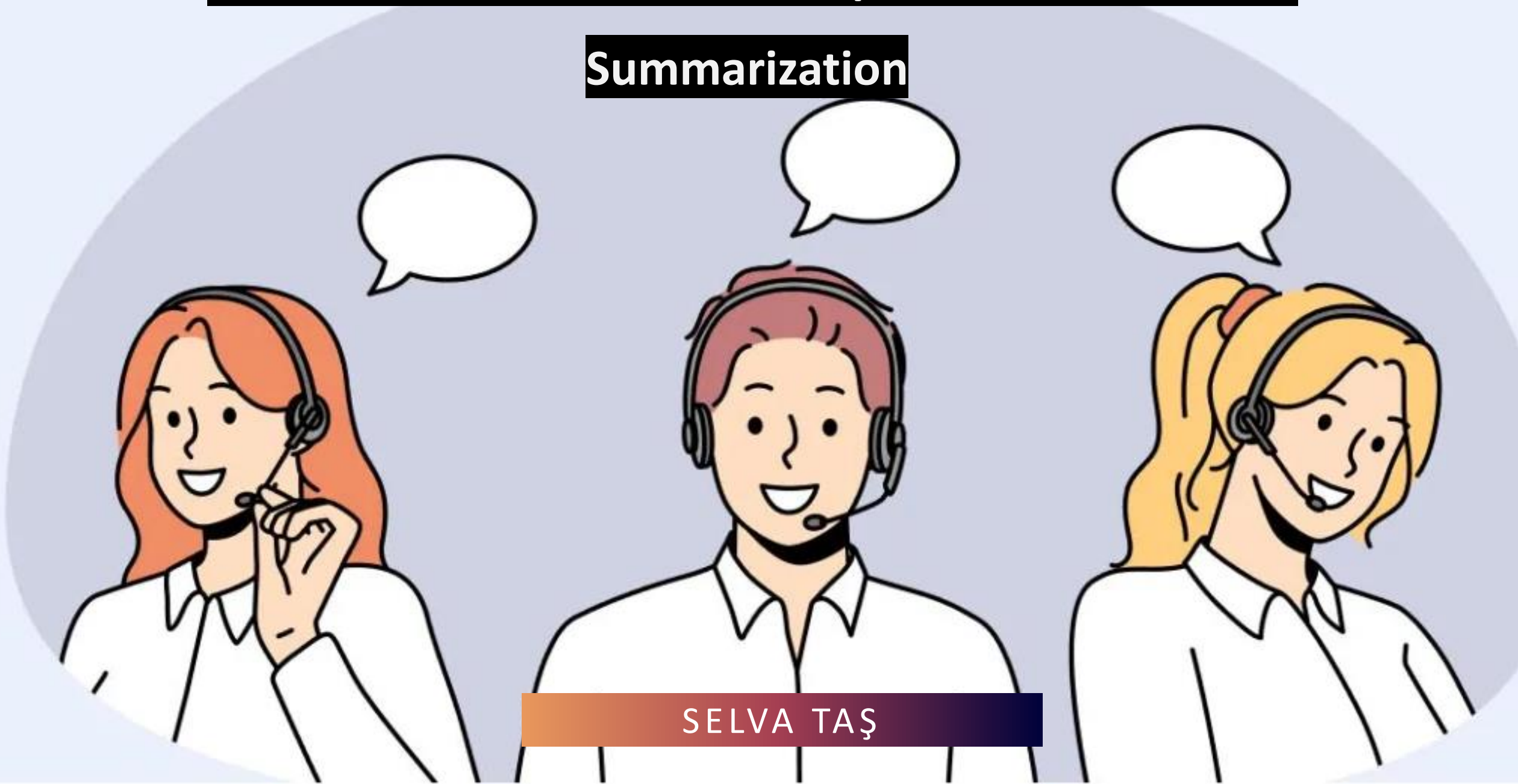
Classification of Financial Complaints & LLM-Based Summarization



SELVA TAŞ

Zero - shot classification için uygun, çok dilli bir veri kümesi üzerinde eğitilmiş bir NLI modeli kullandım. (https://nlpprogress.com/english/natural_language_inference.html)

Natural language inference

Natural language inference is the task of determining whether a “hypothesis” is true (entailment), false (contradiction), or undetermined (neutral) given a “premise”.

Example:

Premise	Label	Hypothesis
A man inspects the uniform of a figure in some East Asian country.	contradiction	The man is sleeping.
An older and younger man smiling.	neutral	Two men are smiling and laughing at the cats playing on the floor.
A soccer game with multiple males playing.	entailment	Some men are playing a sport.

NLI modelleri, bir öncül (premise) ve bir hipotez (hypothesis) kullanılarak eğitildiği için, bir metin dizisini öncül olarak kullanırız ve olası etiketlerin bir setini hipotezler olarak belirleriz.

```
sequence = "A walk during your lunch break is an excellent way to keep you a vital employee."
candidate_labels = ["politics", "family", "health", "work"]
hypothesis_template = "This statement is about {}"

output = first_time_right(sequence, candidate_labels, hypothesis_template=hypothesis_template, multi_label=False)
```

```
def format_pred(input):
  print(f"Premise \t{input['sequence']}")
  print(f"Hypothesis \t{hypothesis_template[:-3]}:")
  for label, score in zip(input['labels'], input['scores']):
   print((f" - {label}:\t {score:.2f}").expandtabs(40))

format_pred(output)
```

```
Premise         A walk during your lunch break is an excellent way to keep you a vital employee.
Hypothesis      This statement is about:
 - health:                              0.65
 - work:                                0.34
 - family:                              0.00
 - politics:                            0.00
```

Kendi verimize uygulayalım:

```
sequence = df.iloc[2,2]
candidate_labels = ['closing the account', 'online login to account', 'a deposit or withdrawal', 'an unauthorized transacti
hypothesis_template = "This is a customer complaint about {}"

output = first_time_right(sequence, candidate_labels, hypothesis_template=hypothesis_template, multi_label=True)
format_pred(output)
```

```
Premise         Dear Sir/Madam, On , BOA froze my checking account ending in. I reached out to the BOA and found out that it
was a business decision they took to freeze my account but they wouldn't close the account and release my money till the issu
e with my other checking account ending in is closed. Basically keeping my money in the account.Regarding, we suspected fraud
activity on this account onand the account has been in the credit only state since then i.e. . The balance in that account wa
s before it went into credit only state. Now the balance is cents due to all the BOA holding fees. But BOA is not able to clo
se this account due to fraud transactions always in the pending/processing status. I have spoken to Fraud dept multiple times
in last months, they just not able to block these fraud ACH transactions but told me not to worry about it as the account is
in credit only state, the transactions wouldnt post but they wouldnt be able to close this account with transactions pending.
I have been calling literally everyday since . Oni was told there was no pending transaction on account yet the risk and clos
ure dept wouldn't close the account due to pending review. Risk and closure dept keep giving me tentative closure dates and t
hen push the dates out. When I ask, I just get told they can do that its per the contract I signed before opening the accoun
t.At this point, I'm out of sorts and frustrated. Your immediate attention regarding this issue will be highly appreciated.Th
anks,
Hypothesis      This is a customer complaint about:
 - closing the account:                 1.00
 - an unauthorized transaction:         1.00
 - a deposit or withdrawal:             0.00
 - online login to account:             0.00
```

OBJECTIVE

'DeBERTa-v3-large' modeli, şikayet metinlerini önceden tanımlanmış kategorilere ("hesap kapatma", "giriş sorunu" gibi) sıfırdan sınıflandırma yaparak ayırır.

'facebook/bart-large' ve 't5-based' modelleri şikayet metinlerinden ana noktaları koruyan anlamlı özetler oluşturur.

Ayrıca, 'SentenceTransformer' modeli ile şikayet metinleri ve kategoriler arasındaki semantik benzerlik hesaplanarak metnin hangi kategoriye daha yakın olduğu değerlendirilir. Bu yöntemler, müşteri şikayetlerini hızlı ve etkili bir şekilde analiz etmeyi sağlar.

About Data

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9903 entries, 0 to 9902
Data columns (total 2 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   issue_label  9903 non-null   object
 1   complaint    9903 non-null   object
dtypes: object(2)
memory usage: 154.9+ KB
```

	issue_label	complaint
0	Closing an account	I just today received a notification from PNC ...
1	Transaction was not authorized	On XX/XX/XXXX, a series of fraudulent charges ...
2	Closing an account	Dear Sir/Madam, On XX/XX/XXXX, BOA froze my ch...
3	Transaction was not authorized	In the month of XXXX I became a victim of frau...
4	Closing an account	XX/XX/21 us bank XXXX XXXX XXXX branch manager...

Text Pre-processing

```
def clean_text(input):
        input = re.sub(".*?|\{.*?\}", ' ', input) # remove content between {}
        input = re.sub('XXXX', ' ', input) # remove masked names  and years
        input = re.sub('XX/XX/', ' ', input) # remove masked date parts
        input = re.sub('<.*?>', ' ', input) #remove HTML code
        input = re.sub('\n+', ' ', input)  # remove newline chars
        input = re.sub('[0-9]+', ' ', input) # remove numbers
        input = re.sub(" EUR", ' ', input) # remove EUR remainders
        input = re.sub('  ', '', input) # double spaces
        return(input)
```

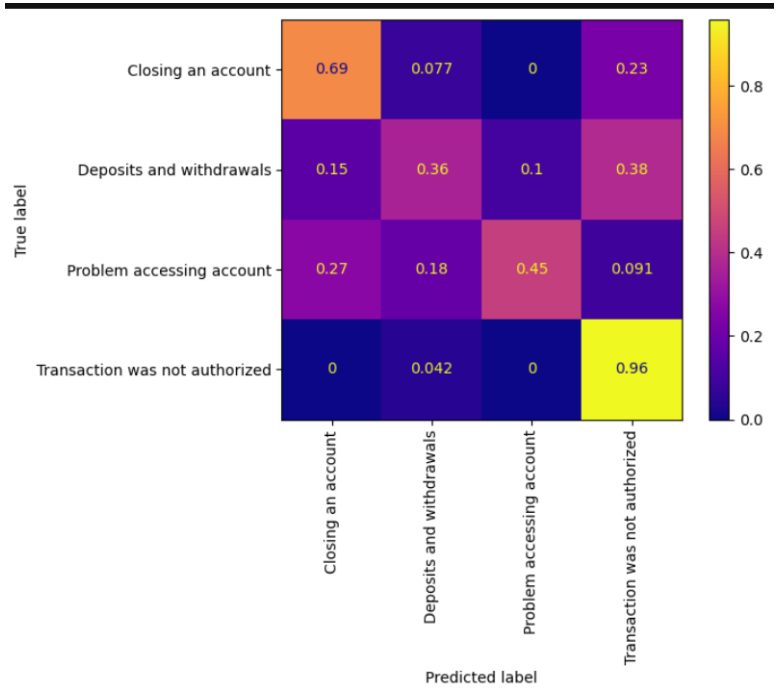
	issue_label	complaint	complaint_cleaned
0	Closing an account	I just today received a notification from PNC ...	I just today received a notification from PNC ...
1	Transaction was not authorized	On XX/XX/XXXX, a series of fraudulent charges ...	On , a series of fraudulent charges hit my Cap...
2	Closing an account	Dear Sir/Madam, On XX/XX/XXXX, BOA froze my ch...	Dear Sir/Madam, On , BOA froze my checking acc...
3	Transaction was not authorized	In the month of XXXX I became a victim of frau...	In the month of I became a victim of fraudulen...
4	Closing an account	XX/XX/21 us bank XXXX XXXX XXXX branch manager...	us bank branch manager of night I had stopped...

Classification

	issue_label	complaint_cleaned	label_1	score_1	label_2	score_2	label_3	score_3	pred_label
0	Closing an account	Citibank has restricted my account since of th...	closing the account	0.999634	online login to account	0.286590	an unauthorized transaction	0.080693	Closing an account
1	Deposits and withdrawals	Over the past-months. I have had several finan...	an unauthorized transaction	0.062227	a deposit or withdrawal	0.025004	online login to account	0.000281	Transaction was not authorized
2	Transaction was not authorized	I had charges on the same morning from a websi...	an unauthorized transaction	0.999778	online login to account	0.001173	a deposit or withdrawal	0.000532	Transaction was not authorized
3	Deposits and withdrawals	I disputed charges by for the canceled flight,...	an unauthorized transaction	0.997911	online login to account	0.048396	a deposit or withdrawal	0.004689	Transaction was not authorized
4	Closing an account	This complaint relates to complaint already fi...	closing the account	0.997006	an unauthorized transaction	0.996423	a deposit or withdrawal	0.000117	Closing an account

```
clf['weighted avg']
```

```
{'precision': 0.6444795321637428,
 'recall': 0.6,
 'f1-score': 0.5798796356538712,
 'support': 100.0}
```



LLM-Based Summarization

```python
from transformers import pipeline
from sentence_transformers import SentenceTransformer
from sklearn.metrics.pairwise import cosine_similarity

classifier = pipeline("zero-shot-classification", model="MoritzLaurer/DeBERTa-v3-large-mnli-fever-anli-ling-wanli")
llm = pipeline("text2text-generation", model="t5-base")
semantic_model = SentenceTransformer('all-MiniLM-L6-v2')

text = input("Lütfen şikayet metnini girin: ")

candidate_labels = [
    'closing the account',
    'online login to account',
    'a deposit or withdrawal',
    'an unauthorized transaction'
]

classification = classifier(text, candidate_labels=candidate_labels, multi_label=False)
predicted_label = classification["labels"][0]

input_text = (f"Summarize the following complaint text meaningfully with more context and details: '{text}'")

expanded_text = llm(
    input_text,
    max_length=250,
    repetition_penalty=2.0,
    num_return_sequences=1,
    truncation=True
)[0]["generated_text"]
```

```
Lütfen şikayet metnini girin: I am a former Wells Fargo customer. I closed my accounts with them several years ago. I still r
eceive bill pay reminder notices and updates to online banking account terms and conditions. I have called and they assure me
it is taken care of. Then I receive another notice.I would like the emails to stop. If Wells thinks I am still a customer, so
mewhere in their systems my profile is still active. This presents an opportunity for fraud!
```

```python
print("\nTahmin Edilen Şikayet Kategorisi:")
print(predicted_label)

print("\nÖzetlenmiş Metin:")
print(expanded_text)
```

```
Tahmin Edilen Şikayet Kategorisi:
closing the account

Özetlenmiş Metin:
'I am still receiving bill pay reminder notices and updates to online banking account terms and conditions. I have called and
they assure me it is taken care of. Then again, the emails are sent to my inbox. If Well Fargo think that you are still a cus
tomer, somewhere within their systems your profile has been active. This presents an opportunity for fraud!'
```

```python
original_text = text
summary_text = expanded_text

from sentence_transformers import SentenceTransformer
model = SentenceTransformer('paraphrase-MiniLM-L6-v2')

original_vec = model.encode([original_text])
summary_vec = model.encode([summary_text])

similarity_score = cosine_similarity(original_vec, summary_vec)[0][0]
print(f"Semantik Benzerlik Skoru: {similarity_score}")
```

```
Semantik Benzerlik Skoru: 0.800458550453186
```

TEŞEKKÜRLER

SELVA TAŞ