BIL 366 Data Mining Final

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Proje Amacı

Bu projede grup üyeleri haftalık ölüm değerlerini kullanarak covid-19 yoğunluk verisindeki toplu ulaşım kullanım artış yüzdesini sınıflandırmayı amaçlamaktadır. Projede karar verilen problem "predictive"dir. Projede 1 haftalık ölüm verilerini kullanarak haftadaki toplu ulaşım kullanım artış yüzdesi sınıflandırılmıştır.

Problem Çözümü

Problem çözümü aşamasında veri setleri incelendikten sonra KNN kullanılmasına karar verilmiştir. KNN ile kullanılmak üzere 5 sınıf kullanılmasına karar verilmiştir. Bu 5 sınıf değeri Ulaşım Kullanım yüzdesi değerlerinin ortalama aralığına göre ayarlanmıştır.

In [319…
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import plotly
import warnings
warnings.filterwarnings('ignore')
```

Proje kapsamında 3 farklı veri seti kullanılmıştır. Bu veri setleri 2021 yılı Fransa Covid-19 Mobility veri seti, 2021 yılı Almanya Covid-19 Mobility veri seti ve tüm ülkelerin 2020-2022 yılları arasındaki vaka sayısı, ölüm sayısı vb. değerleri içeren owid-covid veri setinden oluşur.

In [320…
```
df2021DE = pd.read_csv("2021_DE_Region_Mobility_Report.csv")
owidData = pd.read_csv("owid-covid-data.csv")
df2021FR = pd.read_csv("2021_FR_Region_Mobility_Report.csv")
```

In [321…
```
owidData.columns[:10]
```

Out[321…
```
Index(['iso_code', 'continent', 'location', 'date', 'total_cases', 'new_cases',
       'new_cases_smoothed', 'total_deaths', 'new_deaths',
       'new_deaths_smoothed'],
      dtype='object')
```

1.Veri Setlerinin Düzenlenmesi

1.1 Fransa Covid Verileri

In [322…
```
owidDataFR = owidData[owidData['iso_code'] == 'FRA']
owidDataFR = owidDataFR.loc[:,: 'new_deaths_smoothed']
owidDataFR['date'] =  pd.to_datetime(owidDataFR['date'])
owidDataFR = owidDataFR.set_index(owidDataFR['date'])
owidDataFR = owidDataFR.drop('date', axis=1)
```

In [323…
```
owidDataFR = owidDataFR[(owidDataFR.index >= '2021-01-4') & (owidDataFR.index < '2021-12-27')]
```

Bu veriler for döngüsü yardımıyla haftalık olarak düzenlenir. 4 Ocak - 27 Aralık tarihleri arasında toplam 51 hafta olduğu için yeni oluşacak DataFrame 51 adet satıra sahiptir. Yeni oluşturalan DataFrame'de önceki haftaya göre artış oranları da "roi" sütunları şeklinde eklenmiştir.

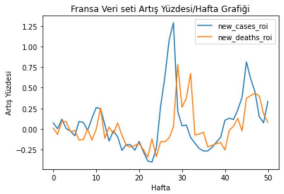
In [324…
```
caseList = []
deathList = []
smoothCaseList = []
smoothDeathList = []
rateOfIncreaseCase = [0]
rateOfIncreaseDeath = [0]
rateOfIncreaseCaseSmooth = [0]
rateOfIncreaseDeathSmooth = [0]
for i in range(0,51):
    caseList.append(owidDataFR['new_cases'].iloc[i* 7:i* 7 + 7].sum())
    deathList.append(owidDataFR['new_deaths'].iloc[i* 7:i* 7 + 7].sum())
    smoothCaseList.append(owidDataFR['new_cases_smoothed'].iloc[i* 7:i* 7 + 7].sum())
    smoothDeathList.append(owidDataFR['new_deaths_smoothed'].iloc[i* 7:i* 7 + 7].sum())
    if i >0:
        rateOfIncreaseCase.append((caseList[i] - caseList[i-1]) / caseList[i-1] )
        rateOfIncreaseDeath.append((deathList[i] - deathList[i-1]) / deathList[i-1] )
        rateOfIncreaseCaseSmooth.append((smoothCaseList[i] - smoothCaseList[i-1]) / smoothCaseList[i-1] )
        rateOfIncreaseDeathSmooth.append((smoothDeathList[i] - smoothDeathList[i-1]) / smoothDeathList[i-1] )


weeklyDataFR = pd.DataFrame(data = np.array([caseList, rateOfIncreaseCase, smoothCaseList, rateOfIncreaseCaseSmooth, deathList, rateOfIncreaseDeath, smoothDeathList, rateOfIncreaseDeathSmooth]).T, columns= ['new_cases', 'new_cases_roi', 'new_cases_smoothed', 'new_cases_smoothed_roi' , 'new_deaths', 'new_deaths_roi', 'new_deaths_smoothed', 'new_deaths_smoothed_roi'])

for i in range(0,4):
    weeklyDataFR.iloc[0,2*i + 1] = weeklyDataFR.iloc[1:,2*i + 1].mean()
```

In [325…
```
weeklyDataFR.head()
```

Out[325…

	new_cases	new_cases_roi	new_cases_smoothed	new_cases_smoothed_roi	new_deaths	new_deaths_roi	new_deaths_smoothed	new_deaths_smoothed_roi
0	127536.0	0.073385	110657.858	0.073406	2713.0	0.008167	2422.999	0.007133
1	127810.0	0.002148	126222.143	0.140652	2533.0	-0.066347	2528.000	0.043335
2	142925.0	0.118261	136281.999	0.079700	2766.0	0.091986	2667.286	0.055097
3	143598.0	0.004709	142635.143	0.046618	3008.0	0.087491	2877.857	0.078946
4	139934.0	-0.025516	139456.857	-0.022283	2908.0	-0.033245	2986.573	0.037777

In [326…
```
weeklyDataFR.new_cases_roi.plot(label = 'new_cases_roi')
weeklyDataFR.new_deaths_roi.plot(label = 'new_deaths_roi')
plt.title('Fransa Veri setl Artış Yüzdesi/Hafta Grafiğl')
plt.xlabel('Hafta')
plt.ylabel('Artış Yüzdesi')
plt.legend()
plt.show()
```



1.2 Almanya Covid Verileri

In [327…
```
owidDataDE = owidData[owidData['iso_code'] == 'DEU']
owidDataDE = owidDataDE.loc[:,: 'new_deaths_smoothed']
owidDataDE['date'] =  pd.to_datetime(owidDataDE['date'])
owidDataDE = owidDataDE.set_index(owidDataDE['date'])
owidDataDE = owidDataDE.drop('date', axis=1)
```

In [328…
```
owidDataDE = owidDataDE[(owidDataDE.index >= '2021-01-4') & (owidDataDE.index < '2021-12-27')]
```

Bu veriler for döngüsü yardımıyla haftalık olarak düzenlenii 4 Ocak - 27 Aralık tarihleri arasında toplam 51 hafta olduğu için yeni oluşacak DataFrame 51 adet satıra sahiptir. Yeni oluşturalan DataFrame'de önceki haftaya göre artış oranları da "roi" sütunları şeklinde eklenmiştir.

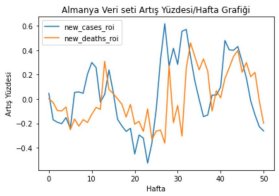
In [329…
```
caseList = []
deathList = []
smoothCaseList = []
smoothDeathList = []
rateOfIncreaseCase = [0]
rateOfIncreaseDeath = [0]
rateOfIncreaseCaseSmooth = [0]
rateOfIncreaseDeathSmooth = [0]
for i in range(0,51):
    caseList.append(owidDataDE['new_cases'].iloc[i* 7:i* 7 + 7].sum())
    deathList.append(owidDataDE['new_deaths'].iloc[i* 7:i* 7 + 7].sum())
    smoothCaseList.append(owidDataDE['new_cases_smoothed'].iloc[i* 7:i* 7 + 7].sum())
    smoothDeathList.append(owidDataDE['new_deaths_smoothed'].iloc[i* 7:i* 7 + 7].sum())
    if i >0:
        rateOfIncreaseCase.append((caseList[i] - caseList[i-1]) / caseList[i-1] )
        rateOfIncreaseDeath.append((deathList[i] - deathList[i-1]) / deathList[i-1] )
        rateOfIncreaseCaseSmooth.append((smoothCaseList[i] - smoothCaseList[i-1]) / smoothCaseList[i-1] )
        rateOfIncreaseDeathSmooth.append((smoothDeathList[i] - smoothDeathList[i-1]) / smoothDeathList[i-1] )


weeklyDataDE = pd.DataFrame(data = np.array([caseList, rateOfIncreaseCase, smoothCaseList, rateOfIncreaseCaseSmooth, deathList, rateOfIncreaseDeath, smoothDeathList, rateOfIncreaseDeathSmooth]).T, columns= ['new_cases', 'new_cases_roi', 'new_cases_smoothed', 'new_cases_smoothed_roi' , 'new_deaths', 'new_deaths_roi', 'new_deaths_smoothed', 'new_deaths_smoothed_roi'])

for i in range(0,4):
    weeklyDataDE.iloc[0,2*i + 1] = weeklyDataDE.iloc[1:,2*i + 1].mean()
```

In [330…
```
weeklyDataDE.head()
```

Out[330…

	new_cases	new_cases_roi	new_cases_smoothed	new_cases_smoothed_roi	new_deaths	new_deaths_roi	new_deaths_smoothed	new_deaths_smoothed_roi
0	145514.0	0.045551	135302.429	0.048628	6145.0	0.001853	5282.999	0.005027
1	120719.0	-0.170396	132727.286	-0.019032	5965.0	-0.029292	6025.572	0.140559
2	97640.0	-0.191180	102865.714	-0.224984	5395.0	-0.095557	5709.570	-0.052443
3	77890.0	-0.202274	85667.429	-0.167192	4867.0	-0.097868	4950.430	-0.132959
4	66014.0	-0.152471	70361.142	-0.178671	4545.0	-0.066160	4908.999	-0.008369

In [331…
```
weeklyDataDE.new_cases_roi.plot(label = 'new_cases_roi')
weeklyDataDE.new_deaths_roi.plot(label = 'new_deaths_roi')
plt.title('Almanya Veri seti Artış Yüzdesi/Hafta Grafiği')
plt.xlabel('Hafta')
plt.ylabel('Artış Yüzdesi')
plt.legend()
plt.show()
```



1.3 Fransa İçin Region_Mobility_Report Verilerinin Düzenlenmesi

In [332…
```
df2021FR = df2021FR[pd.isnull(df2021FR['sub_region_1'])]
```

In [333…
```
df2021FR['date'] =  pd.to_datetime(df2021FR['date'])
df2021FR = df2021FR.set_index(df2021FR['date'])
```

In [334…
```
df2021FR = df2021FR.loc[:, 'retail_and_recreation_percent_change_from_baseline':]
```

In [335…
```
df2021FR = df2021FR[(df2021FR.index >= '2021-01-4') & (df2021FR.index < '2021-12-27')]
```

1.3.1 Günlük Verilerin Haftalık Verilere Çevrilmesi

In [336…
```
emptyArray = np.zeros([6, 51])

for j in range(0,6):
    x = []
    for i in range(0, 51):
        x.append(df2021FR.iloc[i * 7:i* 7 + 7,j].mean())
    x = np.array(x)
    emptyArray[j] = x

weeklydf2021FR = pd.DataFrame(data= emptyArray.T, columns= df2021FR.columns)
```

In [337…
```
weeklydf2021FR = pd.concat([weeklyDataFR, weeklydf2021FR], axis=1)
```

In [338…
```
weeklydf2021FR.head()
```

Out[338…

	new_cases	new_cases_roi	new_cases_smoothed	new_cases_smoothed_roi	new_deaths	new_deaths_roi	new_deaths_smoothed	new_deaths_smoothed_roi	retail_and_recreation_percent_change_from_baseline	grocery_and_pharmacy_percent_change_from_baseline	parks_percent_change_from_baseline	transit_stations_percent_change_from_baseline	workplaces_percent_change_from_baseline	residential_percent_change_from_baseline
0	127536.0	0.073385	110657.858	0.073406	2713.0	0.008167	2422.999	0.007133	-39.000000	-2.714286	-21.714286	-34.285714	-22.857143	10.142857
1	127810.0	0.002148	126222.143	0.140652	2533.0	-0.066347	2528.000	0.043335	-43.428571	-10.285714	-24.000000	-36.285714	-24.571429	9.285714
2	142925.0	0.118261	136281.999	0.079700	2766.0	0.091986	2667.286	0.055097	-42.428571	-11.142857	-24.285714	-36.428571	-24.142857	9.142857
3	143598.0	0.004709	142635.143	0.046618	3008.0	0.087491	2877.857	0.078946	-40.714286	-8.714286	-20.000000	-34.000000	-23.714286	8.857143
4	139934.0	-0.025516	139456.857	-0.022283	2908.0	-0.033245	2986.573	0.037777	-43.857143	-9.000000	-16.714286	-34.714286	-23.857143	9.142857

1.4 Almanya İçin Region_Mobility_Report Verilerinin Düzenlenmesi

In [339…
```
df2021DE = df2021DE[pd.isnull(df2021DE['sub_region_1'])]
```

In [340…
```
df2021DE['date'] =  pd.to_datetime(df2021DE['date'])
```

```
df2021DE = df2021DE.set_index(df2021DE['date'])
```

In [341…
```
df2021DE = df2021DE.loc[:, 'retail_and_recreation_percent_change_from_baseline':]
```

In [342…
```
df2021DE = df2021DE[(df2021DE.index >= '2021-01-4') & (df2021DE.index < '2021-12-27')]
```

1.4.1 Günlük Verilerin Haftalık Verilere Çevrilmesi

In [343…
```
emptyArray = np.zeros([6, 51])

for j in range(0,6):
    x = []
    for i in range(0, 51):
        x.append(df2021DE.iloc[i * 7:i* 7 + 7,j].mean())
    x = np.array(x)
    emptyArray[j] = x

weeklydf2021DE = pd.DataFrame(data= emptyArray.T, columns= df2021DE.columns)
```

In [344…
```
weeklydf2021DE = pd.concat([weeklyDataDE, weeklydf2021DE], axis=1)
```

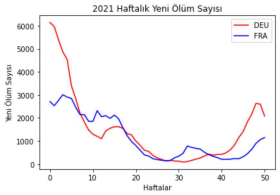
In [345…
```
weeklydf2021DE.head()
```

Out[345…

	new_cases	new_cases_roi	new_cases_smoothed	new_cases_smoothed_roi	new_deaths	new_deaths_roi	new_deaths_smoothed	new_deaths_smoothed_roi	retail_and_recreation_percent_change_from_baseline	grocery_and_phamacy_percent_change_from_baseline	parks_percent_change_from_baseline	transit_stations_percent_change_from_baseline	workplaces_percent_change_from_baseline	residential_percent_change_from_baseline
0	145514.0	0.045551	135302.429	0.048628	6145.0	0.001853	5282.999	0.005027	-60.142857	-15.428571	-7.000000	-50.142857	-35.714286	14.714286
1	120719.0	-0.170396	132727.286	-0.019032	5965.0	-0.029292	6025.572	0.140559	-60.142857	-15.285714	-11.714286	-48.285714	-28.285714	12.285714
2	97640.0	-0.191180	102865.714	-0.224984	5395.0	-0.095557	5709.570	-0.052443	-59.571429	-15.714286	-10.714286	-48.571429	-28.428571	12.142857
3	77890.0	-0.202274	85667.429	-0.167192	4867.0	-0.097868	4950.430	-0.132959	-58.142857	-13.285714	-5.000000	-46.571429	-27.857143	12.142857
4	66014.0	-0.152471	70361.142	-0.178671	4545.0	-0.066160	4908.999	-0.008369	-58.142857	-12.857143	-12.714286	-48.571429	-28.571429	12.000000

1.5 İstenilen Haftalık Verinin Görselleştirilmesi

In [346…
```
plt.plot(weeklydf2021DE.new_deaths, color ='red', label = 'DEU')
plt.plot(weeklydf2021FR.new_deaths, color ='blue',label = 'FRA')
plt.title('2021 Haftalık Yeni Ölüm Sayısı')
plt.xlabel('Haftalar')
plt.ylabel('Yeni Ölüm Sayısı')
plt.legend()
plt.show()
```

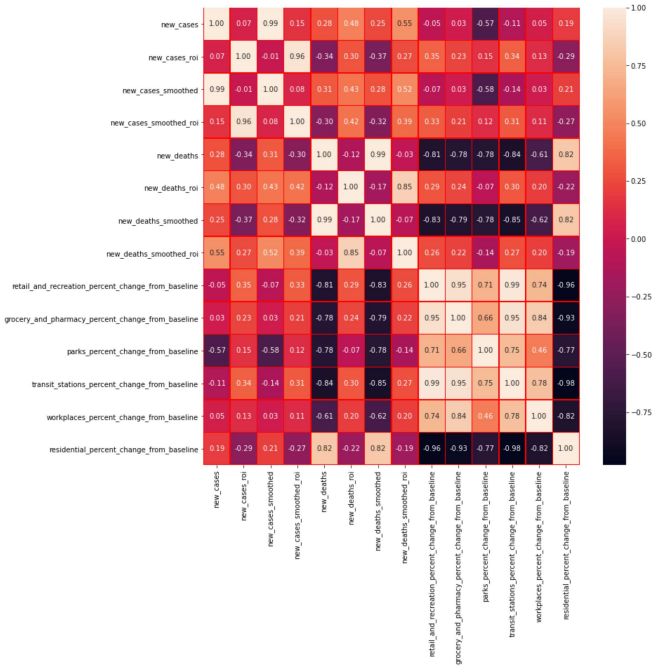


In [347…
```
plt.plot(weeklydf2021DE.transit_stations_percent_change_from_baseline, color = 'red', label = 'DEU')
plt.plot(weeklydf2021FR.transit_stations_percent_change_from_baseline, color = 'blue', label = 'FRA')
plt.title('2021 Haftalık Toplu Taşıma Kullanımı Yüzdesi')
plt.xlabel('Haftalar')
plt.ylabel('Toplu Taşıma Kullanımı Yüzdesi')
plt.legend()
plt.show()
```

2. Veriler Arasındaki İlişki

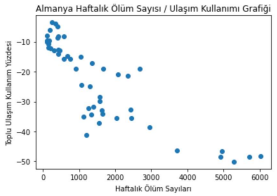
2.1 Almanya Verileri Arasındaki İlişki

In [348…
```
f,ax = plt.subplots(figsize=(12, 12))
sns.heatmap(weeklydf2021DE.corr(), annot=True, linewidths=0.5,linecolor="red", fmt= '.2f',ax=ax)
plt.show()
```



In [349…

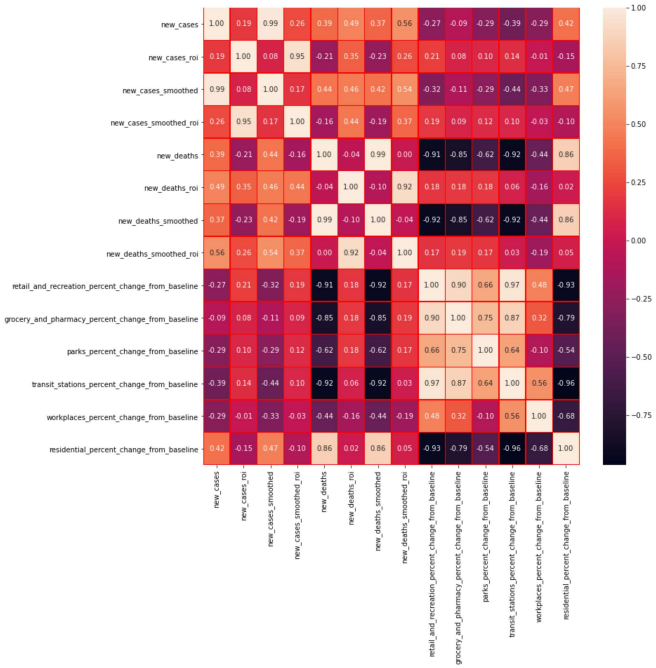
```
plt.scatter(weeklydf2021DE['new_deaths_smoothed'], weeklydf2021DE['transit_stations_percent_change_from_baseline'] )
plt.title('Almanya Haftalık Ölüm Sayısı / Ulaşım Kullanımı Grafiği')
plt.xlabel('Haftalık Ölüm Sayıları')
plt.ylabel('Toplu Ulaşım Kullanım Yüzdesi')
plt.show()
```



Fransa Verileri Arasındaki İlişki

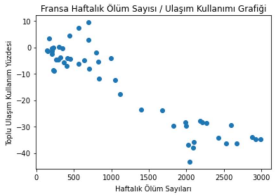
In [350…

```
f,ax = plt.subplots(figsize=(12, 12))
sns.heatmap(weeklydf2021FR.corr(), annot=True, linewidths=0.5,linecolor="red", fmt= '.2f',ax=ax)
plt.show()
```



In [351…

```
plt.scatter(weeklydf2021FR['new_deaths_smoothed'], weeklydf2021FR['transit_stations_percent_change_from_baseline'] )
plt.title('Fransa Haftalık Ölüm Sayısı / Ulaşım Kullanımı Grafiği')
plt.xlabel('Haftalık Ölüm Sayıları')
plt.ylabel('Toplu Ulaşım Kullanım Yüzdesi')
plt.show()
```



Toplu taşıma istasyonları ve yeni ölüm verileri arasında region_mobility_report verisindekilere göre en yüksek negatif korelasyon vardır. Bu yüzden yapılacak tahminlerde toplu taşıma istasyonları kullanılmasına karar verilmiştir.

Uygulanan Yöntem

Projede kullanılan sınıf sayısı ve veri sayısının az olması ve kolay kullanılabilir olmasından dolayı KNN algoritmasının uygulanmasına karar verildi. KNN algoritmasında kullanılan sınıf sayısı 5'tir. Bu sınıflar artış miktarına göre belirlenir. Artış miktarı 5 farklı değere göre ayarlanır. Bu sınıfların hangi aralıklarda oldukları aşağıda açıklanmıştır.

3. Veriyi KNN En Yakın Komşu Algoritmasına Hazırlama

3.1 Fransa Verilerini Hazırlama

In [352…

```
weeklydf2021FR['how_much_decreased'] = pd.Series(weeklydf2021FR.transit_stations_percent_change_from_baseline.values, index=weeklydf2021FR.index)
```

Veriler -12'den kucukse 1 sinif degeri

-12 ve -22 arasindaysa 2

-22 ve -32 arasindaysa 3

-32 ve -42 arasindayda 4

-42 den kucukse 5 degerini alirlar.

In [353…

```
i = 0
for each in weeklydf2021FR.how_much_decreased:
    if each > -12:
        weeklydf2021FR.how_much_decreased.values[i] = 1
    elif each <= -12 and each > -22:
        weeklydf2021FR.how_much_decreased.values[i] = 2
    elif each <= -22 and each > -32:
        weeklydf2021FR.how_much_decreased.values[i] = 3
    elif each <= -32 and each > -42:
        weeklydf2021FR.how_much_decreased.values[i] = 4
    elif each <= -42:
        weeklydf2021FR.how_much_decreased.values[i] = 5
    i += 1
```

In [354…

```
weeklydf2021FR.head()
```

Out[354…

	new_cases	new_cases_roi	new_cases_smoothed	new_cases_smoothed_roi	new_deaths	new_deaths_roi	new_deaths_smoothed	new_deaths_smoothed_roi	retail_and_recreation_percent_change_from_baseline	grocery_and_pharmacy_percent_change_from_baseline	parks_percent_change_from_baseline	transit_stations_percent_change_from_baseline	workplaces_percent_change_from_baseline	residential_percent_change_from_baseline	how_much_decreased
0	127536.0	0.073385	110657.858	0.073406	2713.0	0.008167	2422.999	0.007133	-39.000000	-2.714286	-21.714286	-34.285714	-22.857143	10.142857	4.0
1	127810.0	0.002148	126222.143	0.140652	2533.0	-0.066347	2528.000	0.043335	-43.428571	-10.285714	-24.000000	-36.285714	-24.571429	9.285714	4.0
2	142925.0	0.118261	136281.999	0.079700	2766.0	0.091986	2667.286	0.055097	-42.428571	-11.142857	-24.285714	-36.428571	-24.142857	9.142857	4.0
3	143598.0	0.004709	142635.143	0.046618	3008.0	0.087491	2877.857	0.078946	-40.714286	-8.714286	-20.000000	-34.000000	-23.714286	8.857143	4.0
4	139934.0	-0.025516	139456.857	-0.022283	2908.0	-0.033245	2986.573	0.037777	-43.857143	-9.000000	-16.714286	-34.714286	-23.857143	9.142857	4.0

3.2 Almanya Verilerini Hazırlama

In [355…

```
weeklydf2021DE['how_much_decreased'] = pd.Series(weeklydf2021DE.transit_stations_percent_change_from_baseline.values, index=weeklydf2021DE.index)
```

In [356…

```
i = 0
for each in weeklydf2021DE.how_much_decreased:
    if each > -12:
        weeklydf2021DE.how_much_decreased.values[i] = 1
    elif each <= -12 and each > -22:
        weeklydf2021DE.how_much_decreased.values[i] = 2
    elif each <= -22 and each > -32:
        weeklydf2021DE.how_much_decreased.values[i] = 3
    elif each <= -32 and each > -42:
        weeklydf2021DE.how_much_decreased.values[i] = 4
    elif each <= -42:
        weeklydf2021DE.how_much_decreased.values[i] = 5
    i += 1
```

In [357…

```
weeklydf2021DE.head()
```

Out[357…

	new_cases	new_cases_roi	new_cases_smoothed	new_cases_smoothed_roi	new_deaths	new_deaths_roi	new_deaths_smoothed	new_deaths_smoothed_roi	retail_and_recreation_percent_change_from_baseline	grocery_and_pharmacy_percent_change_from_baseline	parks_percent_change_from_baseline	transit_stations_percent_change_from_baseline	workplaces_percent_change_from_baseline	residential_percent_change_from_baseline	how_much_decreased
0	145514.0	0.045551	135302.429	0.048628	6145.0	0.001853	5282.999	0.005027	-60.142857	-15.428571	-7.000000	-50.142857	-35.714286	14.714286	5.0
1	120719.0	-0.170396	132727.286	-0.019032	5965.0	-0.029292	6025.572	0.140559	-60.142857	-15.285714	-11.714286	-48.285714	-28.285714	12.285714	5.0
2	97640.0	-0.191180	102865.714	-0.224984	5395.0	-0.095557	5709.570	-0.052443	-59.571429	-15.714286	-10.714286	-48.571429	-28.428571	12.142857	5.0
3	77890.0	-0.202274	85667.429	-0.167192	4867.0	-0.097868	4950.430	-0.132959	-58.142857	-13.285714	-5.000000	-46.571429	-27.857143	12.142857	5.0
4	66014.0	-0.152471	70361.142	-0.178671	4545.0	-0.066160	4908.999	-0.008369	-58.142857	-12.857143	-12.714286	-48.571429	-28.571429	12.000000	5.0

3.3 Almanya ve Fransa Verilerindeki Sınıf Dağılımlarını Görselleştirme

Aşağıdaki grafiklerde Almanya ve Fransa verilerindeki sınıf dağılımlarını görselleştirilmiştir.

In [358…

```
# prepare data frames
bes = weeklydf2021DE[weeklydf2021DE.how_much_decreased == 5]
dort = weeklydf2021DE[weeklydf2021DE.how_much_decreased == 4]
uc = weeklydf2021DE[weeklydf2021DE.how_much_decreased == 3]
iki = weeklydf2021DE[weeklydf2021DE.how_much_decreased == 2]
bir = weeklydf2021DE[weeklydf2021DE.how_much_decreased == 1]

# import graph objects as "go"
import plotly.graph_objs as go
# creating trace1
trace1 =go.Scatter(
                    x = bir.new_deaths_smoothed,
                    y = bir.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "Bir",
                    marker = dict(color = 'rgba(0, 255, 20, 0.8)'),
                    text= weeklydf2021DE.how_much_decreased)
# creating trace2
trace2 =go.Scatter(
                    x = iki.new_deaths_smoothed,
                    y = iki.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "İki",
                    marker = dict(color = 'rgba(0, 255, 200, 0.8)'),
                    text= weeklydf2021DE.how_much_decreased)
# creating trace3
trace3 =go.Scatter(
                    x = uc.new_deaths_smoothed,
                    y = uc.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "Üç",
                    marker = dict(color = 'rgba(255, 128, 2, 0.8)'),
                    text= weeklydf2021DE.how_much_decreased)
# creating trace4
trace4 =go.Scatter(
                    x = dort.new_deaths_smoothed,
                    y = dort.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "Dört",
                    marker = dict(color = 'rgba(255, 12, 2, 0.8)'),
                    text= weeklydf2021DE.how_much_decreased)
# creating trace5
trace5 =go.Scatter(
                    x = bes.new_deaths_smoothed,
                    y = bes.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "Bes",
                    marker = dict(color = 'rgba(255, 128, 255, 0.8)'),
                    text= weeklydf2021DE.how_much_decreased)

data = [trace1, trace2, trace3, trace4, trace5]
layout = dict(title = 'Almanya Haftalık Ölüm Sayısı / Ulaşım Kullanımı Sınıflandırma Grafiği',
              xaxis= dict(title= 'Haftalık Ölüm',ticklen= 5,zeroline= False),
             yaxis= dict(title= 'Toplu Ulaşım Kullanım Yüzdesi',ticklen= 5,zeroline= False),
             height=450, width=750
             )
fig = dict(data = data, layout = layout)
```

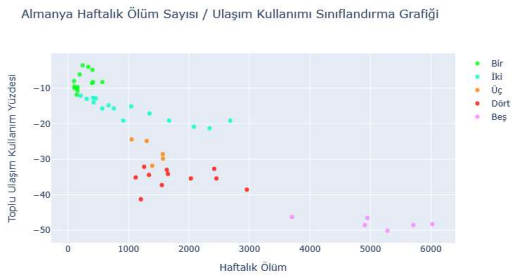
In [359…

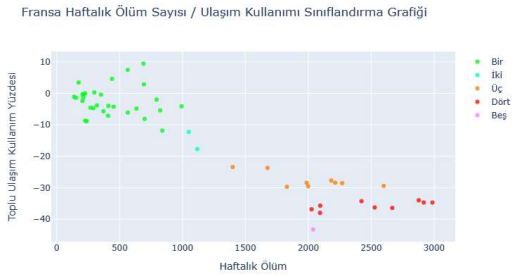
```
# prepare data frames
bes = weeklydf2021FR[weeklydf2021FR.how_much_decreased == 5]
dort = weeklydf2021FR[weeklydf2021FR.how_much_decreased == 4]
uc = weeklydf2021FR[weeklydf2021FR.how_much_decreased == 3]
iki = weeklydf2021FR[weeklydf2021FR.how_much_decreased == 2]
bir = weeklydf2021FR[weeklydf2021FR.how_much_decreased == 1]

# import graph objects as "go"
import plotly.graph_objs as go
# creating trace1
trace1 =go.Scatter(
                    x = bir.new_deaths_smoothed,
                    y = bir.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "Bir",
                    marker = dict(color = 'rgba(0, 255, 20, 0.8)'),
                    text= weeklydf2021FR.how_much_decreased)
# creating trace2
trace2 =go.Scatter(
```

```
                    x = iki.new_deaths_smoothed,
                    y = iki.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "İki",
                    marker = dict(color = 'rgba(0, 255, 200, 0.8)'),
                    text= weeklydf2021FR.how_much_decreased)
# creating trace3
trace3 =go.Scatter(
                    x = uc.new_deaths_smoothed,
                    y = uc.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "Üç",
                    marker = dict(color = 'rgba(255, 128, 2, 0.8)'),
                    text= weeklydf2021FR.how_much_decreased)
# creating trace4
trace4 =go.Scatter(
                    x = dort.new_deaths_smoothed,
                    y = dort.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "Dört",
                    marker = dict(color = 'rgba(255, 12, 2, 0.8)'),
                    text= weeklydf2021FR.how_much_decreased)
# creating trace5
trace5 =go.Scatter(
                    x = bes.new_deaths_smoothed,
                    y = bes.transit_stations_percent_change_from_baseline,
                    mode = "markers",
                    name = "Beş",
                    marker = dict(color = 'rgba(255, 128, 255, 0.8)'),
                    text= weeklydf2021FR.how_much_decreased)

data = [trace1, trace2, trace3, trace4, trace5]
layout = dict(title = 'Fransa Haftalık Ölüm Sayısı / Ulaşım Kullanımı Sınıflandırma Grafiği',
              xaxis= dict(title= 'Haftalık Ölüm',ticklen= 5,zeroline= False),
              yaxis= dict(title= 'Toplu Ulaşım Kullanım Yüzdesi',ticklen= 5,zeroline= False),
              height=450, width=750
             )
fig2 = dict(data = data, layout = layout)
```

In [360…

```
#Plotly html'de gözükmediği için ayrıca resimlerini ekledik.
#plotly.offline.iplot(fig)
#plotly.offline.iplot(fig2)
```

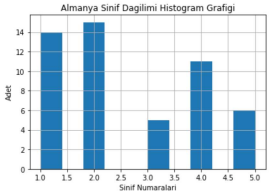




Aşağıdaki grafiklerde Almanya ve Fransa Mobility verilerindeki sınıf dağılımlarının histogram grafikleri gösterilmiştir.

In [361…

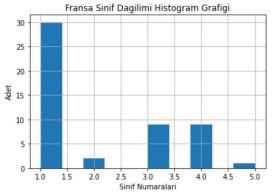
```
weeklydf2021DE['how_much_decreased'].hist()
plt.title('Almanya Sinif Dagilimi Histogram Grafigi')
plt.xlabel('Sinif Numaralari')
plt.ylabel('Adet')
plt.show()
```



In [362…

```
weeklydf2021FR['how_much_decreased'].hist()
```

```
plt.title('Fransa Sinif Dagilimi Histogram Grafigi')
plt.xlabel('Sinif Numaralari')
plt.ylabel('Adet')
plt.show()
```



4. KNN İşlemi

4.1 Eğitim ve Test Olarak Veriyi Ayırmak

In [363…
```
X = np.concatenate([weeklydf2021DE.iloc[:, [6]].values,weeklydf2021FR.iloc[:, [6]].values] )
y = np.concatenate([weeklydf2021DE.iloc[:, 14].values,weeklydf2021FR.iloc[:, 14].values ])
```

In [364…
```
from sklearn.model_selection import train_test_split

X_train,X_test,y_train, y_test = train_test_split(X, y, test_size= 0.33, random_state= 0)
```

4.2 Test Seti ile Tahmin Yapma

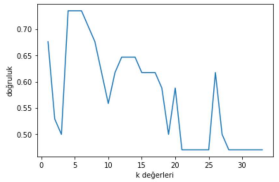
In [365…
```
from sklearn.neighbors import KNeighborsClassifier
knn = KNeighborsClassifier(n_neighbors=5)
knn.fit(X_train, y_train)
prediction = knn.predict(X_test)
```

In [366…
```
print(" {} nn score: {} ".format(5,knn.score(X_test,y_test)))
```

```
5 nn score: 0.7352941176470589
```

4.3 Optimum k Değeri Bulma

In [367…
```
score_list = []
for each in range(1,34):
    knn2 = KNeighborsClassifier(n_neighbors = each)
    knn2.fit(X_train,y_train)
    score_list.append(knn2.score(X_test,y_test))

#print(score_list)
plt.plot(range(1,34),score_list)
plt.xlabel("k değerleri")
plt.ylabel("doğruluk")
plt.show()
```



4.4 Confusion Matrix

In [368…
```
from sklearn.metrics import confusion_matrix, classification_report
cm = confusion_matrix(y_test, prediction)
print(cm)
```

```
[[13  0  0  0  0]
 [ 4  1  2  0  0]
 [ 0  0  1  2  0]
 [ 0  0  1  8  0]
 [ 0  0  0  0  2]]
```

In [369…
```
cr = classification_report(y_test, prediction)
print(cr)
```

```
              precision    recall  f1-score   support

         1.0       0.76      1.00      0.87        13
         2.0       1.00      0.14      0.25         7
         3.0       0.25      0.33      0.29         3
         4.0       0.80      0.89      0.84         9
         5.0       1.00      1.00      1.00         2

    accuracy                           0.74        34
   macro avg       0.76      0.67      0.65        34
weighted avg       0.79      0.74      0.69        34
```

Proje Sonucu

Ölüm sayısı verileri kullanılarak toplu ulaşım kullanımı artış yüzdesini sınıflandırma gerçekleştirilmiştir. Ölüm sayısı verileri ile toplu ulaşım kullanımı arasında bir ilişki bulunduğu ortaya çıkmıştır. Ölüm sayısı arttıkça o hafta toplu ulaşım kullanımı azalmıştır. Eğitilen KNN modeli %73.5 doğruluk değeriyle tahmin etmiştir.