
    giris_vector = np.mean(vectors, axis=0).reshape(1, -1)

    tarif_vectors = []
    valid_indices = []
    for i, tokens in enumerate(tokenized_corpus_lemmatized if 'lemmatized' in model_name else tokenized_corpus_stemmed):
        vecs = [model.wv[word] for word in tokens if word in model.wv]
        if vecs:
            tarif_vectors.append(np.mean(vecs, axis=0))
            valid_indices.append(i)

    tarif_vectors = np.array(tarif_vectors)
    benzerlikler = cosine_similarity(giris_vector, tarif_vectors)[0]
    top_indices = np.argsort(benzerlikler)[-top_n:][::-1]
    top_scores = benzerlikler[top_indices]
    top_recipe_indices = [valid_indices[i] for i in top_indices]

    return df.iloc[top_recipe_indices][['recipe_id', 'recipe_name', 'ingredients_list']].reset_index(drop=True)

```

```

In [23]: # Tüm Word2Vec modelleri için benzerlik hesaplama
w2v_sonuclar = {}
w2v_skorlar = {}
for model_name in models.keys():
    corpus = tokenized_corpus_lemmatized if 'lemmatized' in model_name else tokenized_corpus_stemmed
    tfidf_df = tfidf_lemmatized_df if 'lemmatized' in model_name else tfidf_stemmed_df
    giris_tokens = lemmatized_giris if 'lemmatized' in model_name else stemmed_giris

    print(f"\n{model_name} - En Benzer 5 Tarif:")
    sonuc, skorlar = word2vec_benzerlik_hesapla(giris_tokens, models[model_name], tfidf_df)
    print(sonuc)
    print("Benzerlik Skorları:", skorlar)
    w2v_sonuclar[model_name] = sonuc
    w2v_skorlar[model_name] = skorlar

```

```

lemmatized_model_cbow_window2_dim100 - En Benzer 5 Tarif:
  recipe_id  recipe_name \
0    222388    Homemade Bacon
1    240136    Crispy Pork Belly
2    255280  Chef John's Paper Pork Shoulder

```

```

3      244199      Hot Dog Sausages
4      223502      Cretons de Chez-Nous!

ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['Rub:', 'kosher salt', 'freshly ground black ...
3 ['lean ground beef', 'ground pork', 'kosher sa...
4 ['fresh pork fat without skin', 'lean ground p...
Benzerlik Skorları: [0.99999994 0.9780143 0.94570386 0.9382908 0.9379264 ]

```

lemmatized_model_skipgram_window2_dim100 - En Benzer 5 Tarif:

```

recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      247093      How to "Dry-Brine" Pork Chops
3      236114      Pork Roast with the World's Best Rub
4      244199      Hot Dog Sausages

```

```

ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['large center-cut bone-in pork chops', 'koshe...
3 ['brown sugar', 'coarsely ground black pepper'...]
4 ['lean ground beef', 'ground pork', 'kosher sa...
Benzerlik Skorları: [1. 0.98446685 0.9532156 0.9517798 0.9515225 ]

```

lemmatized_model_cbow_window4_dim100 - En Benzer 5 Tarif:

```

recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      255280      Chef John's Paper Pork Shoulder
3      247093      How to "Dry-Brine" Pork Chops
4      244199      Hot Dog Sausages

```

```

ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['Rub:', 'kosher salt', 'freshly ground black ...
3 ['large center-cut bone-in pork chops', 'koshe...
4 ['lean ground beef', 'ground pork', 'kosher sa...
Benzerlik Skorları: [0.9999999 0.97509027 0.94472384 0.94019234 0.92728364]

```

lemmatized_model_skipgram_window4_dim100 - En Benzer 5 Tarif:

```

recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      247093      How to "Dry-Brine" Pork Chops
3      236114      Pork Roast with the World's Best Rub
4      241609      Pork Rub Rubbed and Baked Pork Chops

```

```

ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['large center-cut bone-in pork chops', 'koshe...
3 ['brown sugar', 'coarsely ground black pepper'...]
4 ['paprika', 'white sugar', 'salt', 'ground bla...
Benzerlik Skorları: [1.00000001 0.98427546 0.9567575 0.9549174 0.949501 ]

```

lemmatized_model_cbow_window2_dim300 - En Benzer 5 Tarif:

```

recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      255280      Chef John's Paper Pork Shoulder
3      247093      How to "Dry-Brine" Pork Chops
4      223502      Cretons de Chez-Nous!

```

```

ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['Rub:', 'kosher salt', 'freshly ground black ...
3 ['large center-cut bone-in pork chops', 'koshe...
4 ['fresh pork fat without skin', 'lean ground p...
Benzerlik Skorları: [0.9999999 0.97783613 0.94375324 0.9401095 0.9372685 ]

```

lemmatized_model_skipgram_window2_dim300 - En Benzer 5 Tarif:

```

recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      244199      Hot Dog Sausages
3      247093      How to "Dry-Brine" Pork Chops
4      236114      Pork Roast with the World's Best Rub

```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['lean ground beef', 'ground pork', 'kosher sa...
3 ['large center-cut bone-in pork chops', 'koshe...
4 ['brown sugar', 'coarsely ground black pepper'...]
Benzerlik Skorları: [1. 0.9824421 0.95118433 0.95117927 0.95030993]
```

lemmatized_model_cbow_window4_dim300 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      255280      Chef John's Paper Pork Shoulder
3      247093      How to "Dry-Brine" Pork Chops
4      223502      Cretons de Chez-Nous!
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['Rub:', 'kosher salt', 'freshly ground black ...
3 ['large center-cut bone-in pork chops', 'koshe...
4 ['fresh pork fat without skin', 'lean ground p...
Benzerlik Skorları: [1.0000001 0.97636867 0.940148 0.93779737 0.9255469 ]
```

lemmatized_model_skipgram_window4_dim300 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      247093      How to "Dry-Brine" Pork Chops
3      236114      Pork Roast with the World's Best Rub
4      241609      Pork Rub Rubbed and Baked Pork Chops
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['large center-cut bone-in pork chops', 'koshe...
3 ['brown sugar', 'coarsely ground black pepper'...]
4 ['paprika', 'white sugar', 'salt', 'ground bla...
Benzerlik Skorları: [1. 0.9804243 0.94764817 0.9471879 0.9414089 ]
```

stemmed_model_cbow_window2_dim100 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      223502      Cretons de Chez-Nous!
3      219108      Pastrami Chicken Wings
4      255280      Chef John's Paper Pork Shoulder
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['fresh pork fat without skin', 'lean ground p...
3 ['chicken wings', 'vegetable oil', 'white pepp...
4 ['Rub:', 'kosher salt', 'freshly ground black ...
Benzerlik Skorları: [0.9999999 0.9765811 0.93322134 0.9326804 0.93239486]
```

stemmed_model_skipgram_window2_dim100 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      262225      Instant Pot® Baby Back Ribs
3      236114      Pork Roast with the World's Best Rub
4      219108      Pastrami Chicken Wings
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['kosher salt', 'brown sugar', 'chili powder',...
3 ['brown sugar', 'coarsely ground black pepper'...]
4 ['chicken wings', 'vegetable oil', 'white pepp...
Benzerlik Skorları: [0.9999999 0.9839409 0.95242393 0.95236474 0.95130813]
```

stemmed_model_cbow_window4_dim100 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      255280      Chef John's Paper Pork Shoulder
3      219108      Pastrami Chicken Wings
4      238401      Pepper Jelly Pork
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...]
1 ['pork belly', 'smoked paprika', 'kosher salt ...
```

```
2 ['Rub:', 'kosher salt', 'freshly ground black ...
3 ['chicken wings', 'vegetable oil', 'white pepp...
4 ['chili powder', 'freshly ground black pepper'...
Benzerlik Skorları: [1.0000001 0.9744491 0.9406923 0.928047 0.9241748]
```

stemmed_model_skipgram_window4_dim100 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      262225      Instant Pot® Baby Back Ribs
3      236114      Pork Roast with the World's Best Rub
4      242101      Rib Rub for Fall-Off-The-Bone Ribs
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['kosher salt', 'brown sugar', 'chili powder',...
3 ['brown sugar', 'coarsely ground black pepper'...
4 ['white sugar', 'brown sugar', 'seasoned salt'...
```

Benzerlik Skorları: [1. 0.98296595 0.95223606 0.95222676 0.9515821]

stemmed_model_cbow_window2_dim300 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      255280      Chef John's Paper Pork Shoulder
3      245630      Grilled Tilapia with Smoked Paprika
4      223502      Cretons de Chez-Nous!
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['Rub:', 'kosher salt', 'freshly ground black ...
3 ['olive oil', 'ground smoked paprika', 'garlic...
4 ['fresh pork fat without skin', 'lean ground p...
```

Benzerlik Skorları: [1.0000001 0.9777173 0.9396494 0.9322601 0.9318886]

stemmed_model_skipgram_window2_dim300 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      219108      Pastrami Chicken Wings
3      14726      Grilled Pork Tenderloin
4      247093      How to "Dry-Brine" Pork Chops
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['chicken wings', 'vegetable oil', 'white pepp...
3 ['pork tenderloins', 'garlic powder', 'salt', ...
4 ['large center-cut bone-in pork chops', 'koshe...
```

Benzerlik Skorları: [0.9999998 0.98216003 0.9493147 0.94670546 0.9462017]

stemmed_model_cbow_window4_dim300 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      255280      Chef John's Paper Pork Shoulder
3      245630      Grilled Tilapia with Smoked Paprika
4      219108      Pastrami Chicken Wings
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['Rub:', 'kosher salt', 'freshly ground black ...
3 ['olive oil', 'ground smoked paprika', 'garlic...
4 ['chicken wings', 'vegetable oil', 'white pepp...
```

Benzerlik Skorları: [0.9999998 0.9763694 0.93705124 0.92251325 0.92209405]

stemmed_model_skipgram_window4_dim300 - En Benzer 5 Tarif:

```
recipe_id      recipe_name \
0      222388      Homemade Bacon
1      240136      Crispy Pork Belly
2      262225      Instant Pot® Baby Back Ribs
3      242101      Rib Rub for Fall-Off-The-Bone Ribs
4      236114      Pork Roast with the World's Best Rub
```

```
ingredients_list
0 ['pork belly', 'smoked paprika', 'kosher salt'...
1 ['pork belly', 'smoked paprika', 'kosher salt ...
2 ['kosher salt', 'brown sugar', 'chili powder',...
3 ['white sugar', 'brown sugar', 'seasoned salt'...
4 ['brown sugar', 'coarsely ground black pepper'...
```

Benzerlik Skorları: [1. 0.98151577 0.9438546 0.9426413 0.9423203]

```
In [24]: # Anlamsal değerlendirme (örnek puanlar, gerçek değerlendirme yapılmalı)
anlamsal_puanlar = {
    'tfidf_lemmatized': [4, 4, 3, 3, 2],
    'tfidf_stemmed': [3, 3, 2, 2, 1],
    'lemmatized_model_cbow_window2_dim100': [4, 3, 3, 2, 2],
    'lemmatized_model_skipgram_window2_dim100': [4, 4, 3, 3, 2],
    'lemmatized_model_cbow_window4_dim100': [3, 3, 2, 2, 1],
    'lemmatized_model_skipgram_window4_dim100': [4, 3, 3, 2, 2],
    'lemmatized_model_cbow_window2_dim300': [4, 4, 3, 3, 2],
    'lemmatized_model_skipgram_window2_dim300': [5, 4, 4, 3, 3],
    'lemmatized_model_cbow_window4_dim300': [3, 3, 2, 2, 1],
    'lemmatized_model_skipgram_window4_dim300': [4, 4, 3, 3, 2],
    'stemmed_model_cbow_window2_dim100': [3, 2, 2, 1, 1],
    'stemmed_model_skipgram_window2_dim100': [3, 3, 2, 2, 1],
    'stemmed_model_cbow_window4_dim100': [2, 2, 1, 1, 1],
    'stemmed_model_skipgram_window4_dim100': [3, 2, 2, 1, 1],
    'stemmed_model_cbow_window2_dim300': [3, 3, 2, 2, 1],
    'stemmed_model_skipgram_window2_dim300': [4, 3, 3, 2, 2],
    'stemmed_model_cbow_window4_dim300': [2, 2, 1, 1, 1],
    'stemmed_model_skipgram_window4_dim300': [3, 3, 2, 2, 1]
}
```

```
In [25]: # Ortalama anlamsal puanları hesapla
ortalama_puanlar = {model: np.mean(puanlar) for model, puanlar in anlamsal_puanlar.items()}
print("\nModel Başına Ortalama Anlamsal Puanlar:")
for model, ortalama in ortalama_puanlar.items():
    print(f"{model}: {ortalama:.2f}")
```

Model Başına Ortalama Anlamsal Puanlar:

tfidf_lemmatized:	3.20
tfidf_stemmed:	2.20
lemmatized_model_cbow_window2_dim100:	2.80
lemmatized_model_skipgram_window2_dim100:	3.20
lemmatized_model_cbow_window4_dim100:	2.20
lemmatized_model_skipgram_window4_dim100:	2.80
lemmatized_model_cbow_window2_dim300:	3.20
lemmatized_model_skipgram_window2_dim300:	3.80
lemmatized_model_cbow_window4_dim300:	2.20
lemmatized_model_skipgram_window4_dim300:	3.20
stemmed_model_cbow_window2_dim100:	1.80
stemmed_model_skipgram_window2_dim100:	2.20
stemmed_model_cbow_window4_dim100:	1.40
stemmed_model_skipgram_window4_dim100:	1.80
stemmed_model_cbow_window2_dim300:	2.20
stemmed_model_skipgram_window2_dim300:	2.80
stemmed_model_cbow_window4_dim300:	1.40
stemmed_model_skipgram_window4_dim300:	2.20

```
In [26]: # Anlamsal değerlendirme tablosu
anlamsal_tablo = pd.DataFrame({
    'Model': anlamsal_puanlar.keys(),
    'Benzer Tarifler': [w2v_sonuclar[model]['recipe_name'].tolist() if model in w2v_sonuclar else tfidf_lemmati:
    'Skorlar': anlamsal_puanlar.values(),
    'Ortalama': [f"{ortalama:.2f}" for ortalama in ortalama_puanlar.values()]
})
print("\nAnlamsal Değerlendirme Tablosu:")
print(anlamsal_tablo)
```


Anlamsal Değerlendirme Tablosu:

```
Model \
0      tfidf_lemmatized
1      tfidf_stemmed
2      lemmatized_model_cbow_window2_dim100
3      lemmatized_model_skipgram_window2_dim100
4      lemmatized_model_cbow_window4_dim100
5      lemmatized_model_skipgram_window4_dim100
6      lemmatized_model_cbow_window2_dim300
7      lemmatized_model_skipgram_window2_dim300
8      lemmatized_model_cbow_window4_dim300
9      lemmatized_model_skipgram_window4_dim300
10     stemmed_model_cbow_window2_dim100
11     stemmed_model_skipgram_window2_dim100
12     stemmed_model_cbow_window4_dim100
13     stemmed_model_skipgram_window4_dim100
14     stemmed_model_cbow_window2_dim300
15     stemmed_model_skipgram_window2_dim300
16     stemmed_model_cbow_window4_dim300
17     stemmed_model_skipgram_window4_dim300
```

```
Benzer Tarifler      Skorlar \
0 [Homemade Bacon, Crispy Pork Belly, Filippino ... [4, 4, 3, 3, 2]
1 [Homemade Bacon, Crispy Pork Belly, Filippino ... [3, 3, 2, 2, 1]
2 [Homemade Bacon, Crispy Pork Belly, Chef John'... [4, 3, 3, 2, 2]
3 [Homemade Bacon, Crispy Pork Belly, How to "Dr... [4, 4, 3, 3, 2]
4 [Homemade Bacon, Crispy Pork Belly, Chef John'... [3, 3, 2, 2, 1]
5 [Homemade Bacon, Crispy Pork Belly, How to "Dr... [4, 3, 3, 2, 2]
6 [Homemade Bacon, Crispy Pork Belly, Chef John'... [4, 4, 3, 3, 2]
7 [Homemade Bacon, Crispy Pork Belly, Hot Dog Sa... [5, 4, 4, 3, 3]
8 [Homemade Bacon, Crispy Pork Belly, Chef John'... [3, 3, 2, 2, 1]
9 [Homemade Bacon, Crispy Pork Belly, How to "Dr... [4, 4, 3, 3, 2]
10 [Homemade Bacon, Crispy Pork Belly, Cretons de... [3, 2, 2, 1, 1]
11 [Homemade Bacon, Crispy Pork Belly, Instant Po... [3, 3, 2, 2, 1]
12 [Homemade Bacon, Crispy Pork Belly, Chef John'... [2, 2, 1, 1, 1]
13 [Homemade Bacon, Crispy Pork Belly, Instant Po... [3, 2, 2, 1, 1]
14 [Homemade Bacon, Crispy Pork Belly, Chef John'... [3, 3, 2, 2, 1]
15 [Homemade Bacon, Crispy Pork Belly, Pastrami C... [4, 3, 3, 2, 2]
16 [Homemade Bacon, Crispy Pork Belly, Chef John'... [2, 2, 1, 1, 1]
17 [Homemade Bacon, Crispy Pork Belly, Instant Po... [3, 3, 2, 2, 1]
```

```
Ortalama
0      3.20
1      2.20
2      2.80
3      3.20
4      2.20
5      2.80
6      3.20
7      3.80
8      2.20
9      3.20
10     1.80
11     2.20
12     1.40
13     1.80
14     2.20
15     2.80
16     1.40
17     2.20
```

```
In [27]: # Jaccard benzerlik hesaplama
def jaccard_benzerligi(set1, set2):
    """
    İki küme arasında Jaccard benzerliğini hesaplar.
    """
    set1 = set(set1)
    set2 = set(set2)
    kesisim = len(set1.intersection(set2))
    birlesim = len(set1.union(set2))
    return kesisim / birlesim if birlesim > 0 else 0
```

```
In [28]: # Tüm modeller için Jaccard benzerlik matrisini oluştur
model_isimleri = ['tfidf_lemmatized', 'tfidf_stemmed'] + list(models.keys())
jaccard_matrisi = np.zeros((len(model_isimleri), len(model_isimleri)))
for i, j in combinations(range(len(model_isimleri)), 2):
    model1 = model_isimleri[i]
    model2 = model_isimleri[j]
    set1 = set(tfidf_lemmatized_sonuc['recipe_id'] if model1 == 'tfidf_lemmatized' else tfidf_stemmed_sonuc['recipe_id'])
    set2 = set(tfidf_lemmatized_sonuc['recipe_id'] if model2 == 'tfidf_lemmatized' else tfidf_stemmed_sonuc['recipe_id'])
    jaccard_skor = jaccard_benzerligi(set1, set2)
    jaccard_matrisi[i, j] = jaccard_skor
    jaccard_matrisi[j, i] = jaccard_skor
```

```
In [29]: # Köşegeni 1 yap
np.fill_diagonal(jaccard_matrisi, 1)
```

```
In [30]: # Jaccard matrisini DataFrame olarak kaydet
jaccard_df = pd.DataFrame(jaccard_matrisi, index=model_isimleri, columns=model_isimleri)
jaccard_df.to_csv('jaccard_benzerlik_matrisi.csv')
print("\nJaccard Benzerlik Matrisi:")
print(jaccard_df)
```

Jaccard Benzerlik Matrisi:

	tfidf_lemmatized	tfidf_stemmed	\
tfidf_lemmatized	1.00	1.00	
tfidf_stemmed	1.00	1.00	
lemmatized_model_cbow_window2_dim100	0.25	0.25	
lemmatized_model_skipgram_window2_dim100	0.25	0.25	
lemmatized_model_cbow_window4_dim100	0.25	0.25	
lemmatized_model_skipgram_window4_dim100	0.25	0.25	
lemmatized_model_cbow_window2_dim300	0.25	0.25	
lemmatized_model_skipgram_window2_dim300	0.25	0.25	
lemmatized_model_cbow_window4_dim300	0.25	0.25	
lemmatized_model_skipgram_window4_dim300	0.25	0.25	
stemmed_model_cbow_window2_dim100	0.25	0.25	
stemmed_model_skipgram_window2_dim100	0.25	0.25	
stemmed_model_cbow_window4_dim100	0.25	0.25	
stemmed_model_skipgram_window4_dim100	0.25	0.25	
stemmed_model_cbow_window2_dim300	0.25	0.25	
stemmed_model_skipgram_window2_dim300	0.25	0.25	
stemmed_model_cbow_window4_dim300	0.25	0.25	
stemmed_model_skipgram_window4_dim300	0.25	0.25	

	lemmatized_model_cbow_window2_dim100	\
tfidf_lemmatized	0.250000	
tfidf_stemmed	0.250000	
lemmatized_model_cbow_window2_dim100	1.000000	
lemmatized_model_skipgram_window2_dim100	0.428571	
lemmatized_model_cbow_window4_dim100	0.666667	
lemmatized_model_skipgram_window4_dim100	0.250000	
lemmatized_model_cbow_window2_dim300	0.666667	
lemmatized_model_skipgram_window2_dim300	0.428571	
lemmatized_model_cbow_window4_dim300	0.666667	
lemmatized_model_skipgram_window4_dim300	0.250000	
stemmed_model_cbow_window2_dim100	0.666667	
stemmed_model_skipgram_window2_dim100	0.250000	
stemmed_model_cbow_window4_dim100	0.428571	
stemmed_model_skipgram_window4_dim100	0.250000	
stemmed_model_cbow_window2_dim300	0.666667	
stemmed_model_skipgram_window2_dim300	0.250000	
stemmed_model_cbow_window4_dim300	0.428571	
stemmed_model_skipgram_window4_dim300	0.250000	

	lemmatized_model_skipgram_window2_dim100	\
tfidf_lemmatized	0.250000	
tfidf_stemmed	0.250000	
lemmatized_model_cbow_window2_dim100	0.428571	
lemmatized_model_skipgram_window2_dim100	1.000000	
lemmatized_model_cbow_window4_dim100	0.666667	
lemmatized_model_skipgram_window4_dim100	0.666667	
lemmatized_model_cbow_window2_dim300	0.428571	
lemmatized_model_skipgram_window2_dim300	1.000000	
lemmatized_model_cbow_window4_dim300	0.428571	
lemmatized_model_skipgram_window4_dim300	0.666667	
stemmed_model_cbow_window2_dim100	0.250000	
stemmed_model_skipgram_window2_dim100	0.428571	
stemmed_model_cbow_window4_dim100	0.250000	
stemmed_model_skipgram_window4_dim100	0.428571	
stemmed_model_cbow_window2_dim300	0.250000	
stemmed_model_skipgram_window2_dim300	0.428571	
stemmed_model_cbow_window4_dim300	0.250000	
stemmed_model_skipgram_window4_dim300	0.428571	

	lemmatized_model_cbow_window4_dim100	\
tfidf_lemmatized	0.250000	
tfidf_stemmed	0.250000	
lemmatized_model_cbow_window2_dim100	0.666667	
lemmatized_model_skipgram_window2_dim100	0.666667	
lemmatized_model_cbow_window4_dim100	1.000000	
lemmatized_model_skipgram_window4_dim100	0.428571	
lemmatized_model_cbow_window2_dim300	0.666667	
lemmatized_model_skipgram_window2_dim300	0.666667	
lemmatized_model_cbow_window4_dim300	0.666667	
lemmatized_model_skipgram_window4_dim300	0.428571	
stemmed_model_cbow_window2_dim100	0.428571	
stemmed_model_skipgram_window2_dim100	0.250000	

[illegible]

stemmed_model_skipgram_window2_dim300	0.428571
stemmed_model_cbow_window4_dim300	0.428571
stemmed_model_skipgram_window4_dim300	0.250000
tfidf_lemmatized	lemmatized_model_skipgram_window4_dim300 \
tfidf_stemmed	0.250000
lemmatized_model_cbow_window2_dim100	0.250000
lemmatized_model_skipgram_window2_dim100	0.666667
lemmatized_model_cbow_window4_dim100	0.428571
lemmatized_model_skipgram_window4_dim100	1.000000
lemmatized_model_cbow_window2_dim300	0.428571
lemmatized_model_skipgram_window2_dim300	0.666667
lemmatized_model_cbow_window4_dim300	0.428571
lemmatized_model_skipgram_window4_dim300	1.000000
stemmed_model_cbow_window2_dim100	0.250000
stemmed_model_skipgram_window2_dim100	0.428571
stemmed_model_cbow_window4_dim100	0.250000
stemmed_model_skipgram_window4_dim100	0.428571
stemmed_model_cbow_window2_dim300	0.250000
stemmed_model_skipgram_window2_dim300	0.428571
stemmed_model_cbow_window4_dim300	0.250000
stemmed_model_skipgram_window4_dim300	0.428571
tfidf_lemmatized	stemmed_model_cbow_window2_dim100 \
tfidf_stemmed	0.250000
lemmatized_model_cbow_window2_dim100	0.666667
lemmatized_model_skipgram_window2_dim100	0.250000
lemmatized_model_cbow_window4_dim100	0.428571
lemmatized_model_skipgram_window4_dim100	0.250000
lemmatized_model_cbow_window2_dim300	0.666667
lemmatized_model_skipgram_window2_dim300	0.250000
lemmatized_model_cbow_window4_dim300	0.666667
lemmatized_model_skipgram_window4_dim300	0.250000
stemmed_model_cbow_window2_dim100	1.000000
stemmed_model_skipgram_window2_dim100	0.428571
stemmed_model_cbow_window4_dim100	0.666667
stemmed_model_skipgram_window4_dim100	0.250000
stemmed_model_cbow_window2_dim300	0.666667
stemmed_model_skipgram_window2_dim300	0.428571
stemmed_model_cbow_window4_dim300	0.666667
stemmed_model_skipgram_window4_dim300	0.250000
tfidf_lemmatized	stemmed_model_skipgram_window2_dim100 \
tfidf_stemmed	0.250000
lemmatized_model_cbow_window2_dim100	0.250000
lemmatized_model_skipgram_window2_dim100	0.428571
lemmatized_model_cbow_window4_dim100	0.250000
lemmatized_model_skipgram_window4_dim100	0.428571
lemmatized_model_cbow_window2_dim300	0.250000
lemmatized_model_skipgram_window2_dim300	0.428571
lemmatized_model_cbow_window4_dim300	0.250000
lemmatized_model_skipgram_window4_dim300	0.428571
stemmed_model_cbow_window2_dim100	0.428571
stemmed_model_skipgram_window2_dim100	1.000000
stemmed_model_cbow_window4_dim100	0.428571
stemmed_model_skipgram_window4_dim100	0.666667
stemmed_model_cbow_window2_dim300	0.250000
stemmed_model_skipgram_window2_dim300	0.428571
stemmed_model_cbow_window4_dim300	0.428571
stemmed_model_skipgram_window4_dim300	0.666667
tfidf_lemmatized	stemmed_model_cbow_window4_dim100 \
tfidf_stemmed	0.250000
lemmatized_model_cbow_window2_dim100	0.428571
lemmatized_model_skipgram_window2_dim100	0.250000
lemmatized_model_cbow_window4_dim100	0.428571
lemmatized_model_skipgram_window4_dim100	0.250000
lemmatized_model_cbow_window2_dim300	0.428571
lemmatized_model_skipgram_window2_dim300	0.250000
lemmatized_model_cbow_window4_dim300	0.428571
lemmatized_model_skipgram_window4_dim300	0.250000
stemmed_model_cbow_window2_dim100	0.666667
stemmed_model_skipgram_window2_dim100	0.428571
stemmed_model_cbow_window4_dim100	1.000000
stemmed_model_skipgram_window4_dim100	0.250000
stemmed_model_cbow_window2_dim300	0.428571
stemmed_model_skipgram_window2_dim300	0.428571
stemmed_model_cbow_window4_dim300	0.666667
stemmed_model_skipgram_window4_dim300	0.250000

tfidf_stemmed	0.250000
lemmatized_model_cbow_window2_dim100	0.250000
lemmatized_model_skipgram_window2_dim100	0.428571
lemmatized_model_cbow_window4_dim100	0.250000
lemmatized_model_skipgram_window4_dim100	0.428571
lemmatized_model_cbow_window2_dim300	0.250000
lemmatized_model_skipgram_window2_dim300	0.428571
lemmatized_model_cbow_window4_dim300	0.250000
lemmatized_model_skipgram_window4_dim300	0.428571
stemmed_model_cbow_window2_dim100	0.250000
stemmed_model_skipgram_window2_dim100	0.666667
stemmed_model_cbow_window4_dim100	0.250000
stemmed_model_skipgram_window4_dim100	1.000000
stemmed_model_cbow_window2_dim300	0.250000
stemmed_model_skipgram_window2_dim300	0.250000
stemmed_model_cbow_window4_dim300	0.250000
stemmed_model_skipgram_window4_dim300	1.000000

```
In [31]: # Değerlendirme ve yorum
print("\nDeğerlendirme Yorumları:")
print("""
- Hangi model(ler) daha yüksek ortalama aldı?
  - Skip-gram modelleri (özellikle lemmatized_model_skipgram_window2_dim300: {:.2f}) en yüksek anlamsal puanlar:
- En anlamlı sonuçları hangi model verdi?
  - Lemmatized skip-gram modelleri, kelimelerin tam formunu koruduğu için daha anlamlı sonuçlar üretti.
- TF-IDF ile Word2Vec modelleri arasında fark var mı?
  - TF-IDF modelleri yüzeysel kelime eşleşmelerine odaklanırken, Word2Vec modelleri bağlamsal ilişkileri daha i
- Model yapılandırmalarının etkisi gözlenebiliyor mu?
  - Vector_size=300 modelleri daha fazla bilgi sakladı, ancak CBOW modelleri daha az anlamlı sonuçlar üretti. W
- Jaccard Benzerliği Yorumu:
  - Jaccard matrisine bakıldığında, lemmatized ve stemmed modeller arasında düşük örtüşme gözlemlendi (örneğin, tf
  - Skip-gram modelleri birbirine daha yakın sonuçlar üretti, özellikle aynı veri seti (lemmatized veya stemmed
""").format(ortalama_puanlar['lemmatized_model_skipgram_window2_dim300'], jaccard_df.loc['tfidf_lemmatized', 'tfidf_stemmed'])
```

Cell In[31], line 16

SyntaxError: invalid syntax

In []:

Loading [MathJax]/extensions/Safe.js