In [1]:

```
pip install pyspark
```

```
Requirement already satisfied: pyspark in /opt/anaconda3/lib/python3.
9/site-packages (3.5.0)
Requirement already satisfied: py4j==0.10.9.7 in /opt/anaconda3/lib/py
thon3.9/site-packages (from pyspark) (0.10.9.7)
Note: you may need to restart the kernel to use updated packages.
```

In [2]:

```
!java -version
```

```
java version "1.8.0_391"
Java(TM) SE Runtime Environment (build 1.8.0_391-b13)
Java HotSpot(TM) 64-Bit Server VM (build 25.391-b13, mixed mode)
```

In [3]:

```
import warnings
from pyspark.sql import SparkSession
sparkSession = SparkSession.builder.appName("anji") \
    .config("spark.driver.memory", "4g") \
    .config("spark.executor.memory", "4g") \
    .getOrCreate()
```

```
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use
setLogLevel(newLevel).
23/10/19 00:18:03 WARN NativeCodeLoader: Unable to load native-hadoop
library for your platform... using builtin-java classes where applicab
le
```

In [4]:

```
#creating the schema for loading the Chicago crime datase
from pyspark.sql.types import StructType, StructField, IntegerType, StringType, Doub
c_schema = StructType([
    StructField("ID", IntegerType(), True),
    StructField("Case Number", StringType(), True),
    StructField("Date", StringType(), True),
    StructField("Block", StringType(), True),
    StructField("IUCR", StringType(), True),
    StructField("Primary Type", StringType(), True),
    StructField("Description", StringType(), True),
    StructField("Location Description", StringType(), True),
    StructField("Arrest", BooleanType(), True),
    StructField("Domestic", BooleanType(), True),
    StructField("Beat", StringType(), True),
    StructField("District", StringType(), True),
    StructField("Ward", IntegerType(), True),
    StructField("Community Area", IntegerType(), True),
    StructField("FBI Code", StringType(), True),
    StructField("X Coordinate", DoubleType(), True),
    StructField("Y Coordinate", DoubleType(), True),
    StructField("Year", IntegerType(), True),
    StructField("Updated On", StringType(), True),
    StructField("Latitude", DoubleType(), True),
    StructField("Longitude", DoubleType(), True),
    StructField("Location", StringType(), True)
])
```

In [5]:

```
ch=sparkSession.read.format("csv") \
    .option("header", True) \
    .option("delimiter", ",") \
    .schema(c_schema) \
    .load("Crimes_-_2001_to_Present.csv")
ch.show(5, truncate=False)
print("Number of records:", ch.count())
print("Number of columns:", len(ch.columns))
```

```
+--------+-----------+----------------------+--------------------+----
+-----------------------+-----------------------------------+---------
-----------------------------+------+--------+----+--------+----+-----
---------+--------+------------+------------+----+--------------------
--+------------+-------------+----------------------------+
|ID      |Case Number|Date                  |Block               |IUCR
|Primary Type           |Description                        |Location 
Description                  |Arrest|Domestic|Beat|District|Ward|Commu
nity Area|FBI Code|X Coordinate|Y Coordinate|Year|Updated On          
|Latitude    |Longitude    |Location                    |
+--------+-----------+----------------------+--------------------+----
+-----------------------+-----------------------------------+---------
-----------------------------+------+--------+----+--------+----+-----
---------+--------+------------+------------+----+--------------------
--+------------+-------------+----------------------------+
|5741943 |HN549294   |08/25/2007 09:22:18 AM|074XX N ROGERS AVE  |0560
|ASSAULT                |SIMPLE                             |OTHER
|false |false   |2422|024     |49  |1             |08A     |NULL
|NULL        |2007|08/17/2015 03:03:40 PM|NULL        |NULL         |N
ULL                        |
|1930689 |HH109118   |01/05/2002 09:24:00 PM|007XX E 103 ST      |0820
|THEFT                  |$500 AND UNDER                     |GAS STATI
ON                           |true  |false   |0512|005     |NULL|NULL
|06      |NULL        |NULL        |2002|02/04/2016 06:33:39 AM|NULL
|NULL         |NULL                        |
|13203321|JG415333   |09/06/2023 05:00:00 PM|002XX N Wells st    |1320
|CRIMINAL DAMAGE        |TO VEHICLE                         |PARKING L
OT / GARAGE (NON RESIDENTIAL)|false |false   |0122|001     |42  |32
|14      |NULL        |NULL        |2023|09/14/2023 03:43:09 PM|NULL
|NULL         |NULL                        |
|13210088|JG423627   |08/31/2023 12:00:00 PM|023XX W JACKSON BLVD|1153
|DECEPTIVE PRACTICE     |FINANCIAL IDENTITY THEFT OVER $ 300|STREET
|false |false   |1225|012     |27  |28            |11      |1160870.0
|1898642.0   |2023|09/16/2023 03:41:56 PM|41.877565108|-87.68479102 |
(41.877565108, -87.68479102)|
|13210004|JG422532   |07/24/2023 09:45:00 PM|073XX S JEFFERY BLVD|0281
|CRIMINAL SEXUAL ASSAULT|NON-AGGRAVATED                     |APARTMENT
|false |false   |0333|003     |7   |43            |02      |1190812.0
|1856743.0   |2023|09/16/2023 03:41:56 PM|41.7619185  |-87.576209245|
(41.7619185, -87.576209245) |
+--------+-----------+----------------------+--------------------+----
+-----------------------+-----------------------------------+---------
-----------------------------+------+--------+----+--------+----+-----
---------+--------+------------+------------+----+--------------------
--+------------+-------------+----------------------------+
only showing top 5 rows
```

```
[Stage 1:==================================>                        (8
+ 6) / 14]

Number of records: 7914425
Number of columns: 22
```

In [6]:

```
from pyspark.sql.functions import isnan, when, count, col
ch.show(5)
null_counts = ch.select([
    count(when(col(c).isNull(), c)).alias(c)
    for c in ch.columns
])

pandas_null_counts = null_counts.toPandas()
print("Column wise NULL values ", pandas_null_counts)

fill_values = {
    "ID": 0,
    "X Coordinate": 0.0,
    "Y Coordinate": 0.0,
    "Description": "NA",
}

for col_name, fill_value in fill_values.items():
    ch = ch.na.fill(fill_value, [col_name])

print("DataFrame with Null Values Filled:")
ch.show(5)
```

```
+--------+-----------+--------------------+--------------------+----+-
-------------------+--------------------+--------------------+------+-
-------+----+--------+----+--------------+--------+------------+------
------+----+--------------------+------------+-------------+----------
----------+
|      ID|Case Number|                Date|               Block|IUCR|
Primary Type|         Description|Location Description|Arrest|Domestic
|Beat|District|Ward|Community Area|FBI Code|X Coordinate|Y Coordinate|
Year|          Updated On|    Latitude|    Longitude|            Locat
ion|
+--------+-----------+--------------------+--------------------+----+-
-------------------+--------------------+--------------------+------+-
-------+----+--------+----+--------------+--------+------------+------
------+----+--------------------+------------+-------------+----------
----------+
| 5741943|   HN549294|08/25/2007 09:22:...|  074XX N ROGERS AVE|0560|
ASSAULT|              SIMPLE|               OTHER| false|   false|2422
|     024|  49|             1|     08A|        NULL|        NULL|2007|
08/17/2015 03:03:...|        NULL|         NULL|                NULL|
| 1930689|   HH109118|01/05/2002 09:24:...|      007XX E 103 ST|0820|
THEFT|      $500 AND UNDER|         GAS STATION|  true|   false|0512|
005|NULL|          NULL|      06|        NULL|        NULL|2002|02/04/
2016 06:33:...|        NULL|         NULL|                NULL|
|13203321|   JG415333|09/06/2023 05:00:...|    002XX N Wells st|1320|
CRIMINAL DAMAGE|          TO VEHICLE|PARKING LOT / GAR...| false|   fa
lse|0122|     001|  42|            32|      14|        NULL|        NU
LL|2023|09/14/2023 03:43:...|        NULL|         NULL|
NULL|
|13210088|   JG423627|08/31/2023 12:00:...|023XX W JACKSON BLVD|1153|
DECEPTIVE PRACTICE|FINANCIAL IDENTIT...|              STREET| false|
false|1225|     012|  27|            28|      11|   1160870.0|   18986
42.0|2023|09/16/2023 03:41:...|41.877565108| -87.68479102|(41.87756510
8, -8...|
|13210004|   JG422532|07/24/2023 09:45:...|073XX S JEFFERY BLVD|0281|C
RIMINAL SEXUAL A...|      NON-AGGRAVATED|           APARTMENT| false|
false|0333|     003|   7|            43|      02|   1190812.0|   18567
43.0|2023|09/16/2023 03:41:...|  41.7619185|-87.576209245|(41.7619185,
-87....|
+--------+-----------+--------------------+--------------------+----+-
-------------------+--------------------+--------------------+------+-
-------+----+--------+----+--------------+--------+------------+------
------+----+--------------------+------------+-------------+----------
----------+
only showing top 5 rows
```

```
Column wise NULL values     ID  Case Number  Date  Block  IUCR  Primar
y Type  Description  \
0   0            0     0      0     0             0            0

   Location Description  Arrest  Domestic  ...    Ward  Community Area
\
0                 11907       0         0  ...  614849          613476

   FBI Code  X Coordinate  Y Coordinate  Year  Updated On  Latitude  \
0         0         90108         90108     0           0     90108

   Longitude  Location
0      90108     90108

[1 rows x 22 columns]
DataFrame with Null Values Filled:
+--------+-----------+--------------------+--------------------+----+-
-------------------+--------------------+--------------------+------+-
-------+----+--------+----+--------------+--------+------------+------
------+----+--------------------+------------+-------------+----------
----------+
|      ID|Case Number|                Date|               Block|IUCR|
Primary Type|         Description|Location Description|Arrest|Domestic
|Beat|District|Ward|Community Area|FBI Code|X Coordinate|Y Coordinate|
Year|          Updated On|    Latitude|    Longitude|            Locat
ion|
+--------+-----------+--------------------+--------------------+----+-
-------------------+--------------------+--------------------+------+-
-------+----+--------+----+--------------+--------+------------+------
------+----+--------------------+------------+-------------+----------
----------+
| 5741943|   HN549294|08/25/2007 09:22:...|  074XX N ROGERS AVE|0560|
ASSAULT|              SIMPLE|               OTHER| false|   false|2422
|     024|  49|             1|     08A|         0.0|         0.0|2007|
08/17/2015 03:03:...|        NULL|         NULL|                NULL|
| 1930689|   HH109118|01/05/2002 09:24:...|      007XX E 103 ST|0820|
THEFT|      $500 AND UNDER|         GAS STATION|  true|   false|0512|
005|NULL|          NULL|      06|         0.0|         0.0|2002|02/04/
2016 06:33:...|        NULL|         NULL|                NULL|
|13203321|   JG415333|09/06/2023 05:00:...|    002XX N Wells st|1320|
CRIMINAL DAMAGE|          TO VEHICLE|PARKING LOT / GAR...| false|   fa
lse|0122|     001|  42|            32|      14|         0.0|
0.0|2023|09/14/2023 03:43:...|        NULL|         NULL|
NULL|
|13210088|   JG423627|08/31/2023 12:00:...|023XX W JACKSON BLVD|1153|
DECEPTIVE PRACTICE|FINANCIAL IDENTIT...|              STREET| false|
false|1225|     012|  27|            28|      11|   1160870.0|   18986
42.0|2023|09/16/2023 03:41:...|41.877565108| -87.68479102|(41.87756510
8, -8...|
|13210004|   JG422532|07/24/2023 09:45:...|073XX S JEFFERY BLVD|0281|C
RIMINAL SEXUAL A...|      NON-AGGRAVATED|           APARTMENT| false|
false|0333|     003|   7|            43|      02|   1190812.0|   18567
43.0|2023|09/16/2023 03:41:...|  41.7619185|-87.576209245|(41.7619185,
-87....|
+--------+-----------+--------------------+--------------------+----+-
-------------------+--------------------+--------------------+------+-
-------+----+--------+----+--------------+--------+------------+------
------+----+--------------------+------------+-------------+----------
----------+
only showing top 5 rows
```

In [7]:

```
#after filling null valus, again Checking number for nulls in dataframe column-wise
from pyspark.sql.functions import isnan, when, count, col

ch.select([
    count(when(col(c).isNull(), c)).alias(c)
    for c in ch.columns
]).show()
```

```
[Stage 9:======================================>                    (9
+ 5) / 14]

+---+-----------+----+-----+----+------------+-----------+------------
--------+------+--------+----+--------+------+--------------+--------+
------------+------------+----+----------+--------+---------+--------+
| ID|Case Number|Date|Block|IUCR|Primary Type|Description|Location Des
cription|Arrest|Domestic|Beat|District|  Ward|Community Area|FBI Code|
X Coordinate|Y Coordinate|Year|Updated On|Latitude|Longitude|Location|
+---+-----------+----+-----+----+------------+-----------+------------
--------+------+--------+----+--------+------+--------------+--------+
------------+------------+----+----------+--------+---------+--------+
|  0|          0|   0|    0|   0|           0|          0|            
11907|     0|       0|   0|      47|614849|        613476|       0|
0|           0|   0|         0|   90108|    90108|   90108|
+---+-----------+----+-----+----+------------+-----------+------------
--------+------+--------+----+--------+------+--------------+--------+
------------+------------+----+----------+--------+---------+--------+
```

In [8]:

```
# # # Modified the data type of the Date column to TimestampType by utilizing the ca
from pyspark.sql.functions import to_timestamp, col
from pyspark.sql import functions as F

# Define a list of potential date format patterns
sparkSession.conf.set("spark.sql.legacy.timeParserPolicy", "LEGACY")
date_format_patterns = ["MM/dd/yyyy hh:mm:ss a", "MM/dd/yyyy HH:mm:ss"]

# Create a new column with a timestamp for each format
for pattern in date_format_patterns:
    ch = ch.withColumn("Date_" + pattern, to_timestamp(col("Date"), pattern))

# Find the first non-null date from the multiple columns
ch = ch.withColumn("Date", F.coalesce(*[col("Date_" + pattern) for pattern in date_f

# Drop the temporary columns
for pattern in date_format_patterns:
    ch = ch.drop("Date_" + pattern)
ch.show(5)
```

```
+--------+-----------+-------------------+--------------------+----+--
------------------+--------------------+--------------------+------+--
------+----+--------+----+--------------+--------+------------+-------
-----+----+--------------------+------------+-------------+-----------
---------+
|      ID|Case Number|               Date|               Block|IUCR|
Primary Type|         Description|Location Description|Arrest|Domestic
|Beat|District|Ward|Community Area|FBI Code|X Coordinate|Y Coordinate|
Year|          Updated On|    Latitude|    Longitude|            Locat
ion|
+--------+-----------+-------------------+--------------------+----+--
------------------+--------------------+--------------------+------+--
------+----+--------+----+--------------+--------+------------+-------
-----+----+--------------------+------------+-------------+-----------
---------+
| 5741943|   HN549294|2007-08-25 09:22:18|  074XX N ROGERS AVE|0560|
ASSAULT|              SIMPLE|               OTHER| false|   false|2422
|     024|  49|             1|     08A|         0.0|         0.0|2007|
08/17/2015 03:03:...|        NULL|         NULL|                NULL|
| 1930689|   HH109118|2002-01-05 21:24:00|      007XX E 103 ST|0820|
THEFT|      $500 AND UNDER|         GAS STATION|  true|   false|0512|
005|NULL|          NULL|      06|         0.0|         0.0|2002|02/04/
2016 06:33:...|        NULL|         NULL|                NULL|
|13203321|   JG415333|2023-09-06 17:00:00|    002XX N Wells st|1320|
CRIMINAL DAMAGE|          TO VEHICLE|PARKING LOT / GAR...| false|   fa
lse|0122|     001|  42|            32|      14|         0.0|
0.0|2023|09/14/2023 03:43:...|        NULL|         NULL|
NULL|
|13210088|   JG423627|2023-08-31 12:00:00|023XX W JACKSON BLVD|1153|
DECEPTIVE PRACTICE|FINANCIAL IDENTIT...|              STREET| false|
false|1225|     012|  27|            28|      11|   1160870.0|   18986
42.0|2023|09/16/2023 03:41:...|41.877565108| -87.68479102|(41.87756510
8, -8...|
|13210004|   JG422532|2023-07-24 21:45:00|073XX S JEFFERY BLVD|0281|CR
IMINAL SEXUAL A...|      NON-AGGRAVATED|           APARTMENT| false|
false|0333|     003|   7|            43|      02|   1190812.0|   18567
43.0|2023|09/16/2023 03:41:...|  41.7619185|-87.576209245|(41.7619185,
-87....|
+--------+-----------+-------------------+--------------------+----+--
------------------+--------------------+--------------------+------+--
------+----+--------+----+--------------+--------+------------+-------
-----+----+--------------------+------------+-------------+-----------
---------+
only showing top 5 rows
```

In [9]:

```
# filtering data for the last ten years
ch=ch.filter((ch["Year"] >= 2013))
ch.show(5)
```

```
+--------+-----------+-------------------+--------------------+----+--
------------------+--------------------+--------------------+------+--
------+----+--------+----+--------------+--------+------------+-------
-----+----+--------------------+------------+-------------+-----------
---------+
|      ID|Case Number|               Date|               Block|IUCR|
Primary Type|         Description|Location Description|Arrest|Domestic
|Beat|District|Ward|Community Area|FBI Code|X Coordinate|Y Coordinate|
Year|          Updated On|    Latitude|    Longitude|            Locat
ion|
+--------+-----------+-------------------+--------------------+----+--
------------------+--------------------+--------------------+------+--
------+----+--------+----+--------------+--------+------------+-------
-----+----+--------------------+------------+-------------+-----------
---------+
|13203321|   JG415333|2023-09-06 17:00:00|    002XX N Wells st|1320|
CRIMINAL DAMAGE|          TO VEHICLE|PARKING LOT / GAR...| false|   fa
lse|0122|     001|  42|            32|      14|         0.0|
0.0|2023|09/14/2023 03:43:...|        NULL|         NULL|
NULL|
|13210088|   JG423627|2023-08-31 12:00:00|023XX W JACKSON BLVD|1153|
DECEPTIVE PRACTICE|FINANCIAL IDENTIT...|              STREET| false|
false|1225|     012|  27|            28|      11|   1160870.0|    18986
42.0|2023|09/16/2023 03:41:...|41.877565108| -87.68479102|(41.87756510
8, -8...|
|13210004|   JG422532|2023-07-24 21:45:00|073XX S JEFFERY BLVD|0281|CR
IMINAL SEXUAL A...|      NON-AGGRAVATED|           APARTMENT| false|
false|0333|     003|   7|            43|      02|   1190812.0|    18567
43.0|2023|09/16/2023 03:41:...|  41.7619185|-87.576209245|(41.7619185,
-87....|
|13210062|   JG423596|2023-08-27 07:00:00|034XX N LAWNDALE AVE|0820|
THEFT|      $500 AND UNDER|           APARTMENT| false|   false|1732|
017|  30|            21|      06|   1151117.0|   1922554.0|2023|09/16/
2023 03:41:...|41.943378528|  -87.7199738|(41.943378528, -8...|
|13210107|   JG411849|2023-09-04 21:30:00|   053XX S HOMAN AVE|1310|
CRIMINAL DAMAGE|         TO PROPERTY|  RESIDENCE - GARAGE| false|   fa
lse|0822|     008|  14|            63|      14|   1154617.0|   186904
6.0|2023|09/16/2023 03:41:...|41.796477414|-87.708540915|(41.79647741
4, -8...|
+--------+-----------+-------------------+--------------------+----+--
------------------+--------------------+--------------------+------+--
------+----+--------+----+--------------+--------+------------+-------
-----+----+--------------------+------------+-------------+-----------
---------+
only showing top 5 rows
```

In [10]:

```
# # Remove all the records with the following crime types:
# #'NON-CRIMINAL (SUBJECT SPECIFIED)' 'OTHER OFFENSE' 'STALKING', 'NON - CRIMINAL',
from pyspark.sql.functions import col
print("Count of Before Removing all the records with crime types : ", ch.count())
crime_types_to_remove=[
    'NON-CRIMINAL (SUBJECT SPECIFIED)',
    'OTHER OFFENSE',
    'STALKING',
    'NON - CRIMINAL',
    'ARSON'
]
ch =ch.filter(~col("Primary Type").isin(crime_types_to_remove))
print("Count of after Removing all the records with crime types : ", ch.count())
```

```
Count of Before Removing all the records with crime types :  2778427

[Stage 17:=========================================>               (10
+ 4) / 14]

Count of after Removing all the records with crime types :  2596601
```

In [11]:

```
from pyspark.sql.functions import when, col, date_format
# Print distinct values of Primary Type before merging
ch.select("Primary Type").distinct().orderBy("Primary Type").show(truncate=False)

# Merge similar crime types
ch = ch.withColumn(
    "Primary Type",
    when(
        col("Primary Type").isin("SEX OFFENSE", "PROSTITUTION"),
        "SEX CRIME"
    ).otherwise(col("Primary Type"))
)
print("\nAfter Merging:")
ch.select("Primary Type").distinct().orderBy("Primary Type").show(truncate=False)

# Show the DataFrame
ch.show(5)
```

```
+---------------------------------+
|Primary Type                     |
+---------------------------------+
|ASSAULT                          |
|BATTERY                          |
|BURGLARY                         |
|CONCEALED CARRY LICENSE VIOLATION|
|CRIM SEXUAL ASSAULT              |
|CRIMINAL DAMAGE                  |
|CRIMINAL SEXUAL ASSAULT          |
|CRIMINAL TRESPASS                |
|DECEPTIVE PRACTICE               |
|GAMBLING                         |
|HOMICIDE                         |
|HUMAN TRAFFICKING                |
|INTERFERENCE WITH PUBLIC OFFICER |
|INTIMIDATION                     |
|KIDNAPPING                       |
|LIQUOR LAW VIOLATION             |
|MOTOR VEHICLE THEFT              |
|NARCOTICS                        |
|NON-CRIMINAL                     |
|OBSCENITY                        |
+---------------------------------+
only showing top 20 rows


After Merging:
```

```
+---------------------------------+
|Primary Type                     |
+---------------------------------+
|ASSAULT                          |
|BATTERY                          |
|BURGLARY                         |
|CONCEALED CARRY LICENSE VIOLATION|
|CRIM SEXUAL ASSAULT              |
|CRIMINAL DAMAGE                  |
|CRIMINAL SEXUAL ASSAULT          |
|CRIMINAL TRESPASS                |
|DECEPTIVE PRACTICE               |
|GAMBLING                         |
|HOMICIDE                         |
|HUMAN TRAFFICKING                |
|INTERFERENCE WITH PUBLIC OFFICER |
|INTIMIDATION                     |
|KIDNAPPING                       |
|LIQUOR LAW VIOLATION             |
|MOTOR VEHICLE THEFT              |
|NARCOTICS                        |
|NON-CRIMINAL                     |
|OBSCENITY                        |
+---------------------------------+
only showing top 20 rows

+--------+-----------+-------------------+--------------------+----+--
------------------+--------------------+--------------------+------+--
------+----+--------+----+--------------+--------+------------+-------
-----+----+--------------------+------------+-------------+-----------
---------+
|      ID|Case Number|               Date|               Block|IUCR|
Primary Type|         Description|Location Description|Arrest|Domestic
|Beat|District|Ward|Community Area|FBI Code|X Coordinate|Y Coordinate|
Year|          Updated On|    Latitude|    Longitude|            Locat
ion|
+--------+-----------+-------------------+--------------------+----+--
------------------+--------------------+--------------------+------+--
------+----+--------+----+--------------+--------+------------+-------
-----+----+--------------------+------------+-------------+-----------
---------+
|13203321|   JG415333|2023-09-06 17:00:00|    002XX N Wells st|1320|
CRIMINAL DAMAGE|          TO VEHICLE|PARKING LOT / GAR...| false|   fa
lse|0122|     001|  42|            32|      14|         0.0|
0.0|2023|09/14/2023 03:43:...|        NULL|         NULL|
NULL|
|13210088|   JG423627|2023-08-31 12:00:00|023XX W JACKSON BLVD|1153|
DECEPTIVE PRACTICE|FINANCIAL IDENTIT...|              STREET| false|
false|1225|     012|  27|            28|      11|   1160870.0|   18986
42.0|2023|09/16/2023 03:41:...|41.877565108| -87.68479102|(41.87756510
8, -8...|
|13210004|   JG422532|2023-07-24 21:45:00|073XX S JEFFERY BLVD|0281|CR
IMINAL SEXUAL A...|      NON-AGGRAVATED|           APARTMENT| false|
false|0333|     003|   7|            43|      02|   1190812.0|   18567
43.0|2023|09/16/2023 03:41:...|  41.7619185|-87.576209245|(41.7619185,
-87....|
|13210062|   JG423596|2023-08-27 07:00:00|034XX N LAWNDALE AVE|0820|
THEFT|      $500 AND UNDER|           APARTMENT| false|   false|1732|
017|  30|            21|      06|   1151117.0|   1922554.0|2023|09/16/
2023 03:41:...|41.943378528|  -87.7199738|(41.943378528, -8...|
|13210107|   JG411849|2023-09-04 21:30:00|   053XX S HOMAN AVE|1310|
CRIMINAL DAMAGE|          TO PROPERTY|  RESIDENCE - GARAGE| false|   fa
lse|0822|     008|  14|            63|      14|   1154617.0|   186904
6.0|2023|09/16/2023 03:41:...|41.796477414|-87.708540915|(41.79647741
4, -8...|
+--------+-----------+-------------------+---------------------+----+--
------------------+--------------------+---------------------+------+--
------+----+--------+----+---------------+--------+------------+-------
-----+----+--------------------+------------+-------------+------------
---------+
only showing top 5 rows
```

In [12]:

```
# # # filter out records with null year values in Date column
from pyspark.sql.functions import year
ch = ch.filter(year("Date").isNotNull())
yearly_crime_count = ch.groupBy(year("Date").alias("Year")).agg(count("*").alias("Cr
# Show the yearly crime count
yearly_crime_count.show()
```

```
[Stage 27:=====================================================>   (13
+ 1) / 14]

+----+------+
|Year|Crimes|
+----+------+
|2018|251065|
|2015|246595|
|2023|188267|
|2022|223555|
|2013|288953|
|2014|258216|
|2019|243959|
|2020|198841|
|2016|251822|
|2017|251197|
|2021|194063|
+----+------+
```

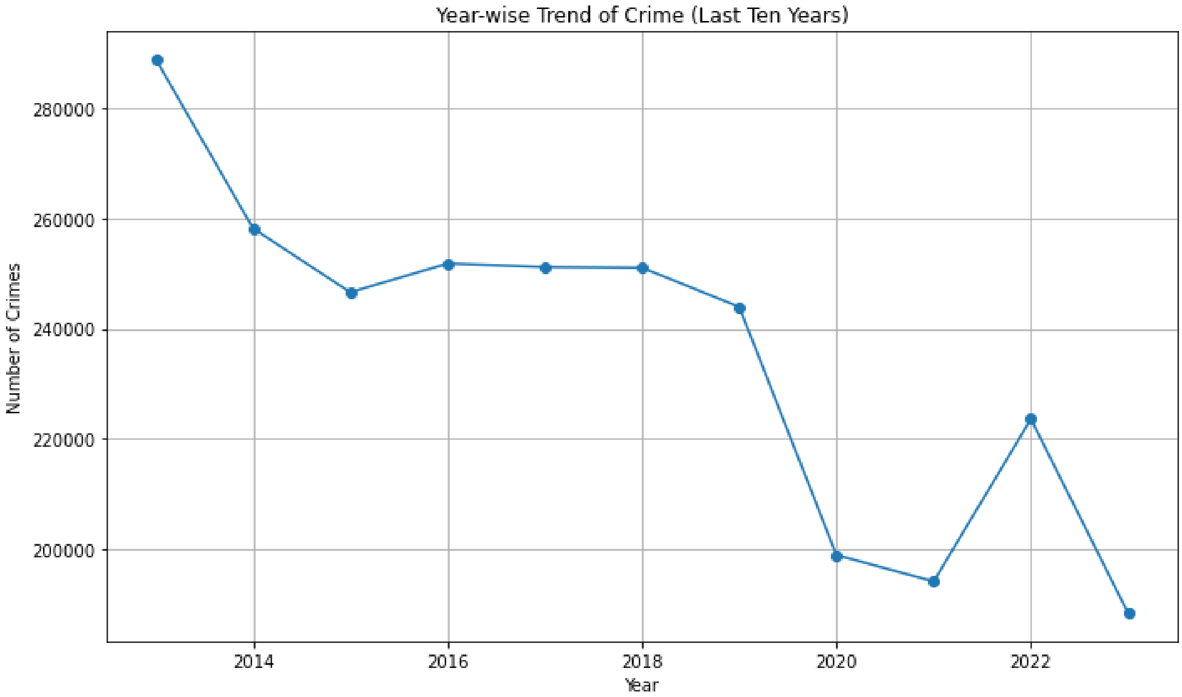
In [13]:

```
# Assuming 'ch' is your DataFrame containing crime data
ch.createOrReplaceTempView("crime_data")
x = sparkSession.sql("""
    SELECT hour(to_timestamp(Date, 'MM/dd/yyyy hh:mm:ss a')) as Hour, COUNT(*) as Cr
    FROM crime_data
    GROUP BY Hour
    ORDER BY CrimeCount DESC
""")
x.show()
most_common_hour = x.first()
print(f"The hour with the highest crime count is {most_common_hour['Hour']} with {mo
```

```
+----+----------+
|Hour|CrimeCount|
+----+----------+
|  12|    152211|
|   0|    146922|
|  18|    145076|
|  19|    144104|
|  15|    141962|
|  17|    139085|
|  20|    138103|
|  16|    137078|
|  14|    129623|
|  21|    128869|
|  22|    126759|
|  13|    123346|
|  11|    117103|
|   9|    115080|
|  10|    113576|
|  23|    107313|
|   8|     87834|
|   1|     80938|
|   2|     70229|
|   7|     61583|
+----+----------+
only showing top 20 rows


[Stage 33:=============================================>           (11
+ 3) / 14]

The hour with the highest crime count is 12 with 152211 crimes.
```

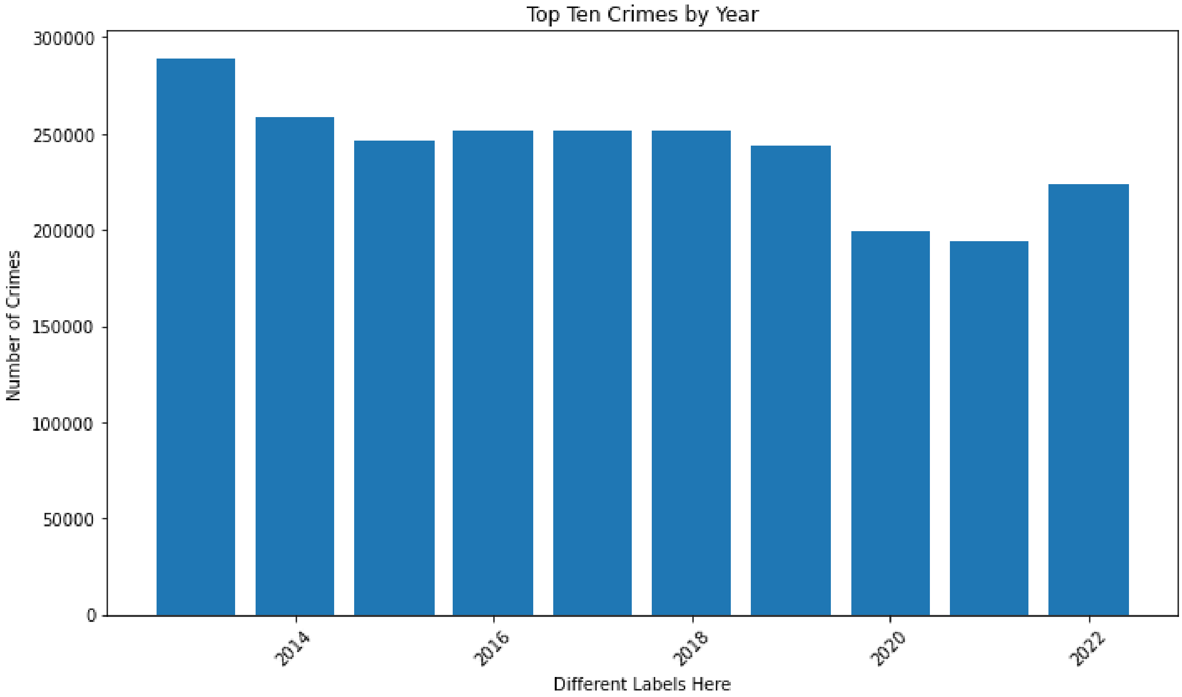
In [14]:

```
import pandas as pd
import matplotlib.pyplot as plt

current_year = F.year(F.current_date())
filtered_data = ch.filter((year("Date") >= current_year - 10) & (year("Date") <= cur
yearly_crime_count = filtered_data.groupBy(year("Date").alias("Year")).agg(F.count('
yearly_crime_count_pandas = yearly_crime_count.toPandas()
yearly_crime_count_pandas = yearly_crime_count_pandas.sort_values(by="Year")

plt.figure(figsize=(10, 6))
plt.plot(yearly_crime_count_pandas['Year'], yearly_crime_count_pandas['Crimes'], mar
plt.xlabel('Year')
plt.ylabel('Number of Crimes')
plt.title('Year-wise Trend of Crime (Last Ten Years)')
plt.grid(True)
plt.tight_layout()
plt.show()
```



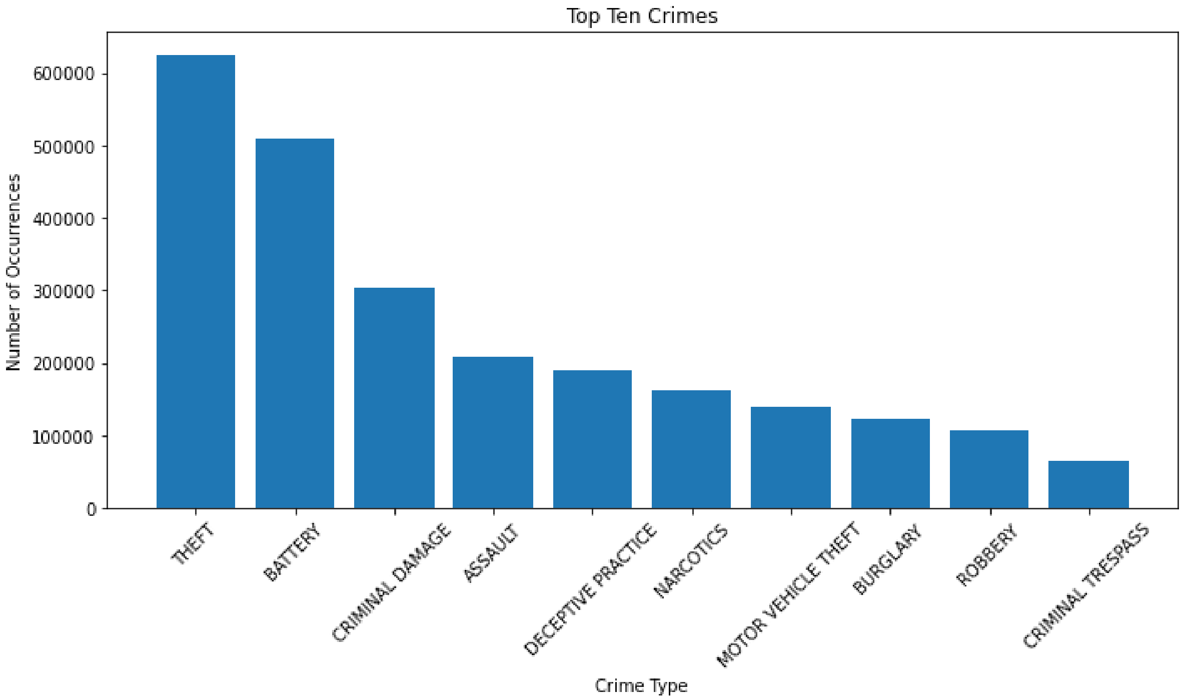
In [15]:

```
import pandas as pd
import matplotlib.pyplot as plt

yearly_crime_count_pandas = yearly_crime_count.toPandas()

top_ten_crimes = yearly_crime_count_pandas.nlargest(10, 'Crimes')

plt.figure(figsize=(10, 6))
plt.bar(top_ten_crimes['Year'], top_ten_crimes['Crimes'])
plt.xlabel('Different Labels Here')
plt.ylabel('Number of Crimes')
plt.title('Top Ten Crimes by Year')
plt.xticks(rotation=45)
plt.tight_layout()

plt.show()
```



In [16]:

```
import pandas as pd
import matplotlib.pyplot as plt

crime_counts = ch.groupBy("Primary Type").count()
top_ten_crimes = crime_counts.orderBy("count", ascending=False).limit(10)
top_ten_crimes_pandas = top_ten_crimes.toPandas()

plt.figure(figsize=(10, 6))
plt.bar(top_ten_crimes_pandas['Primary Type'], top_ten_crimes_pandas['count'])
plt.xlabel('Crime Type')
plt.ylabel('Number of Occurrences')
plt.title('Top Ten Crimes')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```


Top Ten Crimes
Number of Occurrences
THEFT
BATTERY
CRIMINAL DAMAGE
ASSAULT
DECEPTIVE PRACTICE
NARCOTICS
MOTOR VEHICLE THEFT
BURGLARY
ROBBERY
CRIMINAL TRESPASS
Crime Type