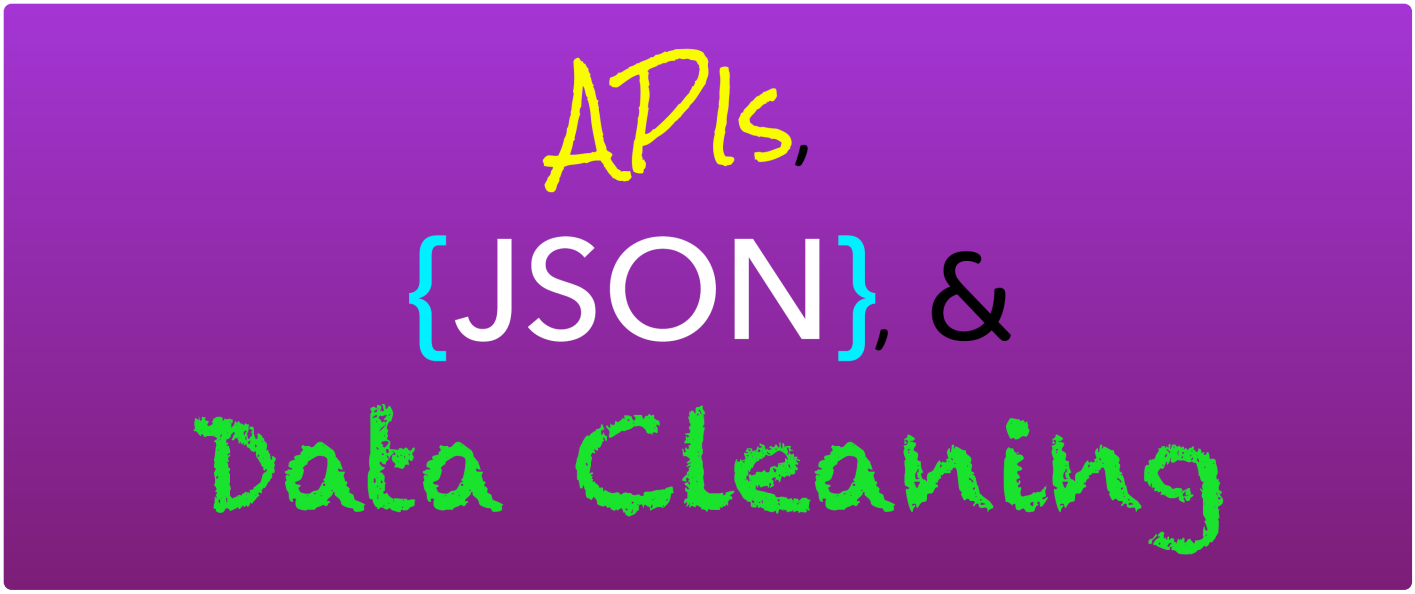


APIs, JSON files, and Data Clearning

~ Evan Marie Carr

FBI Most Wanted API:

- does not require an api key
- has very little documentation aside from a few examples
- fairly simple and straight forward

```
import pandas as pd
import requests
import json
from IPython.display import HTML
import numpy as np
pd.options.display.max_columns = 60
```

Importing Data:

These are the specific methods used below (each has linked documentation):

- [Requests Library Documetation]
- `requests.get` - sends a `get` request to the `http` specified for the parameters specified
- `requests.Response` - the object data type returned when using `requests.get()`
- `json.loads()` - used to parse JSON data and convert it to a Python dictionary
- `response.content` - returns the entire contents of the query

Example Searches from FBI Most Wanted Site:

- These search examples are the extent of the documentation the FBI Most Wanted website gives as documentation for how to use its API

```
# Data from Atlanta field office
response = requests.get('https://api.fbi.gov/wanted/v1/list', params={
    'field_offices': 'atlanta'
})

data = json.loads(response.content)
print("From the Atlanta field office: ", data['total'])
print(data['items'][0]['title'], "\n")

# Second page of data from entire list
response = requests.get('https://api.fbi.gov/wanted/v1/list', params={
    'page': 2
})

data = json.loads(response.content)
print("Page No.: ", data['page'])
print(data['items'][0]['title'], "\n")

# ---------------------------------------------------------------------- #

# Entire list, which is imported only 1 page at a time
response = requests.get('https://api.fbi.gov/wanted/v1/list')
data = json.loads(response.content)

database_length = data['total']

print("Length of entire most wanted list: ", data['total'])
print(data['items'][0]['title'], "\n")
```

```
From the Atlanta field office:  13
DIEGO TREJO

Page No.:  2
KRISTIN DENISE SMART

Length of entire most wanted list:  957
JEANINE DE RIDDERE
```

JSON data before converted to Pandas:

```
data['items'][0]
```

```
{'scars_and_marks': None,
```

'warning_message': None,
'modified': '2022-12-11T00:02:59+00:00',
'hair_raw': 'Brown',
'title': 'JEANINE DE RIDDERE',
'race': 'white',
'possible_countries': None,
'remarks': ' Jeanine De Riddere speaks English and may speak other languages. She has dual citizenship in Belgium and the Democratic Republic of Congo. She may travel to Dubai, United Arab Emirates and Belgium. ',
'person_classification': 'Accomplice',
'uid': '33202d83a9877c6ae8953b018de15057',
'nationality': 'Congolese',
'url': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere',
'publication': '2012-02-07T07:00:00',
'legat_names': None,
'hair': 'brown',
'eyes': 'brown',
'build': None,
'age_min': None,
'weight': '130 to 135 pounds (approximately 59 kg)',
'field_offices': ['miami'],
'details': None,
'weight_min': None,
'path': '/wanted/parental-kidnappings/jeanine-deriddere',
'languages': None,
'subjects': ['Parental Kidnapping'],
'age_range': None,
'possible_states': None,
'status': 'na',
'eyes_raw': 'Brown',
'place_of_birth': 'Democratic Republic of Congo',
'coordinates': [],
'race_raw': 'White',
'sex': 'Female',
'weight_max': None,
'description': 'International Parental Kidnapping',
'occupations': None,
'reward_min': 0,
'files': [{'name': 'English',
'url': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/download.pdf'}],
'dates_of_birth_used': ['April 24, 1955'],
'age_max': None,
'caution': ' <a data-urltype="/view" data-linktype="external" href="https://www.fbi.gov/wanted/parental-kidnappings/leslie-delbecq" data-val="https://www.fbi.gov/wanted/parental-kidnappings/leslie-delbecq">Leslie Delbecq and her mother, Jeanine De Riddere, are wanted for their alleged involvement in the kidnapping of Leslie Delbecq\'s daughter, <a data-urltype="/view" data-linktype="external" href="https://www.fbi.gov/wanted/parental-kidnappings/leslie-

delbecq/gabrielle-dahm" data-val="https://www.fbi.gov/wanted/parental-kidnappings/leslie-delbecq/gabrielle-dahm">Gabrielle Dahm, from Broward County, Florida, in 2010. Leslie Delbecq is the ex-wife of Christopher Dahm, Gabrielle\'s biological father. In January 2010, during a court hearing in Florida, Delbecq and Dahm were awarded joint custody of Gabrielle. \r\n \xa0 \r\n However, it is alleged that Leslie Delbecq and Jeanine De Riddere arranged for Gabrielle to be taken from Florida on August 2, 2010, and arrive in Abu Dhabi, United Arab Emirates, on August 4, 2010. All of their tickets to Abu Dhabi allegedly were purchased through an airline employee. On August 4, 2010, Leslie Delbecq failed to return Gabrielle to her father, Christopher Dahm, as stated in the Broward County Court order. Gabrielle is believed to have been moved to Abu Dhabi in violation of the court order that denied Leslie Delbecq\'s request to relocate to Abu Dhabi with Gabrielle, and stated that Gabrielle is to remain in the United States. \r\n \xa0 \r\n On June 21, 2011, Leslie Delbecq and Jeanine De Riddere were indicted for international parental kidnapping by a Federal Grand Jury for the United States District Court, Southern District of Florida. Federal warrants were issued for their arrests. ',
 'additional_information': None,
 'suspects': None,
 'height_max': None,
 'aliases': ['Jeanine Delbecq', 'Jeanine C. De Riddere', 'Jeanine C. Delbecq'],
 'height_min': None,
 'ncic': 'W762967209',
 'reward_max': 0,
 'complexion': None,
 'images': [{'thumb': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image/thumb',
   'original': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image',
   'caption': None,
   'large': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image/large'}],
 'locations': None,
 'reward_text': None,
 '@id': 'https://api.fbi.gov/@wanted-person/33202d83a9877c6ae8953b018de15057'}

Working with imported data, creating dataframe:

```
print("json.loads() has decoded the data to: ", type(json.loads(response.content)), '\r
```

```
json.loads() has decoded the data to:  <class 'dict'>
```

```
page_one_df = pd.DataFrame(data['items'])
```

Getting general knowledge of the data:

```
col_total = page_one_df.shape[1]
rows_total = page_one_df.shape[0]
pages_total = database_length // rows_total + 1

print(f"Each page of the JSON data has {rows_total} rows and {col_total} columns.")

print(f"The entire database has {database_length} entries.")

print(f"There are {pages_total} total pages of data in the database.\n")
```

```
Each page of the JSON data has 20 rows and 53 columns.
The entire database has 957 entries.
There are 48 total pages of data in the database.
```

Data column informtion:

- I will use these when creating the dataframe with a custom function
- The list database_cols will be used to initialize the new dataframe

```
page_one_df.columns
```

```
Index(['scars_and_marks', 'warning_message', 'modified', 'hair_raw', 'title',
       'race', 'possible_countries', 'remarks', 'person_classification', 'uid',
       'nationality', 'url', 'publication', 'legat_names', 'hair', 'eyes',
       'build', 'age_min', 'weight', 'field_offices', 'details', 'weight_min',
       'path', 'languages', 'subjects', 'age_range', 'possible_states',
       'status', 'eyes_raw', 'place_of_birth', 'coordinates', 'race_raw',
       'sex', 'weight_max', 'description', 'occupations', 'reward_min',
       'files', 'dates_of_birth_used', 'age_max', 'caution',
       'additional_information', 'suspects', 'height_max', 'aliases',
       'height_min', 'ncic', 'reward_max', 'complexion', 'images', 'locations',
       'reward_text', '@id'],
      dtype='object')
```

```
database_cols = ['details', 'languages', 'ncic', 'weight_max', 'path', 'reward_min',
        'coordinates', 'description', 'nationality', 'race_raw', 'sex',
        'additional_information', 'weight_min', 'possible_countries',
        'locations', 'complexion', 'build', 'hair', 'aliases', 'height_min',
        'uid', 'files', 'legat_names', 'reward_text', 'url', 'possible_states',
        'place_of_birth', 'height_max', 'race', 'scars_and_marks', 'hair_raw',
        'caution', 'remarks', 'occupations', 'age_min', 'publication',
        'age_range', 'person_classification', 'status', 'modified',
        'field_offices', 'dates_of_birth_used', 'subjects', 'images', 'age_max',
        'weight', 'title', 'eyes_raw', 'eyes', 'warning_message', 'suspects',
        'reward_max', '@id']
```

Custom function to create a dataframe by importing data page by page:

- Since the data comes in one page at a time, this function will combine all rows of data available into one dataframe, converting each page and concatenating each loop.

```
# function to get all pages

def get_wanted_data():
    page = 1
    entire_database = pd.DataFrame(columns = database_cols)

    for item in range((database_length // rows_total) + 1):
        current_response = requests.get('https://api.fbi.gov/wanted/v1/list', params={'
        current_data = json.loads(current_response.content)
        current_df = pd.DataFrame(current_data['items'])
        entire_database = pd.concat([entire_database, current_df])
        if page % 10 == 0:
            print(f"Pages up through page {page} have been added to database...")
        page += 1
    print("All pages have been added. Database complete.\n")
    return entire_database
```

```
entire_df = get_wanted_data()
```

```
Pages up through page 10 have been added to database...
Pages up through page 20 have been added to database...
Pages up through page 30 have been added to database...
Pages up through page 40 have been added to database...
All pages have been added. Database complete.
```

Completed raw dataframe information:

```
most_wanted = entire_df.copy()
```

```
total_rows = most_wanted.shape[0]
total_cols = most_wanted.shape[1]

print(f"The most_wanted dataframe contains {total_rows} rows and {total_cols} columns.\
```

```
The most_wanted dataframe contains 957 rows and 53 columns.
```

The raw data after converting from JSON data to Pandas dataframe:

- Upon overviw, it is clear there is much cleaning to be done

```
most_wanted.sample(5)
```

	details	languages	ncic	weight_max	path	reward_min	coordinates	de
5	<p>On June 24, 2013, Amy Wells Bridgeman left ...	None	None	180.0	/wanted/vicap/missing-persons/amy-wells-bridgeman	0	[]	Weld Carolina\r\r
6	<p>On Wednesday, September 23, 1998, 19 year-o...	None	None	150.0	/wanted/vicap/missing-persons/amber-lynn-wilde	0	[]	Septe 1998\r\nG W
13	<p>Investigators assigned to the FBI Richmond ...	None	None	NaN	/wanted/seeking-info/tahir-mahmud	0	[]	Victim\r\r Virginia\r\nS
16	<p>The Federal Bureau of Investigation's Albuq...	None	None	130.0	/wanted/seeking-info/zachariah-juwaun-shorty	0	[]	H Victim\r\nNen New Mexi
3	<p>On the night of October 11, 2001, at approx...	None	None	NaN	/wanted/seeking-info/thomas-crane-wales	1000000	[]	Victim\r Washington\r\n

```
most_wanted.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 957 entries, 0 to 16
Data columns (total 53 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   details                 547 non-null    object
 1   languages               87 non-null     object
 2   ncic                    259 non-null    object
 3   weight_max              627 non-null    float64
 4   path                    957 non-null    object
 5   reward_min              957 non-null    object
 6   coordinates             957 non-null    object
 7   description             957 non-null    object
 8   nationality             397 non-null    object
```

```
9   race_raw                713 non-null    object
10  sex                     797 non-null    object
11  additional_information  22 non-null     object
12  weight_min              627 non-null    float64
13  possible_countries      113 non-null    object
14  locations               4 non-null      object
15  complexion              37 non-null     object
16  build                   68 non-null     object
17  hair                    733 non-null    object
18  aliases                 403 non-null    object
19  height_min              637 non-null    float64
20  uid                     957 non-null    object
21  files                   957 non-null    object
22  legat_names             7 non-null      object
23  reward_text             375 non-null    object
24  url                     957 non-null    object
25  possible_states         159 non-null    object
26  place_of_birth          472 non-null    object
27  height_max              637 non-null    float64
28  race                    711 non-null    object
29  scars_and_marks         273 non-null    object
30  hair_raw                744 non-null    object
31  caution                 405 non-null    object
32  remarks                 560 non-null    object
33  occupations             179 non-null    object
34  age_min                 166 non-null    float64
35  publication             957 non-null    object
36  age_range               171 non-null    object
37  person_classification   957 non-null    object
38  status                  957 non-null    object
39  modified                957 non-null    object
40  field_offices           736 non-null    object
41  dates_of_birth_used     574 non-null    object
42  subjects                957 non-null    object
43  images                  957 non-null    object
44  age_max                 166 non-null    float64
45  weight                  644 non-null    object
46  title                   957 non-null    object
47  eyes_raw                706 non-null    object
48  eyes                    695 non-null    object
49  warning_message         287 non-null    object
50  suspects                8 non-null      object
51  reward_max              957 non-null    object
```

```
 52  @id                     957 non-null    object
dtypes: float64(6), object(47)
memory usage: 403.7+ KB
```

Data cleaning:

- The raw data is very unusable for analysis at first importing
- The next steps will remedy these issues one at a time

Columns to retain:

- There are a number of columns that will not be useful for investigation.
- The following columns are the ones that will be used in this data investigation

```
keepers = ['title', 'images', 'field_offices', 'files', 'details', 'subjects', 'nationa
```

```
most_wanted = most_wanted[keepers]
```

```
total_rows = most_wanted.shape[0]
total_cols = most_wanted.shape[1]

print(f"The entire dataframe now contains {total_rows} rows and {total_cols} columns.\n
```

```
The entire dataframe now contains 957 rows and 12 columns.
```

`title` (name) column:

Check that no `title` (name) values missing:

```
print("There are", most_wanted.title.isna().sum(), "missing values in the title column.
```

```
There are 0 missing values in the title column.
```

Rename `title` column to name:

- `df.rename()` - used to rename the columns of a dataframe. Provide `columns = {}` and a dictionary with the old names as keys and new names as values.

```
most_wanted.rename(columns = {'title':'name'}, inplace = True)
```

Parse `files` column for poster:

- The `files` column contains a list with a dictionary that contains the language of a poster and then url link for that poster.

```
print('The values in the files column are in', (type(most_wanted.files.iloc[0])), 'form
```

```
The values in the files column are in <class 'list'> format.
```

The current breakdown of the `files` column fields:

- `df.iloc[]` - used to locate a values in a dataframe by integer indexing

```
print(type(most_wanted.files.iloc[0]), '--', most_wanted.files.iloc[0])
print(type(most_wanted.files.iloc[0][0]), '--', most_wanted.files.iloc[0][0])
print(type(most_wanted.files.iloc[0][0]['url']), '--', most_wanted.files.iloc[0][0]["ur
```

```
<class 'list'> -- [{'name': 'English', 'url': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/download.pdf'}]
<class 'dict'> -- {'name': 'English', 'url': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/download.pdf'}
<class 'str'> -- https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/download.pdf
```

Extracting the url and saving in a new `poster` column:

- First, I will loop through the `files` column and isolate the link path for the poster
- Then I will save value in the field as just the poster path
- Finally, I rename the column to reflect that it contains just the poster path

```
for idx, value in enumerate(most_wanted['files']):
    link = value[0]['url']
    most_wanted.iloc[idx]['files'] = link

most_wanted.rename(columns = {'files': 'poster'}, inplace = True)
```

```
most_wanted.sample(5)
```

	name	images	field_offices	poster
12	CARLA VICENTINI	[{'thumb': 'https://www.fbi.gov/wanted/kidnap/...	[newark]	https://www.fbi.gov/wanted/kidnap/carla-vicent...

	name	images	field_offices	poster
11	SARAH BURTON	[{'thumb': 'https://www.fbi.gov/wanted/kidnap/...	[kansascity]	https://www.fbi.gov/wanted/kidnap/sarah-burton...
2	KRISTEN MODAFFERI	[{'thumb': 'https://www.fbi.gov/wanted/kidnap/...	[sanfrancisco]	https://www.fbi.gov/wanted/kidnap/kristen-moda...
17	ISMAIL SHALASH	[{'thumb': 'https://www.fbi.gov/wanted/wcc/ism...	[cincinnati]	https://www.fbi.gov/wanted/wcc/ismail-shalash/...
17	BALDOMERO BARRIENTOS BANUELOS	[{'thumb': 'https://www.fbi.gov/wanted/murders...	[losangeles]	https://www.fbi.gov/wanted/murders/baldomero-b...

Parse `images` column to keep thumnail only:

- The `images` column contains a list with a dictionary a number of different images of each individual
- For the purposes of this project, I will retain just the thumbnail of each image
- I will then rename the `images` column to just "image" to reflect that it holds one image of each individual

The nested layers inside the `images` fileds:

```
print(type(most_wanted.images.iloc[0]), '--', most_wanted.images.iloc[0], "\n")
print(type(most_wanted.images.iloc[0][0]), '--', most_wanted.images.iloc[0][0], "\n")
print(type(most_wanted.images.iloc[0][0]['thumb']), '--', most_wanted.images.iloc[0][0]
```

```
<class 'list'> -- [{'thumb': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image/thumb', 'original': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image', 'caption': None, 'large': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image/large'}]

<class 'dict'> -- {'thumb': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image/thumb', 'original': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image', 'caption': None, 'large': 'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image/large'}

<class 'str'> -- https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image/thumb
```

Creating an "image" column that contains just the thumbnail and dropping "images" column:

```
for idx, value in enumerate(most_wanted['images']):
    image_link = value[0]['original']
    most_wanted.iloc[idx]['images'] = image_link
```

```
most_wanted.rename(columns = {'images': 'image'}, inplace = True)
```

Example image from first row of dataframe:

- This format can now be viewed within the notebook using the HTML module

```
most_wanted.iloc[0].image
```

'https://www.fbi.gov/wanted/parental-kidnappings/jeanine-deriddere/@@images/image'

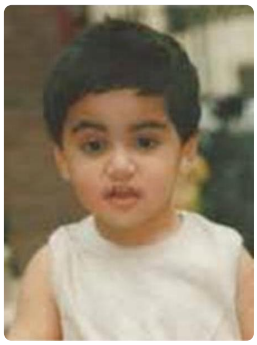
Function to give the HTML module a working path to display images:

```
def path_to_image_html(path):
    return '<img src="'+ path + '" width="125" >'
```

Examples from the dataframe

```
HTML(most_wanted[0:6][['name', 'image']].to_html(escape=False, formatters=dict(image=pa
```

	name	image
0	JEANINE DE RIDDERE	
1	FRANCINA DACANAY FERNANDEZ	

	name	image
2	MICHAEL ALEXANDER REYES	
3	MOHAMMAD HUSSAIN METLA, JR.	
4	MARIA BELEN FRANCESCONI	
5	FLORA MAHMOOD	

Missing persons (data investigation):

Search `details` column for missing persons categorization:

- This database contains not only criminals that the FBI is looking for, but also missing persons of great interest.
- Beause there are still tricky values in some of the fields in the `details` column that would hinder a search, all of the fields must be converted to strings
- `df.column.astype()` - converts all the contents of the column to string values

- The following masks will filter out the majority of common phrases that are involved in the `details` column of a row representing a missing person
- `df.loc[]` - locates values in a dataframe based upon labels and is very useful with masks.

```
most_wanted.details = most_wanted.details.astype(str)
missing_person_mask = most_wanted.details.str.contains('missing person')
went_missing_mask = most_wanted.details.str.contains('went missing')
has_been_missing_mask = most_wanted.details.str.contains('has been missing')
foul_play_mask = most_wanted.details.str.contains('foul play')
reported_missing_mask = most_wanted.details.str.contains('reported_missing')
```

```
missing_df = most_wanted.loc[missing_person_mask |
                             went_missing_mask |
                             has_been_missing_mask |
                             foul_play_mask]
```

```
missing_df.details[2]
```

```
'<p>Cydney Mizell, an American Non-Governmental Organization worker, has been missing since January of 2008, when she was abducted along with her driver by unidentified gunmen from Kandahar City, Afghanistan.\xa0 Mizell was likely killed by her captors in 2008, and may have been buried in the Kandahar area.\xa0 Mizell spoke fluent Pashto after living and working in Kandahar for three years empowering Afghan women and children.</p>\r\n<p>\xa0</p>'
```

```
print('There are', len(missing_df), 'out of', len(most_wanted), 'records that are very
```

```
There are 37 out of 957 records that are very likely missing persons.
```

`dates_of_birth_used` column to datetime:

- The `dates_of_birth_used` column contains `list` values, many with only one date, but some with multiple.
- These dates should be converted to `datetime` objects to be more useable

```
print('The birthdate columns is currently in', type(most_wanted.dates_of_birth_used[0])
```

```
The birthdate columns is currently in <class 'pandas.core.series.Series'> format.
```

Parsing the `dates_of_birth_used` column and convert all birthdates to datetime:

- Because the birthdates are in list format in the fields for each record, it is not possible to pass the entire column to `pd.to_datetime()`. The lists of multiple dates must first be unpacked with `pd.explode()`
- `pd.explode()` - Transform each element of a list-like to a row, replicating index values.

- The resulting dataframe with have multiple rows for records with multiple birthdates listed, however the same records will keep the same unique id / index.

```
most_wanted = most_wanted.explode('dates_of_birth_used')
```

```
most_wanted.dates_of_birth_used = pd.to_datetime(most_wanted.dates_of_birth_used, error
```

```
most_wanted.rename(columns = {'dates_of_birth_used': 'birthdates_used'}, inplace = True
```

```
most_wanted[['name', 'birthdates_used', 'subjects']].sample(5)
```

	name	birthdates_used	subjects
15	ALI HAMAD A ALZABARAH	1983-09-08	[Counterintelligence]
1	JOHN DOE - LAKE BARKLEY, KENTUCKY	NaT	[ViCAP Unidentified Persons]
5	UNKNOWN INDIVIDUAL - JOHN DOE 41	NaT	[ECAP]
3	DAVID WILLIAMS	1962-10-09	[Kidnappings and Missing Persons]
19	JOSEPH WAYNE McCOOL	1947-10-03	[White-Collar Crime]

`subjects` (cateogirs) column:

- The `subjects` column mainly contains the offense or offenses that an individual is charged with
- Many rows contain more than one offense
- For data analysis and comparison, it would be helpful to be able to, for example, use `df.column.value_counts()` to see how many of each offese is present.
- This again calls for `pd.explode()` to expand those lists
- This column also would make a bit more sense if it was named "category", so I will do that here as well.

```
most_wanted = most_wanted.explode('subjects')
```

```
most_wanted = most_wanted.rename(columns = {'subjects': 'category'})
```

```
most_wanted.category.value_counts().head(10)
```

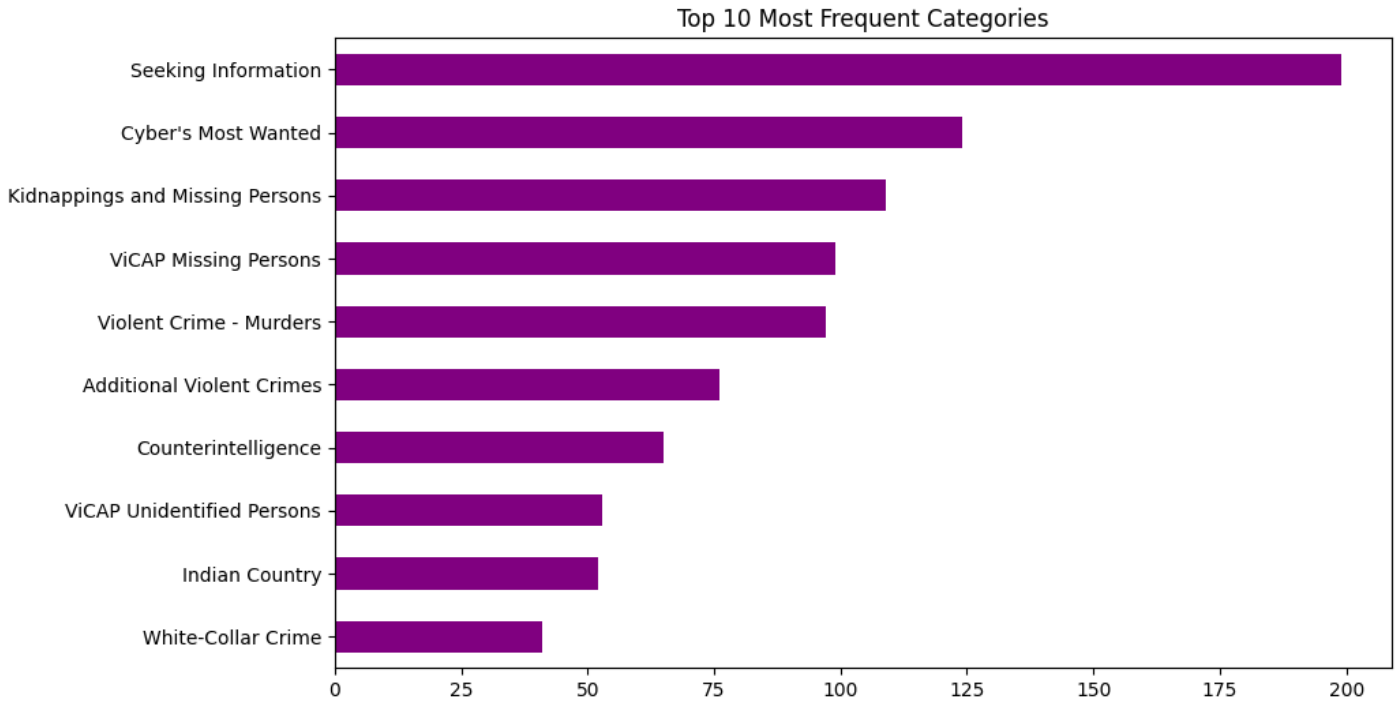
```
Seeking Information                199
Cyber's Most Wanted                124
Kidnappings and Missing Persons    109
ViCAP Missing Persons               99
Violent Crime - Murders             97
Additional Violent Crimes           76
Counterintelligence                 65
ViCAP Unidentified Persons          53
```

```
Indian Country                    52
White-Collar Crime                41
Name: category, dtype: int64
```

Missing Persons:

Now that this information has been parsed so that we can get a better look at it, we can now see that missing persons is a category with 99 entries

```
most_wanted.category.value_counts().head(10).sort_values().plot(kind = 'barh', title =
```



Field Offices:

- Again, some of these fields contain multiple values
- `pd.explode()` will once again expand these to their own rows of data
- Looking at the exploded value counts, it is clear that the field office names are not in the most useful formats
- I will first capitalize the names of the field offices
- Then I will replace the field office names that are still problematic by providing a dictionary with the correct versions

```
most_wanted = most_wanted.explode('field_offices')
```

```
most_wanted.field_offices.value_counts()
```

```
newyork          117
washingtondc      95
albuquerque       82
newark            56
```

losangeles	55
miami	54
sacramento	31
portland	31
philadelphia	29
sanfrancisco	28
boston	28
chicago	27
baltimore	25
pittsburgh	24
atlanta	21
denver	21
omaha	20
houston	19
saltlakecity	19
phoenix	19
minneapolis	19
richmond	17
kansascity	15
charlotte	15
seattle	14
cleveland	13
indianapolis	10
sandiego	10
detroit	10
columbia	10
memphis	8
tampa	8
albany	8
littlerock	7
milwaukee	7
louisville	6
lasvegas	6
cincinnati	6
dallas	6
buffalo	6
stlouis	5
birmingham	5
oklahomacity	5
honolulu	5
elpaso	4
mobile	4
neworleans	4
sanjuan	4
jackson	3
norfolk	2
sanantonio	2
newhaven	2

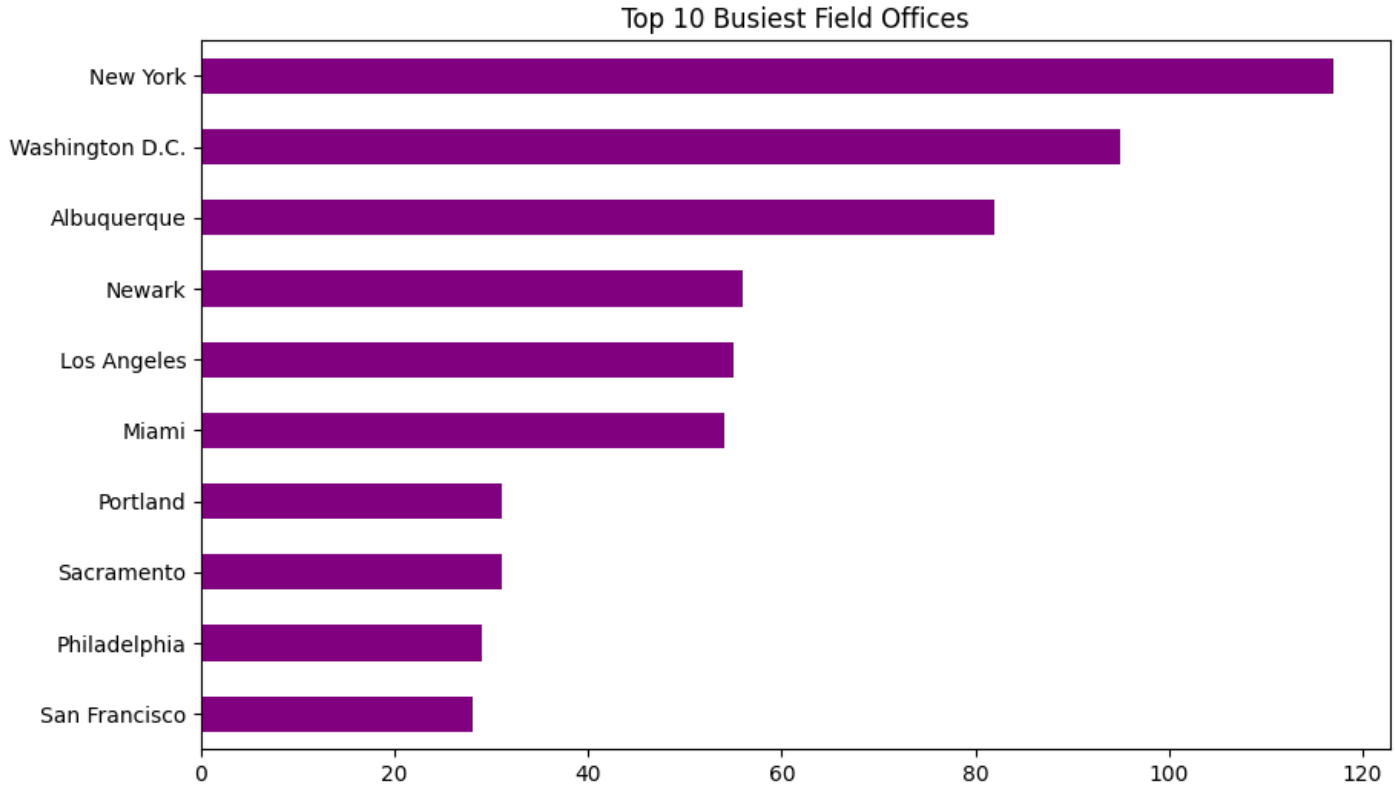
```
knoxville         1
Name: field_offices, dtype: int64
```

```
most_wanted['field_offices'] = most_wanted['field_offices'].str.capitalize()

bad_field_names = {
    'Newyork': 'New York',
    'Washingtondc': 'Washington D.C.',
    'Sanfrancisco': 'San Francisco',
    'Losangeles': 'Los Angeles',
    'Saltlakecity': 'Salt Lake City',
    'Kansascity': "Kansas City",
    'Sandiego': 'San Diego',
    'Littlerock': "Little Rock",
    'Lasvegas': 'Las Vegas',
    'Stlouis': 'St. Louis',
    'Oklahomacity': 'Oklahoma City',
    'Elpaso': 'El Paso',
    'Neworleans': 'New Orleans',
    'Sanjuan': 'San Juan',
    'Sanantonio': 'San Antonio',
    'Newhaven': 'New Haven'
}

most_wanted.field_offices = most_wanted.field_offices.apply(lambda x: (x in bad_field_r
```

```
most_wanted.field_offices.value_counts().head(10)
```

```
New York           117
Washington D.C.     95
Albuquerque         82
Newark              56
Los Angeles         55
Miami               54
Sacramento          31
Portland            31
Philadelphia        29
San Francisco       28
Name: field_offices, dtype: int64
```

```
most_wanted.field_offices.value_counts().head(10).sort_values().plot(kind = 'barh', tit
```



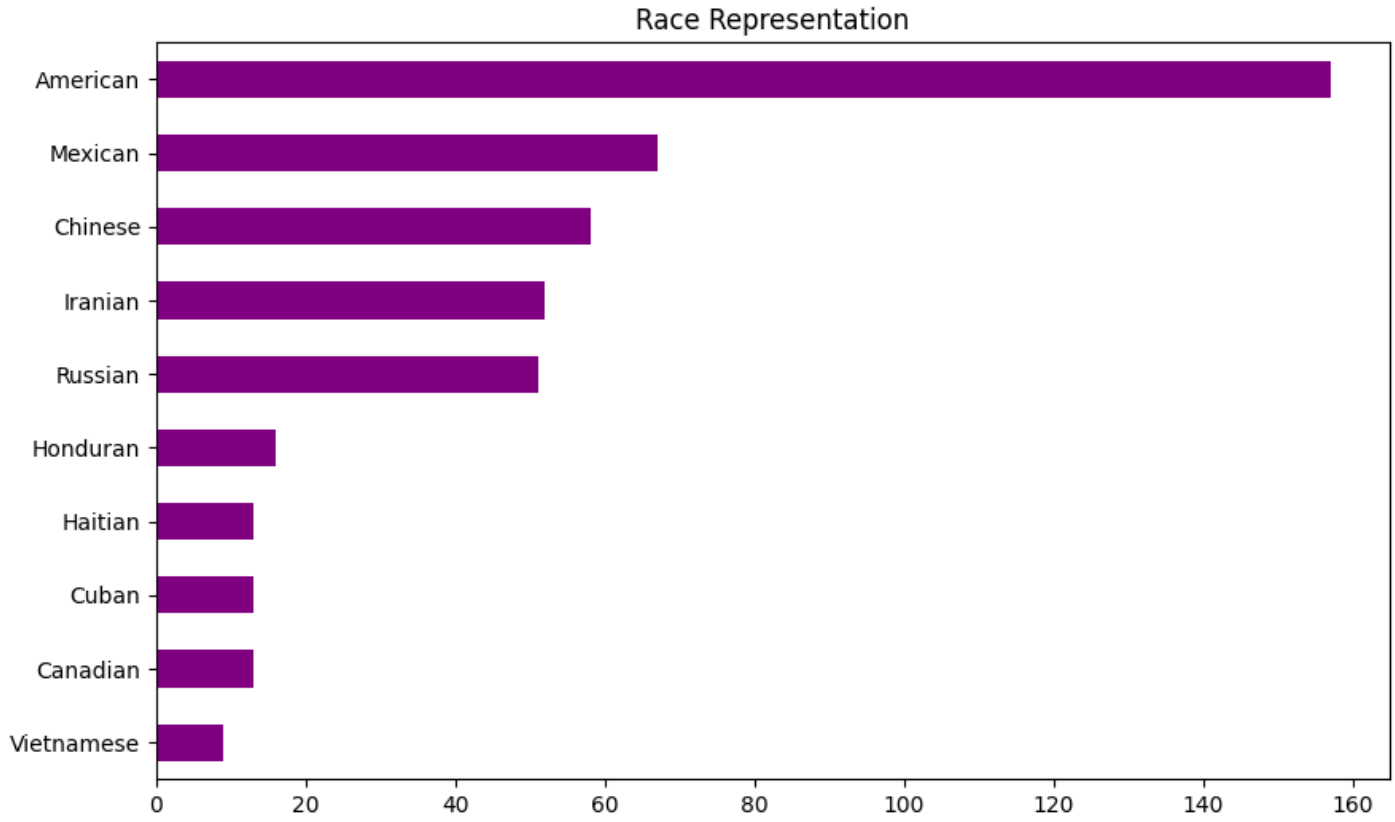
Nationality Column:

- The nationality looks good for the most part!

```
most_wanted.nationality.value_counts().head(10)
```

```
American      157
Mexican        67
Chinese        58
Iranian        52
Russian        51
Honduran       16
Canadian       13
Cuban          13
Haitian        13
Vietnamese      9
Name: nationality, dtype: int64
```

```
most_wanted.nationality.value_counts().head(10).sort_values().plot(kind = 'barh', title
```



Sex column:

- While it is unfortunate to have any missing data, in the columns left to clean, any values marked None or just left empty will be filled with NaN to more accurately indicate that they are unknown values
- NaN is automatically more easily handled in Pandas than a variety of other ways of indicating unknown information.

```
most_wanted.sex.value_counts(dropna = False)
```

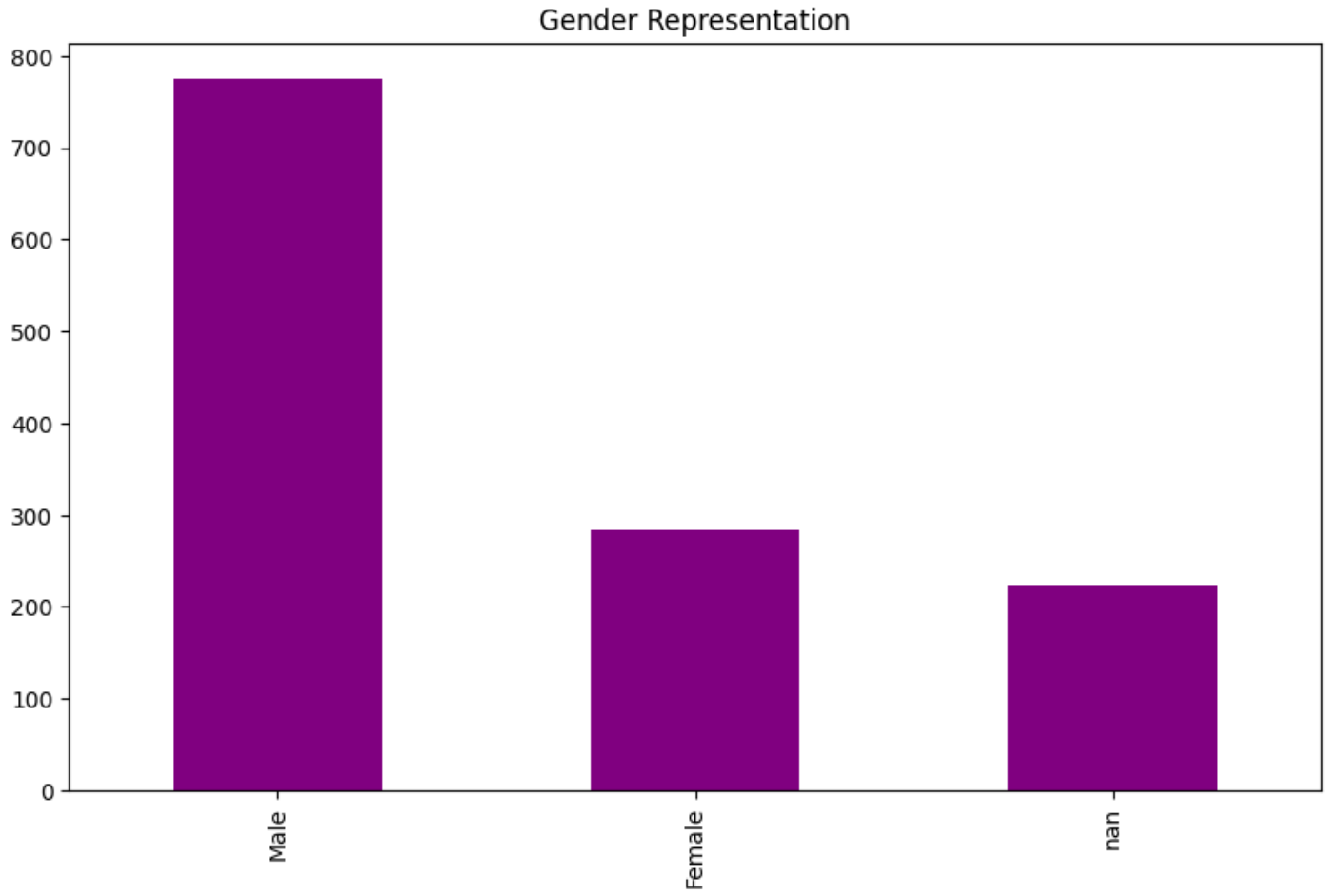
```
Male      775
Female    284
None      195
           28
Name: sex, dtype: int64
```

```
most_wanted['sex'].replace(['', None], np.nan, inplace = True)
```

```
most_wanted.sex.value_counts(dropna = False)
```

```
Male      775
Female    284
NaN       223
Name: sex, dtype: int64
```

```
most_wanted.sex.value_counts(dropna = False).sort_values(ascending = False).plot(kind =
```



Race column:

- This is a challenging column many unique combinations of race
- Let's try to clean this up

```
most_wanted.race_raw.value_counts(dropna = False)
```

```
White                                                  414
None                                                   311
White (Hispanic)                                       194
Black                                                  112
Native American                                         99
Asian                                                   88
Black (Hispanic)                                         8
White (Central Asian)                                    7
Hispanic                                                 6
Biracial (Asian and White)                               5
                                                         5
White (Middle Eastern)                                   3
Biracial (Native American and White)                     3
White or Hispanic                                        2
Asian (Pacific Islander)                                 2
Native American/Alaskan Native                           2
```

```
Asian (Vietnamese Descent)                                                  2
Native American (enrolled member of Eastern Shoshone tribe)                 2
White - Possibly Hispanic                                                   1
White (Hispanic Descent)                                                    1
White/Hispanic or Latino                                                    1
Black or Hispanic                                                           1
Hispanic (Possibly)                                                         1
Possibly bi-racial                                                          1
Unknown                                                                     1
White/Asian                                                                 1
White, possibly Hispanic                                                    1
White or White (Hispanic)                                                   1
White (Indian)                                                              1
Hispanic or Latino                                                          1
Black (light complexion or mixed race)                                      1
Biracial (Black and White)                                                  1
White (Kuwaitian/Lebanese with darker complexion than photographed above)   1
White (Kuwaitian with darker complexion than photographed above)            1
White (Persian)                                                             1
Name: race_raw, dtype: int64
```

Steps to clean race column:

- First, any race fields that should be marked NaN, indicating an unknown value, will be fixed
- Second, it is important to make all races lowercase so that the masking and filtering that follows will be effective
- Third, it is important to create some masks for filtering and try to consolidate as many like fields as possible
- The masks should be applied in a particular order as to create the most accurate labeling, for example a field that says "white and hispanic" should be labeled as hispanic before filtering for white to retain as much accuracy as possible
- The latter will be applied for other races as well

```
most_wanted.race_raw.replace(['', 'Unknown', None, ], np.nan, inplace = True)
```

Making text lower case:

```
most_wanted.race_raw = most_wanted.race_raw.str.lower()
```

Creating masks for races:

```
hispanic_mask = most_wanted.race_raw.str.contains("hispanic") | most_wanted.race_raw.st
asian_mask = most_wanted.race_raw.str.contains("asian") | most_wanted.race_raw.str.cont
middle_eastern_mask = most_wanted.race_raw.str.contains("middle eastern") | most_wanted
                      most_wanted.race_raw.str.contains("kuwaitian") # The proper term i
black_mask = most_wanted.race_raw.str.contains("black", na=False)
native_american_mask = most_wanted.race_raw.str.contains("native american", na=False)
white_mask = most_wanted.race_raw.str.contains("white", na=False) | most_wanted.race_ra
```

Applying race masks:

- pd.df.mask() - replaces values where the mask condition is true.

```
most_wanted.race_raw = most_wanted.race_raw.astype(str)
most_wanted.race_raw = most_wanted.race_raw.mask(hispanic_mask, 'hispanic')
most_wanted.race_raw = most_wanted.race_raw.mask(asian_mask, 'asian')
most_wanted.race_raw = most_wanted.race_raw.mask(middle_eastern_mask, 'middle eastern')
most_wanted.race_raw = most_wanted.race_raw.mask(native_american_mask, "native americar
most_wanted.race_raw = most_wanted.race_raw.mask(black_mask, 'black')
most_wanted.race_raw = most_wanted.race_raw.mask(white_mask, 'white')
```

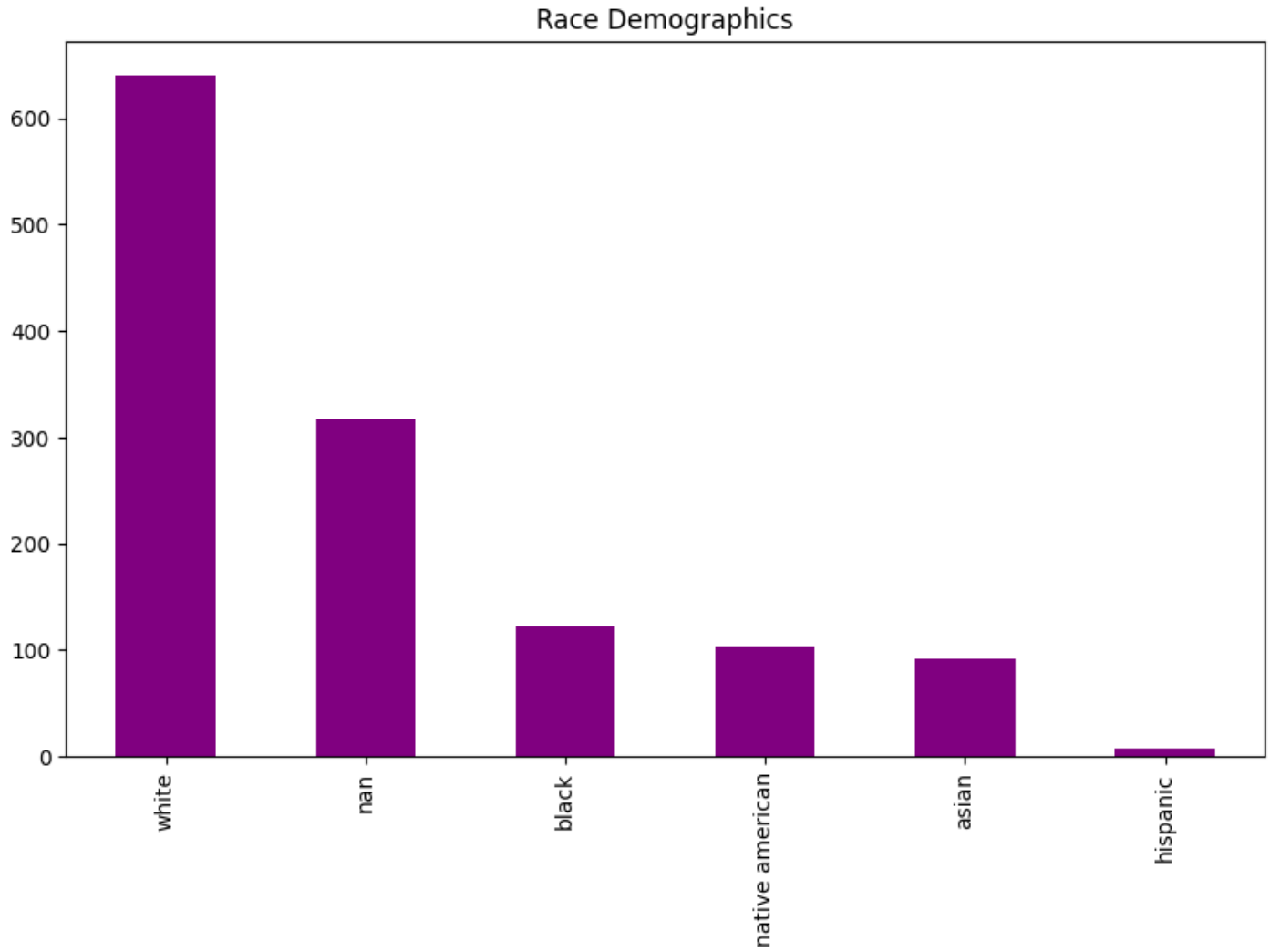
Race value counts after filtering:

```
most_wanted.race_raw.value_counts()
```

```
white              640
nan                317
black              122
native american     103
asian               92
hispanic             8
Name: race_raw, dtype: int64
```

Plotting the race demographics:

```
most_wanted.race_raw.value_counts().sort_values(ascending = False).plot(kind = 'bar', t
```



Warning message column:

- The warning message column contains mostly quite unique values
- First, I will put all text to lower case so that it is easier to work with
- I will create masks to summarize and categorize this data a bit more usefully
- I will apply the masks in order of priority, since some rows may contain more than one of the labels
- I will also rename the column so that it is just "warning"

```
most_wanted.warning_message = most_wanted.warning_message.str.lower()
most_wanted.warning_message.value_counts()
```

```
should be considered armed and dangerous
216
should be considered an international flight risk
75
should be considered an escape risk
25
should be considered armed and dangerous and an escape risk
21
should be considered armed and dangerous, an international flight risk, and an escape
```

```
risk                        21
should be considered armed and extremely dangerous
19
should be considered armed and dangerous and an international flight risk
13
should be considered armed and extremely dangerous and a high-risk arrest
3
these individuals should be considered an international flight risk
3
should be considered armed and  dangerous
3
should be considered armed and dangerous with violent tendencies
3
considered armed and extremely dangerous and an escape risk
3
charles martin vosseler should be considered armed and dangerous
3
should be considered a flight risk
3

3
should be considered dangerous and an escape risk
3
these individuals should be considered armed and dangerous, an international flight
risk, and an escape risk      2
should be considered armed and dangerous and a suicide risk
2
should be considered armed, dangerous, and an escape risk
2
should be considered armed and dangerous and an international escape risk
2
those responsible for this crime should be considered armed and dangerous
1
should be considered armed and extremely dangerous, with suicidal tendencies
1
should be considered armed and dangerous and a flight risk
1
should be considered armed and dangerous and may have violent tendencies
1
these individuals should be considered an international flight risk and an escape risk
1
these individuals should be considered international flight risks
1
bi-polar and may be in need of medications
1
Name: warning_message, dtype: int64
```

Warning message column masks:

```
armed_dangerous_mask = most_wanted.warning_message.str.contains("armed", na=False)
flight_risk_mask = most_wanted.warning_message.str.contains("flight", na=False) | \
                   most_wanted.warning_message.str.contains("international", na=False)
                   most_wanted.warning_message.str.contains("escape", na=False)
extremely_dangerous_mask = most_wanted.warning_message.str.contains("extremely", na=Fal
mental_health_mask = most_wanted.warning_message.str.contains("suicidal", na=False) | \
                     most_wanted.warning_message.str.contains("medications", na=False)
```

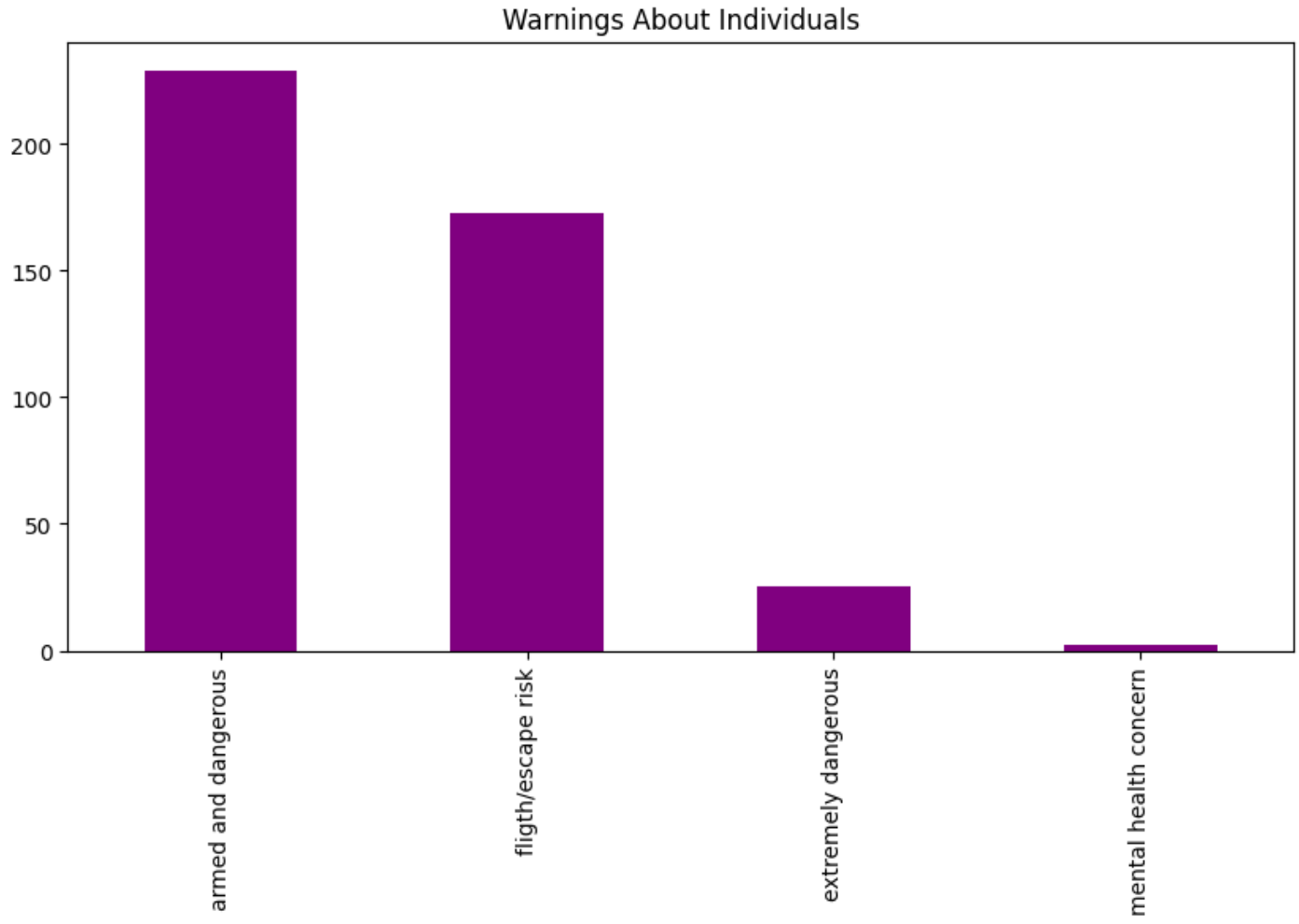
Applying the masks:

```
most_wanted.race_raw = most_wanted.race_raw.astype(str)
most_wanted.warning_message = most_wanted.warning_message.mask(armed_dangerous_mask, 'a
most_wanted.warning_message = most_wanted.warning_message.mask(flight_risk_mask, 'fligt
most_wanted.warning_message = most_wanted.warning_message.mask(extremely_dangerous_mask
most_wanted.warning_message = most_wanted.warning_message.mask(mental_health_mask, 'men
most_wanted.warning_message = most_wanted.warning_message.replace("", np.nan)
```

```
most_wanted.rename(columns = {"warning_message": "warning"}, inplace = True)
most_wanted.warning.value_counts()
```

```
armed and dangerous      229
fligth/escape risk       173
extremely dangerous       25
mental health concern      2
Name: warning, dtype: int64
```

```
most_wanted.warning.value_counts().sort_values(ascending = False).plot(kind = 'bar', ti
```



Reward text column:

- This column is very unique to each situation, so I will not affect the data here
- However perhaps it would be interesting to see a wordcloud for this column

```
print('There are', most_wanted.reward_text.value_counts().sum(), 'mostly unique values
```

```
There are 542 mostly unique values in the reward_text column.
```

Importing WordCloud and Matplotlib to display:

```
from wordcloud import WordCloud
import matplotlib.pyplot as plt
%matplotlib inline
```

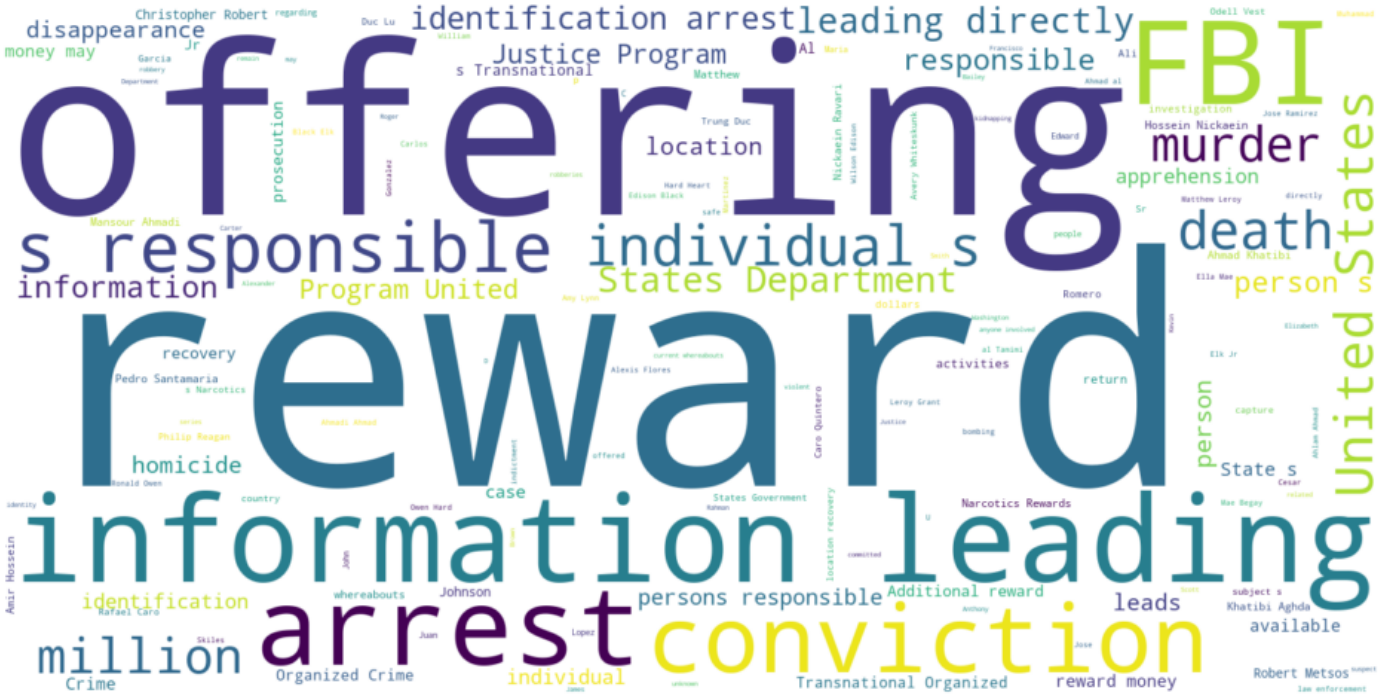
Creating the data and the wordcloud:

```
# creating the wordcloud corpus
reward_text = most_wanted.reward_text.dropna()
reward_corpus = ' '.join(reward_text)
reward_wordcloud = WordCloud(background_color = 'white',
```

```
                                    height=750, width=1500,
                                    max_words = 150).generate(reward_corpus)
```

Plotting the wordcloud:

```
plt.figure(figsize = (12, 7))
plt.imshow(reward_wordcloud, interpolation = 'bilinear')
plt.axis('off')
plt.show()
```



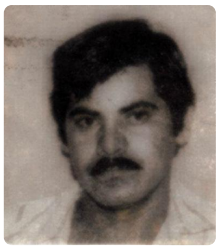
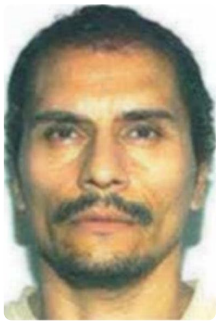
Investigating the cleaned data:

- Now that our data is quite clean, let's investigate a few aspects beyond what we have already seen
- For example, here I am extracting a random selection from the those considered to be most dangerous criminals, labeled "armed and dangerous"

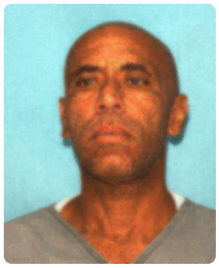
```
most_dangerous_mask = most_wanted.warning.str.contains("armed and dangerous", na=False)
most_dangerous = most_wanted.loc[most_dangerous_mask]
most_dangerous_examples = most_dangerous[['name', 'image', 'category', 'field_offices',
```

```
HTML(most_dangerous_examples.to_html(escape = False, formatters=dict(image=path_to_imag
```

	name	image	category	field_offices	warning

	name	image	category	field_offices	warning
2	ABDULLAH SHAIR KHAN		Seeking Information - Terrorism	Washington D.C.	armed and dangerous
18	LEO FREDERICK BURT		Domestic Terrorism	Milwaukee	armed and dangerous
16	CHARLES LEE HILL		Violent Crime - Murders	Albuquerque	armed and dangerous
0	JUAN DIOS GARZA		Violent Crime - Murders	Miami	armed and dangerous
12	D.C.-AREA HOTEL RAPIST		Seeking Information	Washington D.C.	armed and dangerous
3	JORGE RUEDA LANDEROS		Violent Crime - Murders	Baltimore	armed and dangerous

	name	image	category	field_offices	warning
7	OSCAR D. VEGA		Criminal Enterprise Investigations	Chicago	armed and dangerous
6	BAJRAM ASLLANI		Seeking Information	Charlotte	armed and dangerous
10	ALI ATWA		Most Wanted Terrorists	Washington D.C.	armed and dangerous
1	ZAHIDUL ISLAM		Additional Violent Crimes	Philadelphia	armed and dangerous
13	HECTOR MANUEL MURCIA-BRIZUELA		Violent Crime - Murders	Baltimore	armed and dangerous
10	JOSE EDUARDO ROJO-RIVERA		Violent Crime - Murders	Sacramento	armed and dangerous

	name	image	category	field_offices	warning
2	PEDRO SANTAMARIA		Additional Violent Crimes	Miami	armed and dangerous
16	JAMAINE HARRINGTON		Law Enforcement Assistance	Los Angeles	armed and dangerous
5	JULIO CESAR GUEVARA-MEJIA		Additional Violent Crimes	Sacramento	armed and dangerous