Exploratory Analysis with Python - Association of Tennis Professionals Top 1000 Singles Players

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1 Scraped the data from the Pepperstone ATP Rankings. Data current as of 01/07/2023. The website's table provides us with the player names, ranks, and ages, as well as the ATP points and tournaments played for the year. Also, each row of the website's table links to the player's individual profile, which must also be scraped to provide us with their year turned pro, weight, height, birthplace, playstyle, coach, and federation.

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import requests
from bs4 import BeautifulSoup as bs
import warnings
warnings.filterwarnings('ignore')
```

[ ]:
```
r = requests.get('https://www.atptour.com/en/rankings/singles?
  ↪rankRange=1-5000&rankDate=2023-01-02')
soup = bs(r.content)

table = soup.find('table')
table_headers = table.find_all('th')
columns = []

for table_header in table_headers:
    columns.append(table_header.get_text().strip())
```

[ ]:
```
table_rows = table.find_all('tr')[1:1001]
rows = []

for table_row in table_rows:
```

```
    cells = table_row.find_all('td')
    row = [cell.get_text().strip() for cell in cells]
    rows.append(row)
```

[ ]:
```
links = []

for table_row in table_rows:
    link = table_row.find('a')['href']
    links.append(link)
```

[ ]:
```
# I ran this iteratively instead of as is while constructing the final table
rows_continued = []

for link in links:
    r = requests.get('https://www.atptour.com' + link)
    soup = bs(r.content)

    federation = soup.find('div', attrs={'class': 'player-flag-code'})

    if federation:
        federation = federation.string
    else:
        federation = ''

    table = soup.find('table')

    cells = table.find_all('td')[1:-1]

    row_continued = [cell.get_text().replace('\n', '').replace('\r', '') for␣
 ↪cell in cells]

    row_continued[0] = row_continued[0].replace('Turned Pro', '').strip()
    row_continued[1] = row_continued[1].split('l')[0].replace('Weight', '')
    height = row_continued[2].split("\'")

    try:
        row_continued[2] = int(height[0][-1]) * 12 + int(height[1].
 ↪split('"')[0])
    except:
        row_continued[2] = ''

    row_continued[3] = row_continued[3].replace('Birthplace', '').strip()
    row_continued[4] = row_continued[4].replace('Plays', '').strip()
    row_continued[5] = row_continued[5].replace('Coach', '').strip()

    row_continued.append(federation)
    rows_continued.append(row_continued)
```

[ ]:
```
pd.set_option('display.max_colwidth', None)
pd.set_option('display.max_rows', None)

df = pd.DataFrame(rows, columns=columns)
df2 = pd.DataFrame(rows_continued, columns=['Turned Pro', 'Weight', 'Height',␣
 ↪'Birthplace', 'Plays', 'Coach', 'Federation'])
df = pd.concat([df, df2], axis=1)

df.to_csv('Scraped - Association of Tennis Professionals top 1000 singles␣
 ↪players', index=False) # Scraped table in GitHub
```

2 Beginning of exploratory analysis

[2]:
```
df = pd.read_csv('Scraped - Association of Tennis Professionals top 1000␣
 ↪singles players', thousands=',')

df.head()
```

[2]:

	Rank	+/- Rank	Unnamed: 2	Player	Age	Points	+/- Points	Tourn Played	Dropping	Next Best	Turned Pro	Weight	Height	Birthplace	Plays	Coach	Federation
0	1	NaN	NaN	Carlos Alcaraz	19.0	6820	NaN	17	0	0	2018.0	163.0	72.0	El Palmar, Murcia, Spain	Right-Handed, Two-Handed Backhand	Juan Carlos Ferrero	ESP
1	2	NaN	NaN	Rafael Nadal	36.0	6020	NaN	14	250	0	2001.0	187.0	73.0	Manacor, Mallorca, Spain	Left-Handed, Two-Handed Backhand	Carlos Moya, Marc Lopez, Gustavo Marcaccio	ESP
2	3	NaN	NaN	Casper Ruud	24.0	5820	NaN	23	125	0	2015.0	170.0	72.0	Oslo, Norway	Right-Handed, Two-Handed Backhand	Christian Ruud	NOR
3	4	NaN	NaN	Stefanos Tsitsipas	24.0	5550	NaN	23	60	45	2016.0	198.0	76.0	Athens, Greece	Right-Handed, One-Handed Backhand	Apostolos Tsitsipas	GRE
4	5	NaN	NaN	Novak Djokovic	35.0	4820	NaN	14	0	0	2003.0	170.0	74.0	Belgrade, Serbia	Right-Handed, Two-Handed Backhand	Goran Ivanisevic	SRB

[3]:
```
df.tail()
```

[3]:
```
     Rank  +/- Rank  Unnamed: 2                     Player   Age  Points  \
995   996       NaN         NaN                Fabio Coelho  22.0      11
996   997       NaN         NaN          Guy Orly Iradukunda  26.0      11
997   998       NaN         NaN             Sebastian Sorger  17.0      11
998   999       NaN         NaN  Ignasi De Rueda De Genover  24.0      11
999  1000       NaN         NaN                Isaiah Strode  25.0      11

     +/- Points  Tourn Played  Dropping  Next Best  Turned Pro  Weight  \
995         NaN            14         0          0         NaN   151.0
996         NaN            15         0          0         NaN   167.0
997         NaN            15         0          0         NaN     NaN
998         NaN            17         0          0         NaN   165.0
999         NaN            17         0          0         NaN   165.0

     Height           Birthplace                              Plays  \
995    69.0  Oliveira de Azeméis  Right-Handed, Two-Handed Backhand
996     0.0               Gitega     Right-Handed, Unknown Backhand
997     NaN                  NaN     Right-Handed, Unknown Backhand
998    72.0     Barcelona, Spain  Right-Handed, Two-Handed Backhand
999    72.0            San Diego  Right-Handed, Two-Handed Backhand

                          Coach Federation
995  João Maio, Eduardo Rodrigues        POR
996                           NaN        BDI
997                           NaN        AUT
998                           NaN        ESP
999                           NaN        USA
```

[4]:
```
df.isnull().sum()
```

[4]:
```
Rank              0
+/- Rank        516
Unnamed: 2     1000
Player            0
Age               1
Points            0
+/- Points      947
Tourn Played      0
Dropping          0
Next Best         0
Turned Pro      630
Weight           90
Height           94
Birthplace       86
Plays            62
```

```
Coach            346
Federation        36
dtype: int64
```

3 Cleaning the data

[5]:
```
df.drop(columns=['Unnamed: 2', '+/- Rank', '+/- Points', 'Dropping', 'Next␣
↪Best'], inplace=True)
df.shape
```

[5]:
```
(1000, 12)
```

3.0.1 Observations: It appears an age was missed while scraping, as well as 4 heights (assuming the other 90 are unlisted on the website). Also, the points and tournaments played data aren't floats. Manually checking those:

[6]:
```
df.Points = df.Points.astype('float64')
df['Tourn Played'] = df['Tourn Played'].astype('float64')

df.loc[df.Age.isnull() == True]
```

[6]:
```
     Rank           Player  Age  Points  Tourn Played  Turned Pro  Weight  \
985   986  Luca Wiedenmann  NaN    11.0           6.0         NaN     NaN

     Height Birthplace Plays Coach Federation
985     NaN        NaN   NaN   NaN         GER
```

3.0.2 This player's age is actually unlisted.

[7]:
```
df.loc[(~df.Weight.isnull()) & (df.Height.isnull())]
```

[7]:
```
     Rank                          Player   Age  Points  Tourn Played  \
170   171                  Flavio Cobolli  20.0   335.0          30.0
237   238          Roman Andres Burruchaga  20.0   229.0          30.0
286   287                  Joao Domingues  29.0   179.0          26.0
318   319              Shintaro Mochizuki  19.0   159.0          25.0
357   358                Daniel Cukierman  27.0   132.0          24.0
889   890  Juan Manuel Benitez Chavarriaga  27.0    15.0           7.0

     Turned Pro  Weight  Height                    Birthplace  \
170      2020.0   156.0     NaN                Florence, Italy
237         NaN   176.0     NaN        Buenos Aires, Argentina
286      2013.0   154.0     NaN  Oliveira de Azemeis, Portugal
318         NaN   154.0     NaN                 Kawasaki, Japan
357         NaN   154.0     NaN              Tel Aviv, Israel
889         NaN   170.0     NaN             Medellin, Colombia
```

```
                                  Plays                       Coach Federation
170  Right-Handed, Two-Handed Backhand             Stefano Cobolli         ITA
237     Right-Handed, Unknown Backhand                Mariano Hood         ARG
286  Right-Handed, Two-Handed Backhand  Joao Antunes, Andre Podalka         POR
318  Right-Handed, Two-Handed Backhand                         NaN         JPN
357  Right-Handed, Two-Handed Backhand                         NaN         ISR
889  Right-Handed, Two-Handed Backhand          Jean-Luc Fontanot         COL
```

3.0.3 These players' heights are actually unlisted. Double checking if there are missing weights:

[8]:
```
df.loc[(df.Weight.isnull()) & (~df.Height.isnull())]
```

[8]:
```
     Rank          Player   Age  Points  Tourn Played  Turned Pro  Weight  \
196   197   Kaichi Uchida  28.0   282.0          32.0      2012.0     NaN
426   427  Juan Pablo Paz  27.0   104.0          27.0         NaN     NaN

     Height Birthplace                              Plays  \
196    71.0        NaN  Right-Handed, Two-Handed Backhand
426    67.0        NaN  Right-Handed, Two-Handed Backhand

                          Coach Federation
196           Norberto Valsecchi        JPN
426  Marcelo Garcia - Daniel Paz        ARG
```

3.0.4 These players' weights are unlisted. Weights and heights of 0 should be NaN, and obvious errors removed:

[9]:
```
df.Weight.replace(to_replace=0, value=np.nan, inplace=True)
df.Height.replace(to_replace=0, value=np.nan, inplace=True)
df.Weight.replace(to_replace=[75, 283, 290, 396], value=np.nan, inplace=True)
df.Height.replace(to_replace=[1, 6, 25], value=np.nan, inplace=True)

df.describe()
```

[9]:
```
              Age       Points  Tourn Played   Turned Pro      Weight  \
count  999.000000  1000.000000   1000.000000   370.000000  904.000000
mean    24.931932   242.997000     19.191000  2012.694595  172.332965
std      4.512216   579.930724      6.992812     4.960683   14.534062
min     16.000000    11.000000      1.000000  1997.000000  132.000000
25%     22.000000    27.750000     14.000000  2009.000000  162.000000
50%     24.000000    71.000000     20.000000  2013.000000  172.000000
75%     28.000000   213.250000     24.000000  2016.000000  181.000000
max     41.000000  6820.000000     39.000000  2022.000000  238.000000

           Height
```

```
count  893.000000
mean    72.662934
std      2.625236
min     61.000000
25%     71.000000
50%     73.000000
75%     74.000000
max     83.000000
```

3.0.5 Observations: The mean age of the top 1000 players is 24.9319, the youngest being 16 and the oldest being 41. The mean number of tournaments played this year is 19, the highest being 39. Of the players who went pro, the earliest year to do so is 1997. The mean weight is 172.3330, and the mean height 72.6629, the lowest being 5'01" and the highest being 6'11.

[10]:
```
df.to_csv('Final - Association of Tennis Professionals top 1000 singles␣
 ↪players', index=False) # Final table in GitHub
```

4 Visualization

4.0.1 Question: *What is the correlation matrix of ATP points (which control rank), age, weight, and height?*

[11]:
```
correlation = df.corr()
correlation.drop(columns=['Tourn Played', 'Turned Pro'], inplace=True)
correlation.drop(labels=['Tourn Played', 'Turned Pro'], axis=0, inplace=True)
correlation

heatmap = sns.heatmap(data=correlation, xticklabels=correlation.columns,␣
 ↪yticklabels=correlation.columns, annot=True, cmap='crest')
```

4.0.2 There is a slightly stronger positive correlation between points and height than between points and weight (serving advantage is a consideration), but overall, tennis players of all ages, weights, and heights are spread evenly throughout the top 1000.

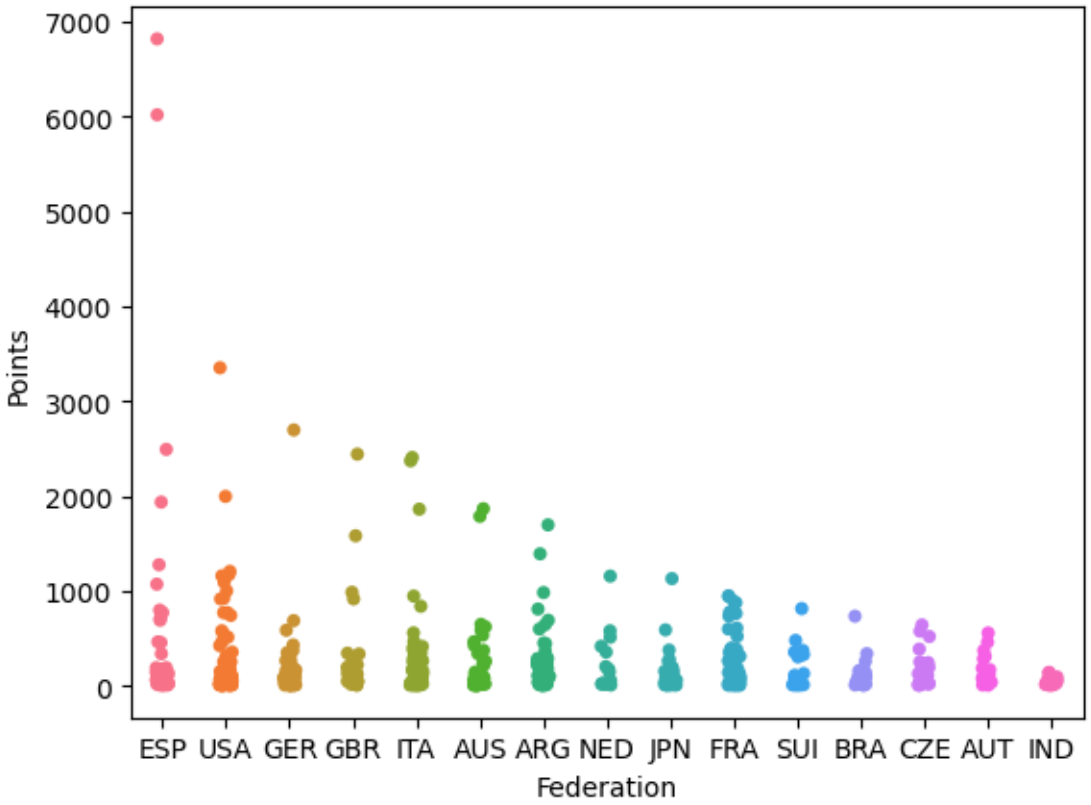
4.0.3 Question: *How do ATP points vary by the top 15 most popular federations?*

[12]:
```
top_15 = df.groupby(['Federation']).count().sort_values('Rank',␣
↪ascending=False).head(15).index.tolist()
```

[13]:
```
new_df = df.copy(deep=True)

for row, federation in enumerate(new_df.Federation):
    if federation not in top_15:
        new_df = new_df.drop(labels=row, axis=0)
```

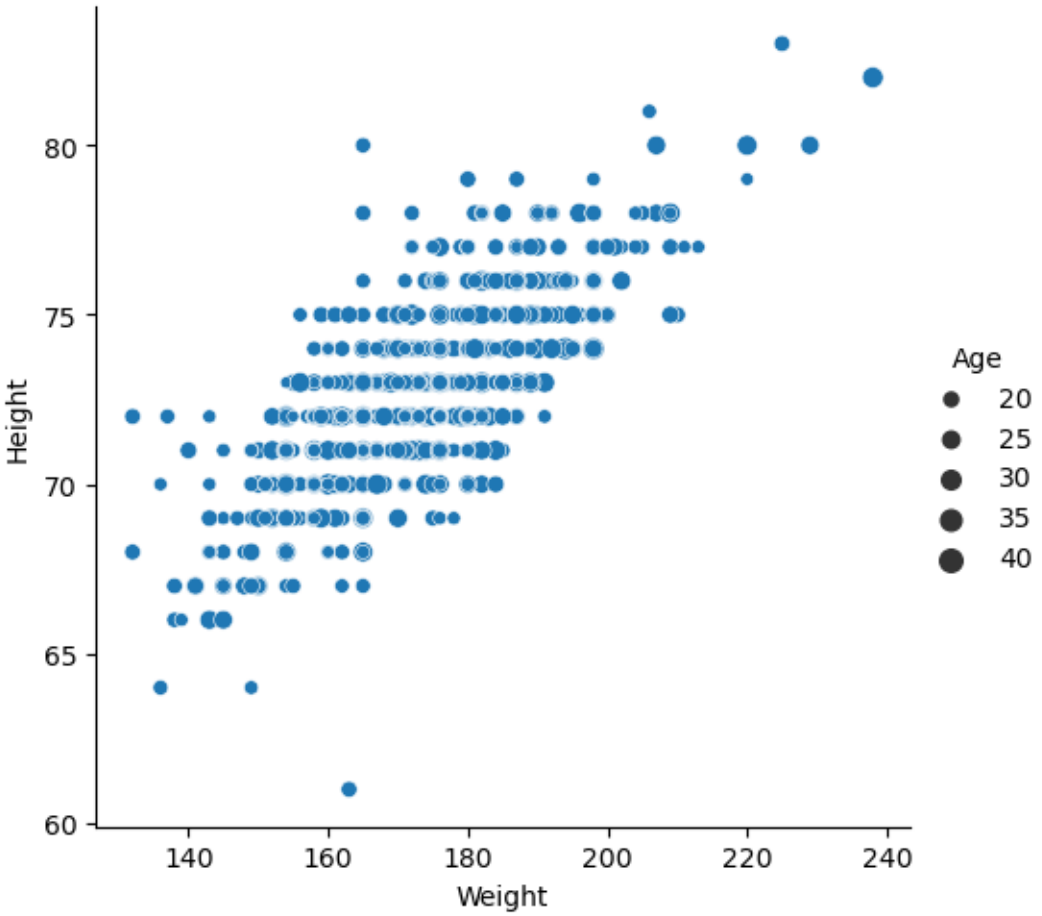
[14]:
```
strip_plot = sns.stripplot(data=new_df, x=new_df.Federation, y=new_df.Points,␣
↪palette='husl')
```



4.0.4 Spain is absolutely dominating the competition with powerful outliers like Carlos Alcaraz and Rafael Nadal.

4.0.5 Question: *What is the physical composition of the players on tour?*

[15]:
```
scatterplot = sns.relplot(data=df, x=df.Weight, y=df.Height, size=df.Age)
```

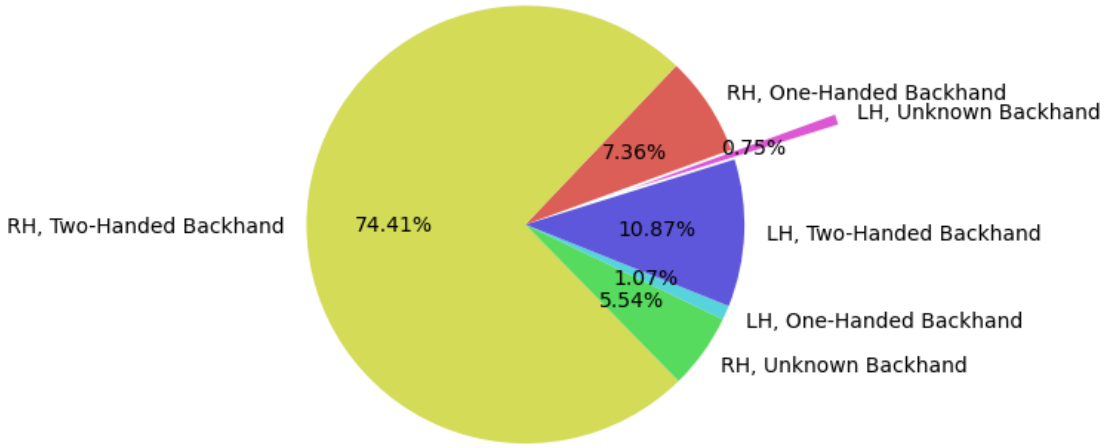


4.0.6 In the top 100, Diego Schwartzman is 5'7" and rank 25, while Reilly Opelka is 6'11" ranking 38th.

4.0.7 Question: *What is the proportion of each backhand style among right-handed and left-handed players?*

[16]:
```
counts = df.groupby('Plays').count()['Rank'].tolist()
counts = counts[3:] + counts[:3]
labels = ['RH, One-Handed Backhand', 'RH, Two-Handed Backhand', 'RH, Unknown␣
 ↪Backhand', 'LH, One-Handed Backhand', 'LH, Two-Handed Backhand', 'LH,␣
 ↪Unknown Backhand', ]
colors = sns.color_palette('hls')

pie_chart = plt.pie(counts, labels=labels, autopct='%.2f%%', colors=colors,␣
 ↪explode=[0, 0, 0, 0, 0, 0.5], startangle=20)
```

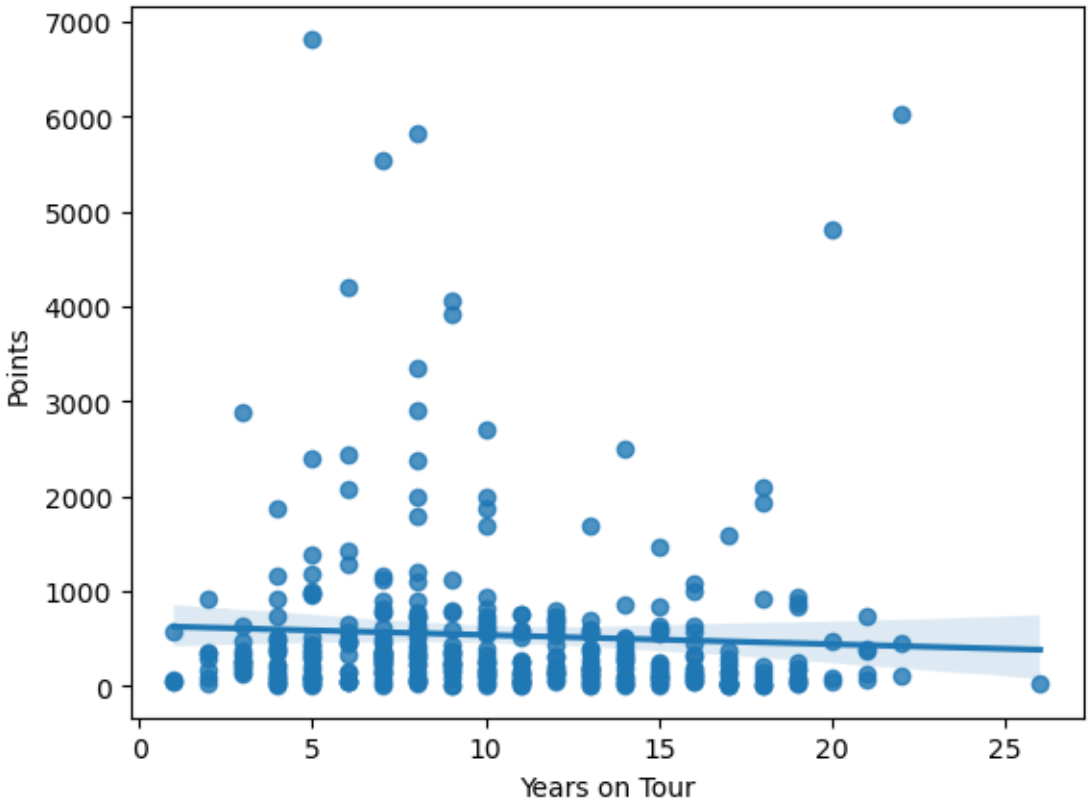


4.0.8 One-handed backhanders are relatively uncommon, which makes players like Stefanos Tsitsipas stand out as a one-handed backhander in the top 10.

4.0.9 Question: *How do seasoned pros compare to newer arrivals on the scene?*

[17]:
```
years_on_tour = [2023 - year for year in df['Turned Pro']]
df['Years on Tour'] = years_on_tour

scatterplot = sns.regplot(data=df, x=df['Years on Tour'], y=df.Points)
```



4.0.10 In the ATP top 1000, experience can certainly compete with youth.