data_wrangling_assignment

August 30, 2023

Python Data Wrangling Assignment

First, the necessary libraries are imported. Two methods to load data from a csv file as well as save data to a csv file are defined, including logging and error handling.

[1]:

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import logging

logging.basicConfig(filename='data_wrangling.log', level=logging.INFO,
                    format='%(asctime)s - %(levelname)s - %(message)s')

def load_data(file_name):
    try:
        data = pd.read_csv(file_name)
        logging.info(f"{file_name} has been loaded successfully.")
        if 'Date' in data.columns:
            data['Date'] = pd.to_datetime(data['Date'])
        return data
    except FileNotFoundError:
        logging.error("The file was not found.")
        return None

def save_data(data, file_name, headers = None):
    try:
        if isinstance(data, pd.DataFrame):
            data.to_csv(file_name, mode="w", index=False)
        elif isinstance(data, list):
            with open(file_name, "w") as f:
                if headers is not None:
                    f.write("%s\n" % headers)  # Write the headers
                for item in data:
                    f.write("%s\n" % item)
        logging.info(f"The data has been saved successfully to {file_name}.")
    except FileNotFoundError:
        logging.error("The file was not found.")
    except Exception:
        if not data:
            logging.warning("The variable is empty.")
```

The Dataframe is loaded and the first 10 rows are displayed, as well as the type of the columns. In the next step, all duplicates in the file are removed.

[2]:
```
data = load_data('visit_data.csv') #uses the load_data function to load the data

print(data.head(10)) #prints the first 10 rows of the data

print(data.dtypes) #shows the data types of each column

try:
  if not data.empty:
    data = data.drop_duplicates() #drops all the duplicates
    logging.info("Duplicates have been dropped successfully.")
  else:
    print("The dataframe is empty.")
    logging.warning("The dataframe is empty.")
except:
  print("No duplicates found.")
```

```
            Patient     Visit_Reason       Date  Visit_Duration
0       David Moore            Cough 2022-01-05              17
1       Ivy Johnson           Injury 2022-10-20              51
2     Hannah Miller         Headache 2022-08-24              25
3        Ivy Wilson          Allergy 2022-08-25              26
4  Charlie Williams  Routine Checkup 2022-10-27              25
5     Charlie Davis           Injury 2022-05-20              39
6        Ivy Miller         Headache 2022-02-20              16
7         Ivy Smith           Injury 2022-11-07              57
8        Jack Moore            Cough 2022-07-14              22
9         Bob Davis            Fever 2022-01-20              30
Patient                   object
Visit_Reason              object
Date              datetime64[ns]
Visit_Duration             int64
dtype: object
```

Next, a list is created containing all the reasons for a visit to the doctor, as well as the number of visits per reason. The list is printed to ascertain that it is correctly filled.

[3]:
```
visit_reason_list = data.Visit_Reason.value_counts()
print(visit_reason_list)
```

```
Headache           1723
Allergy            1679
Routine Checkup    1673
Injury             1664
```

```
Cough                1635
Fever                1610
Name: Visit_Reason, dtype: int64
```

This code iterates on the elements in the list and creates a string containing the name, number of visits, mean, maximum and minimum duration for each visit reason. This string is then appended to a list.

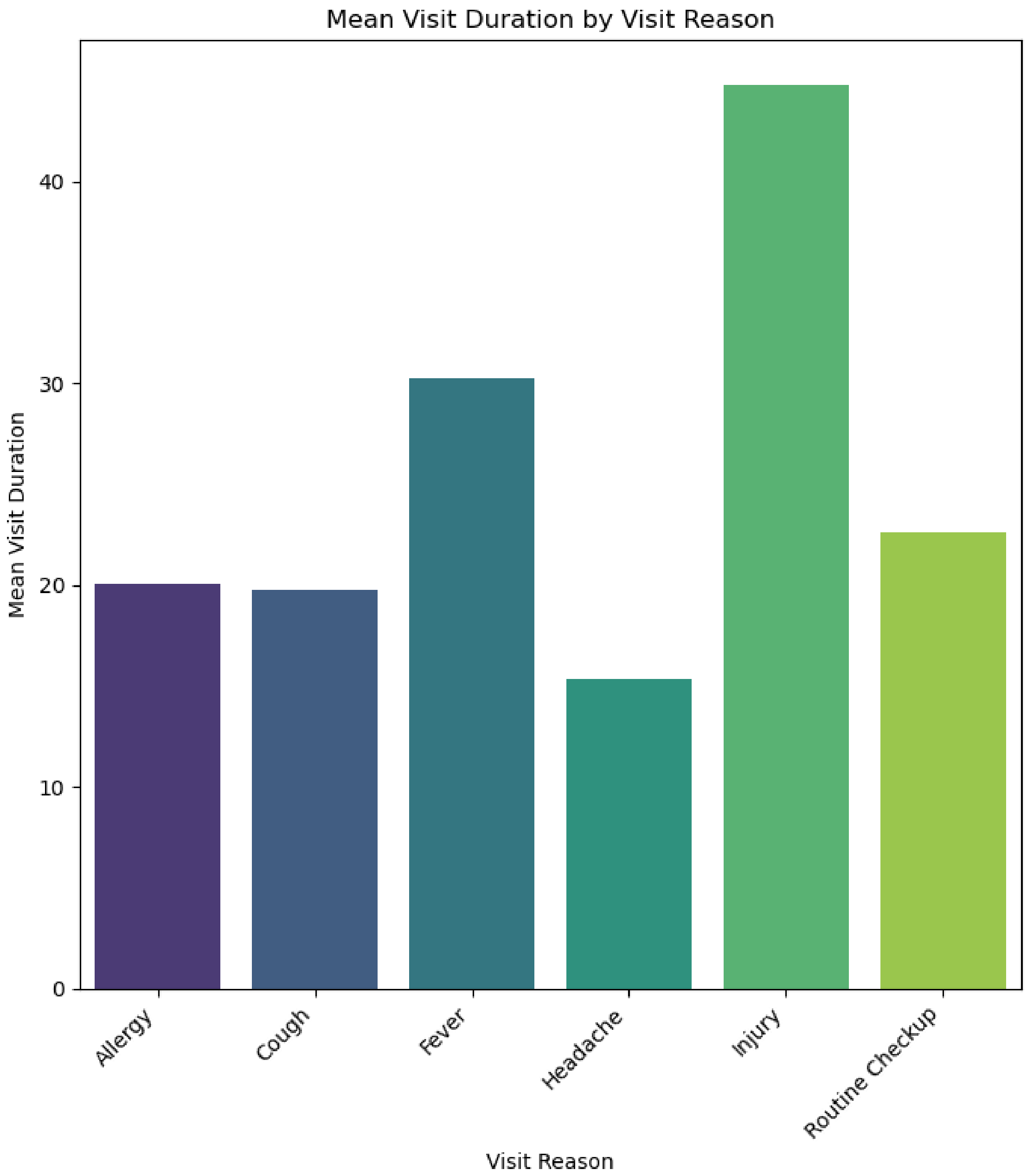
[4]:
```
calculated_list = []
for sickness, visits in visit_reason_list.items():
    mask = data.Visit_Reason == sickness
    mean_sickness = data.loc[mask, 'Visit_Duration'].mean().round(decimals=1)
    max_sickness = data.loc[mask, 'Visit_Duration'].max()
    min_sickness = data.loc[mask, 'Visit_Duration'].min()
    row_sickness= ','.
  ↪join([str(sickness),str(visits),str(mean_sickness),str(max_sickness),str(min_sickness)])
    calculated_list.append(row_sickness)
```

In the next step, the list is saved in a csv file named calculations.csv. Because it is a list and not a dataframe, the header is included for the function so we will be able to call on the columns later on.

[5]:
```
save_data(calculated_list, "calculations.
  ↪csv","Visit_Reason,Visits,Mean_Duration,Max_Duration,Min_Duration") #saves␣
  ↪the calculated list to a csv file
```

In this step, a bar plot is created using the seaborn library. The rows are grouped by reason of visit and a mean is calculated for each reason.

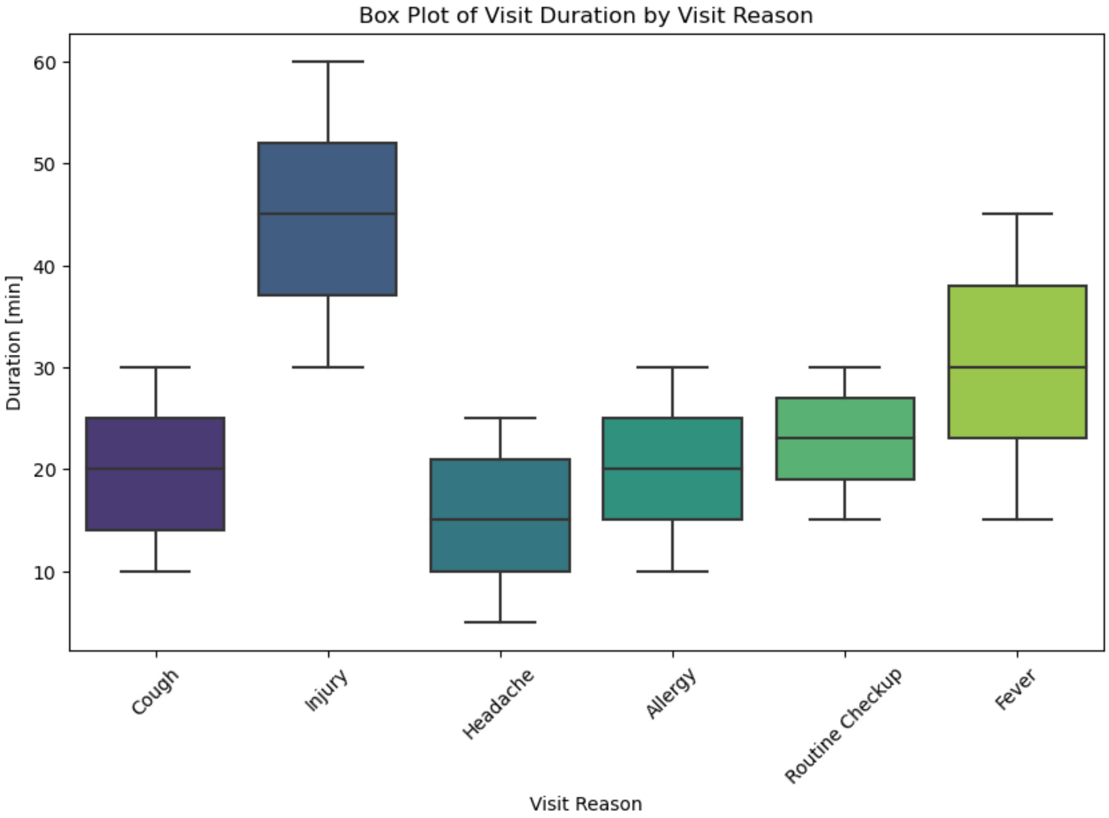
[6]:
```
mean_durations = data.groupby('Visit_Reason')['Visit_Duration'].mean().
  ↪reset_index()

# Set up the plot
plt.figure(figsize=(7, 8))
sns.barplot(x='Visit_Reason', y='Visit_Duration', data=mean_durations,␣
  ↪palette='viridis')

# Adding labels and title
plt.xlabel('Visit Reason')
plt.ylabel('Mean Visit Duration')
plt.title('Mean Visit Duration by Visit Reason')

plt.xticks(rotation=45, ha='right')

# Show the plot
plt.tight_layout()
plt.show()
```



In the next step, a box plot is created, showing the range, median as well as 75% percentile of minutes needed per visit for each reason.

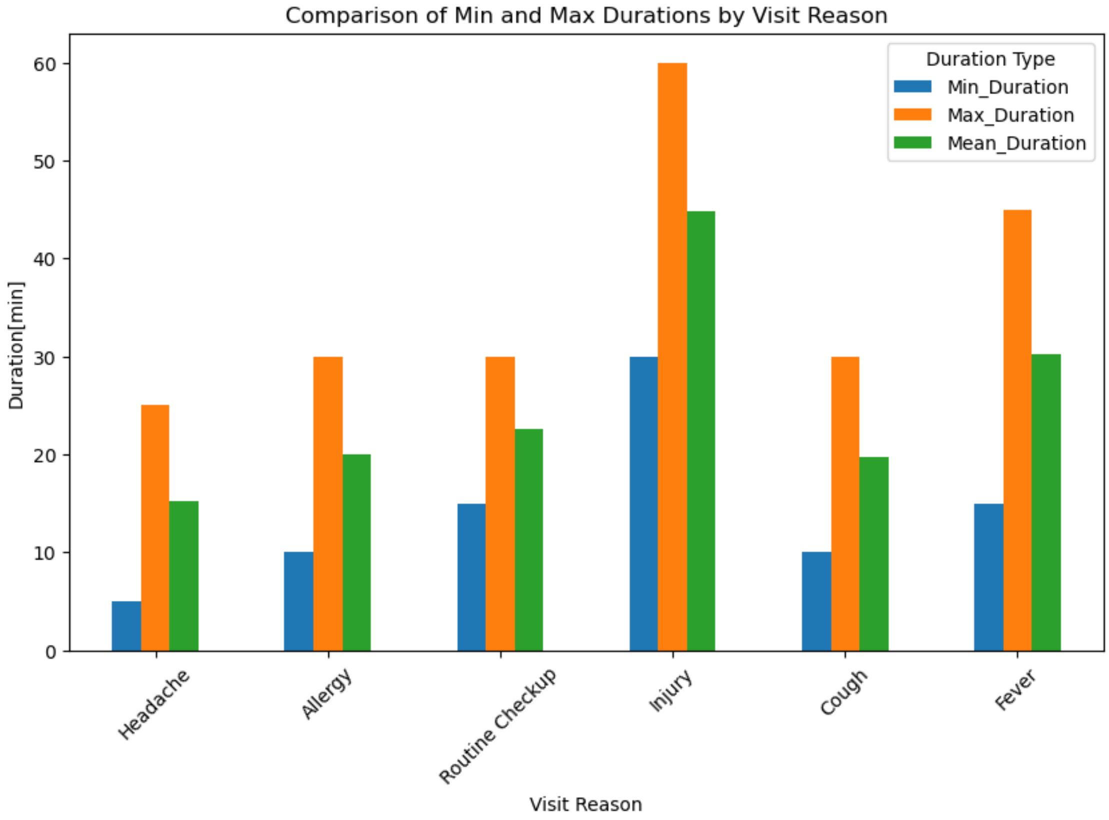
[7]:

```
plt.figure(figsize=(10, 6))
sns.boxplot(data=data, x='Visit_Reason', y='Visit_Duration', palette="viridis")
plt.title('Box Plot of Visit Duration by Visit Reason')
plt.xlabel('Visit Reason')
plt.ylabel('Duration [min]')
plt.xticks(rotation=45)
plt.show()
```



In the next graph, the data from the calculations.csv file is displayed, comparing the minimum, maximum and mean duration of each reason of visit. To achieve this, the data from the file is saved in the calculated_data variable.

[8]:
```
calculated_data = load_data('calculations.csv')



calculated_data.set_index('Visit_Reason', inplace=True)
fig, ax = plt.subplots(figsize=(10, 6))

calculated_data[['Min_Duration', 'Max_Duration',"Mean_Duration"]].
  ↪plot(kind='bar', ax=ax)
plt.title('Comparison of Min and Max Durations by Visit Reason')
plt.xlabel('Visit Reason')
plt.ylabel('Duration[min]')
plt.xticks(rotation=45)
plt.legend(title='Duration Type')
plt.show()
```

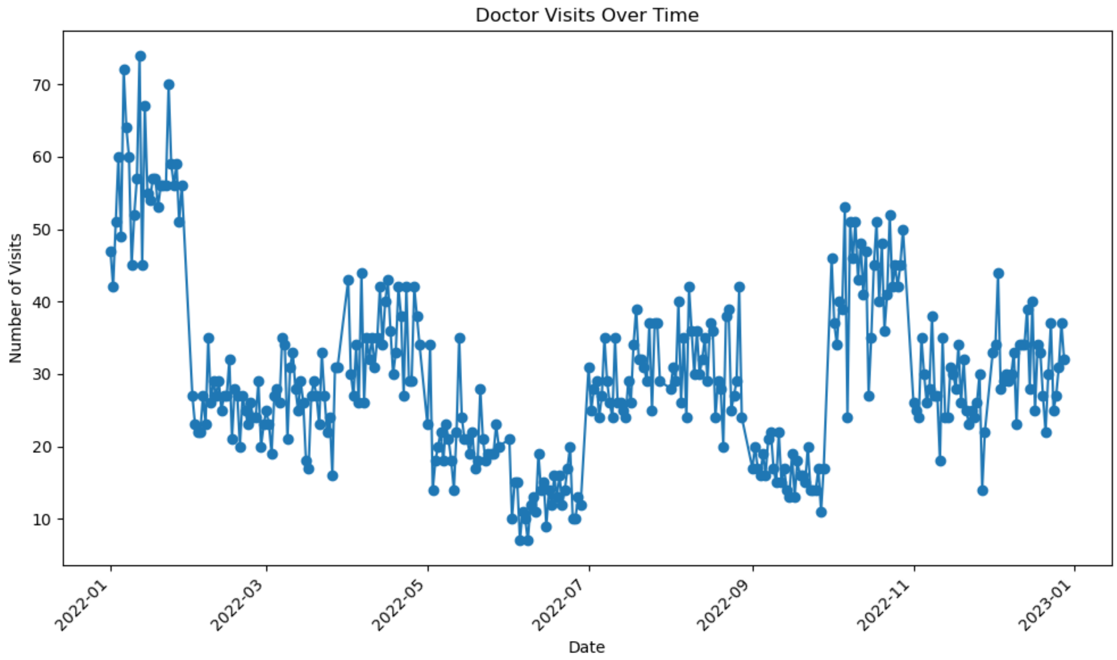


Another interesting aspect is how these visits were spread over time. Analysis of the dates shows, that the doctor was visited more than 10 times as often on the most visited day than on the least visited day. This divergence suggest that there is a big difference between some days and it would be interesting to find out whether there is a trend, for exaple a seasonal trend, visible. With that intent, a plot showing the distribution of the amount of visits to the doctor over time is generated. This graph suggests that throughout January 2022 a spike in visits to the doctor was visible. Apart from that, no clear trend was visible except for some fluctuation.

[9]:

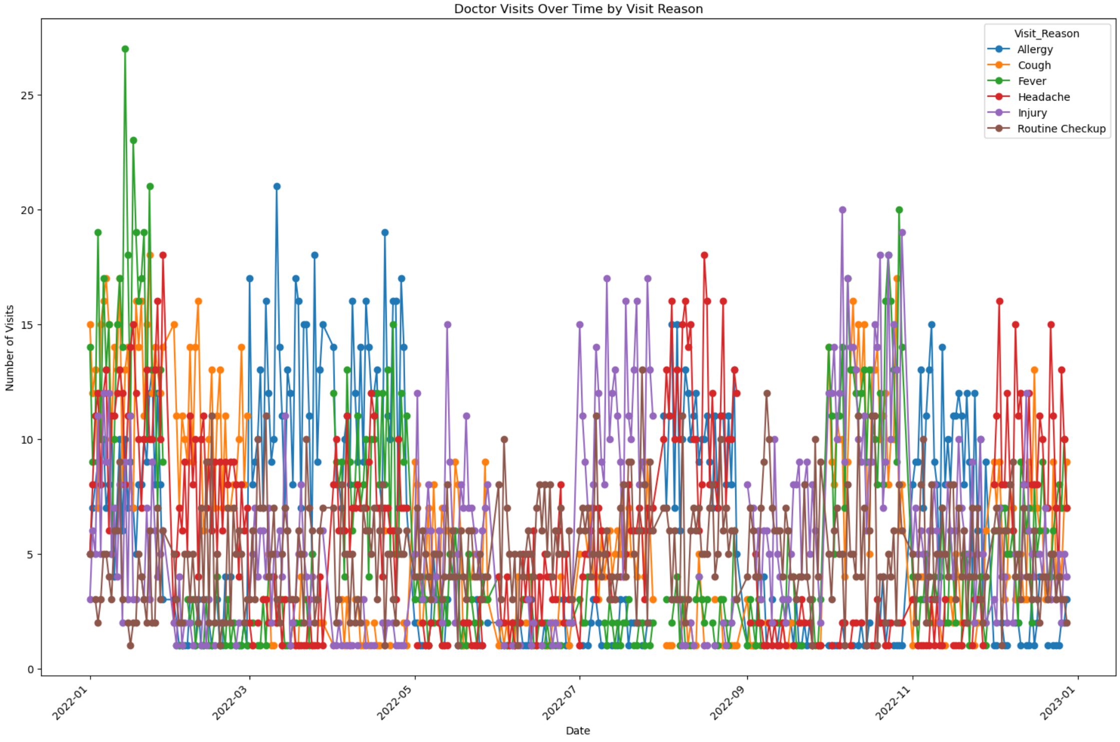
```python
date_visit_counts = data['Date'].value_counts().reset_index()
date_visit_counts.columns = ['Date', 'Visit_Count']
print(date_visit_counts.head(5))
print(date_visit_counts.tail(5))



data['Date'] = pd.to_datetime(data['Date'])

# Group the data by the 'Date' column and count the occurrences
date_visit_counts = data.groupby('Date').size().reset_index(name='Visit_Count')

plt.figure(figsize=(10, 6))
plt.plot(date_visit_counts['Date'], date_visit_counts['Visit_Count'],␣
 ↪marker='o')


plt.xlabel('Date')
plt.ylabel('Number of Visits')
plt.title('Doctor Visits Over Time')
plt.xticks(rotation=45, ha='right')


plt.tight_layout()
plt.show()
```

```
        Date  Visit_Count
0 2022-01-12           74
1 2022-01-06           72
2 2022-01-23           70
3 2022-01-14           67
4 2022-01-07           64
          Date  Visit_Count
331 2022-06-26           10
332 2022-06-07           10
333 2022-06-15            9
334 2022-06-05            7
335 2022-06-08            7
```



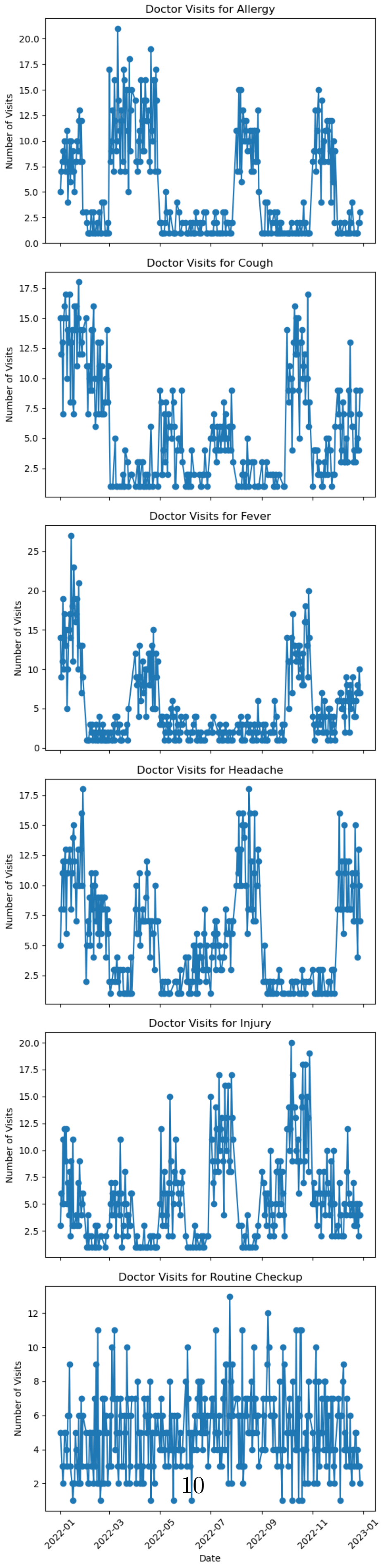
In the next step, it would be interesting to have this plot for each of the reasons, why a visit to the doctor occured. As visible in the plot below, it is not easily interpretable when all reasons are shown in the same lineplot.

```
[10]: data['Date'] = pd.to_datetime(data['Date'])
date_reason_counts = data.groupby(['Date', 'Visit_Reason']).size().reset_index(name='Visit_Count')
pivot_data = date_reason_counts.pivot(index='Date', columns='Visit_Reason', values='Visit_Count')

plt.figure(figsize=(15, 10))
pivot_data.plot(marker='o', ax=plt.gca())

plt.xlabel('Date')
plt.ylabel('Number of Visits')
plt.title('Doctor Visits Over Time by Visit Reason')
plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```



To have a clearer overview over this data, a line plot for each visit reason is displayed. The surge in doctor visits in january and october can be explained by the spike in visits for both Cough and Fever: Routine Checkups have only little fluctuation throughout the year, while Allergy shows a seasonality with several spikes during spring, summer and autumn.

[11]:
```
reason_counts = data.groupby('Visit_Reason').size()

fig, axes = plt.subplots(6, 1, figsize=(6, 4 * 6), sharex=True)

for idx, reason in enumerate("Allergy,Cough,Fever,Headache,Injury,Routine␣
 ↪Checkup".split(",")):
    reason_data = data[data['Visit_Reason'] == reason]
    date_reason_counts = reason_data.groupby('Date').size().
 ↪reset_index(name='Visit_Count')

    axes[idx].plot(date_reason_counts['Date'],␣
 ↪date_reason_counts['Visit_Count'], marker='o')
    axes[idx].set_ylabel('Number of Visits')
    axes[idx].set_title(f'Doctor Visits for {reason}')
    axes[idx].tick_params(axis='x', rotation=45)

plt.xlabel('Date')
plt.tight_layout()
plt.show()
```


Doctor Visits for Allergy

Doctor Visits for Cough

Doctor Visits for Fever

Doctor Visits for Headache

Doctor Visits for Injury

Doctor Visits for Routine Checkup

To gather absolute numbers of doctor visits per month in 2022, the data is filtered by month and added into a new dataframe, which is then displayed.

[12]:

```
def filter_by_month(df, year, month):
    mask = (df['Date'].dt.year == year) & (df['Date'].dt.month == month)
    return df[mask]

monthly_visits = pd.DataFrame(columns=['Month', 'Visits'])
for month in range(1, 13):
    filtered_month = filter_by_month(data, 2022, month)
    monthly_visits.loc[month-1] = [month, len(filtered_month)]

monthly_visits.set_index('Month', inplace=True)
print(monthly_visits)
```

```
      Visits
Month
1       1580
2        718
3        735
4        977
5        591
6        368
7        831
8        881
9        465
10      1199
11       757
12       882
```

In the next step, the busiest month is compared with the least busy. As previously stated, the month of january was very busy due to an increase in visits for almost all reasons (except Routine Checkups, making up only 6.4% of the visits), but especially due to a rise in Cough, Fever and Headache Patients. June was a relatively quiet month whith Routine Checkups being the main visit reason, with a percentage of 40%.

[13]:

```
filtered_january = filter_by_month(data, 2022, 1)
grouped_january = filtered_january.groupby('Visit_Reason').size()
filtered_june = filter_by_month(data, 2022, 6)
grouped_june = filtered_june.groupby('Visit_Reason').size()

print(grouped_january)
print(grouped_june)
```

```
Visit_Reason
Allergy            229
Cough              369
```

```
Fever               405
Headache            311
Injury              165
Routine Checkup     101
dtype: int64
Visit_Reason
Allergy              32
Cough                35
Fever                39
Headache             91
Injury               22
Routine Checkup     149
dtype: int64
```

Another interesting aspect is that there are patients who have visited the doctor more than once. First, the amount of times a patient visited the doctor is counted and the top 10 visitors are printed.

The Data is split and stacked, then grouped by the patient and reason. Unfortunately, all patients have been to the doctor for all 6 of the visit reasons studied :P. This data is then saved to a new csv file using the predefined save_data method.

[14]:

```python
repeated_visits = data.Patient.value_counts()
print(repeated_visits.head(10))

data_by_visit_reason = (data['Visit_Reason'].str.split(', ')
                     .groupby(data['Patient'])
                     .agg(lambda x: ', '.join(set(y for z in x for y in z)))
                     .reset_index())

save_data(data_by_visit_reason, "patients_visit_reasons.csv")
```

```
Alice Smith         129
Jack Miller         121
David Smith         119
Bob Taylor          119
George Williams     115
Jack Taylor         115
Hannah Moore        114
Emma Johnson        113
Charlie Smith       113
Charlie Taylor      112
Name: Patient, dtype: int64
```

In the next step, it would be interesting to know which patient visited the doctor how often for what reason. To achieve this, the original dataframe is grouped by both the “Patients” and the “Visit Reason” column, counting the number of occurences of the combination of a name with the same reason. After sorting by the most visits due to the same reason, the 10 Patients who visited for the same reason most often are printed and the dataframe is saved to a csv file.

[15]:

```
# Count the occurrences of each visit reason for each patient
visit_reason_counts = data.groupby(['Patient', 'Visit_Reason']).size().
 ↪reset_index(name='Count')
visit_reason_counts = visit_reason_counts.sort_values("Count", ascending=False)
print(visit_reason_counts.head(10))

save_data(visit_reason_counts, "visit_reason_counts.csv")
```

```
             Patient     Visit_Reason  Count
501        Ivy Jones         Headache     30
478    Hannah Wilson           Injury     29
228   David Williams          Allergy     28
41       Alice Smith  Routine Checkup     28
527        Ivy Taylor  Routine Checkup     28
452     Hannah Moore            Fever     27
567      Jack Miller         Headache     27
390     George Moore          Allergy     27
29      Alice Miller  Routine Checkup     27
186      David Davis          Allergy     27
```

In the next step, we focus on the patients who visited for a routine checkup. It is remarkable that some patients visited very often for routine checkups. To find these patients and the number of times they visited for that reason, a mask is created. The top and bottom 10 patients are printed. As the patients insurance, I would check if that many routine checkups are really necessary. :P

[16]:

```
maskRoutineCheckup = visit_reason_counts.Visit_Reason == "Routine Checkup"
routine_checkup = visit_reason_counts[maskRoutineCheckup].set_index('Patient')
print(routine_checkup.head(10))
print(routine_checkup.tail(10))
```

```
                   Visit_Reason  Count
Patient
Alice Smith     Routine Checkup     28
Ivy Taylor      Routine Checkup     28
Alice Miller    Routine Checkup     27
Fiona Brown     Routine Checkup     25
Charlie Davis   Routine Checkup     25
Jack Davis      Routine Checkup     24
Emma Wilson     Routine Checkup     23
Ivy Brown       Routine Checkup     23
Hannah Johnson  Routine Checkup     22
Ivy Williams    Routine Checkup     22
                  Visit_Reason  Count
Patient
Alice Johnson  Routine Checkup     12
Hannah Moore   Routine Checkup     12
Hannah Wilson  Routine Checkup     11
Ivy Johnson    Routine Checkup     11
Alice Brown    Routine Checkup     11
```

```
David Moore    Routine Checkup     10
David Taylor   Routine Checkup     10
Bob Wilson     Routine Checkup      9
David Wilson   Routine Checkup      7
Fiona Wilson   Routine Checkup      7
```