Women's Tennis Serve Stats

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SDS 348

5/10/2021

This dataset includes the service game stats for the top 50 women's tennis players in the Women's Tennis Association for 2019. I referred to the WTA Tennis website as well as a website called TennisAbstract to collect and acquire the data.

```
# Run to allow multiple outputs from a single chunk
from IPython.core.interactiveshell import InteractiveShell
InteractiveShell.ast_node_interactivity = "all"
```

```
# Import packages
import numpy as np
import pandas as pd
import seaborn as sns
import scipy.stats as stats
import matplotlib.pyplot as plt
```

```
# Import and view the dataset
serve = pd.read_excel("/content/WTA_Top_50_Serve_Stats.xlsx")
serve.head()
```

	Rank	player	Hand	Height	M	M W	M W Perc	SPW	Aces	AcePerc	DFs	DFPerc	1stln	1stPerc	2ndPerc	HldPerc
0	1st	A.Barty	right	under	64	52	0.813	0.637	409	0.092	198	0.044	0.577	0.729	0.512	0.797
1	2nd	N.Osaka	right	above	51	40	0.784	0.621	351	0.098	97	0.027	0.609	0.719	0.469	0.778
2	3rd	S.Halep	right	under	56	39	0.696	0.587	87	0.023	138	0.037	0.692	0.635	0.479	0.698
3	4th	S.Kenin	right	under	70	48	0.686	0.599	137	0.026	278	0.052	0.654	0.662	0.480	0.742
4	5th	E.Svitolina	right	under	61	39	0.639	0.580	226	0.050	183	0.041	0.603	0.667	0.448	0.697

```
# Number of observations and columns
serve.shape
```

```
(50, 16)
```

```
# Information about the variables
serve.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 16 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   Rank      50 non-null     object 
 1   player    50 non-null     object 
 2   Hand      50 non-null     object 
 3   Height    50 non-null     object 
 4   M         50 non-null     int64  
 5   M W       50 non-null     int64  
 6   M W Perc  50 non-null     float64
 7   SPW       50 non-null     float64
 8   Aces      50 non-null     int64  
 9   AcePerc   50 non-null     float64
 10  DFs       50 non-null     int64  
 11  DFPerc    50 non-null     float64
 12  1stln     50 non-null     float64
 13  1stPerc   50 non-null     float64
 14  2ndPerc   50 non-null     float64
 15  HldPerc   50 non-null     float64
dtypes: float64(8), int64(4), object(4)
memory usage: 6.4+ KB
```

The dataset includes 16 variables (12 numerical and 4 categorical) and 50 observations. For the numeric variables, there are 8 where the data type is considered float64 (double presicion float), and 4 which are considered the data type int64 (integer).

Summary Statistics

For more information of the variables, I provided some summary statistics for the numeric variables. They include the number of observations (count), some descriptive statistics (min, max, median, and mean), standard deviation (std), quartile values (25%, 50%, and 75%), and variance (var).

```
# Summary statistics
(serve.describe()
.T)
(serve.filter(['M','M W', 'M W Perc', 'SPW', 'Aces', 'AcePerc', 'DFs','DFPerc', '1stln', '1stPerc', '2ndPerc', 'HldPerc'])
.agg(['median', 'var'])
.T)
```

	count	mean	std	min	25%	50%	75%	max
M	50.0	47.58000	12.010353	25.000	40.00000	47.5000	54.50000	81.000
M W	50.0	30.00000	9.936533	14.000	23.00000	28.0000	35.00000	55.000
M W Perc	50.0	0.62470	0.097700	0.455	0.54700	0.6090	0.68425	0.862
SPW	50.0	0.58416	0.027177	0.488	0.56825	0.5810	0.59875	0.646
Aces	50.0	156.44000	110.715145	0.000	70.50000	135.0000	205.00000	488.000
AcePerc	50.0	0.04670	0.024952	0.000	0.02650	0.0425	0.05675	0.114
DFs	50.0	146.60000	83.182857	7.000	89.50000	126.0000	201.75000	350.000
DFPerc	50.0	0.04620	0.015314	0.024	0.03525	0.0430	0.05675	0.084
1stIn	50.0	0.62216	0.039794	0.538	0.59500	0.6215	0.65150	0.726
1stPerc	50.0	0.65516	0.039929	0.564	0.63050	0.6480	0.68100	0.752
2ndPerc	50.0	0.46862	0.029869	0.345	0.46325	0.4770	0.48350	0.512
HldPerc	50.0	0.69314	0.061779	0.444	0.65875	0.6930	0.73250	0.801

	median	var
M	47.5000	144.248571
M W	28.0000	98.734694
M W Perc	0.6090	0.009545
SPW	0.5810	0.000739
Aces	135.0000	12257.843265
AcePerc	0.0425	0.000623
DFs	126.0000	6919.387755
DFPerc	0.0430	0.000235
1stIn	0.6215	0.001584
1stPerc	0.6480	0.001594
2ndPerc	0.4770	0.000892
HldPerc	0.6930	0.003817

An example of some summary statistics for a specific numeric variable grouped by a categorical variable is given below. The two variables used were Aces and Hand.

```
(serve.filter(['Aces', 'Hand'])
.groupby(['Hand'])
.describe())
```

	Aces							
	count	mean	std	min	25%	50%	75%	max
Hand								
left	4.0	106.75000	96.240584	56.0	56.00	60.0	110.75	251.0
right	46.0	160.76087	111.764869	0.0	87.75	136.5	205.00	488.0

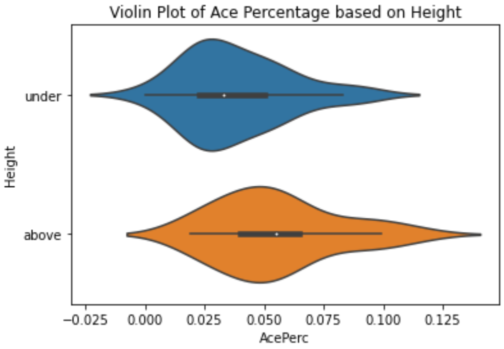
Based on this table, there are only 4 observations for left-handed players while there are 46 observations for right-handed players. Also, the mean number of aces and standard deviation are observed to be greater for right-heanded players. Other statistics are also found in the table.

Exploratory Data Analysis

Here, I took the numeric variable AcePerc (percentage of aces) and the categorical variable Height (above or equal/under 5'9"). To determine whether the mean ace percentage differs between players above and players equal to/under 5'9", an independent t-test was performed, where the null hypothesis was that the ace percentage means between players above and equal/under 5'9" were not significantly different. I also included visuals displaying the relationship between the two variables.

```
# Create violin plot to display relationship between 'AcePerc' and 'Height
sns.violinplot(data = serve, x = "AcePerc", y = "Height").set_title('Violin Plot of Ace Percentage based on Height')
```

```
    Text(0.5, 1.0, 'Violin Plot of Ace Percentage based on Height')
```



```
# Perform independent t-test
stats.ttest_ind(serve['AcePerc'][serve['Height'] == 'above'],
                serve['AcePerc'][serve['Height'] == 'under'])
```

```
    Ttest_indResult(statistic=2.512142306328478, pvalue=0.015415832560663072)
```

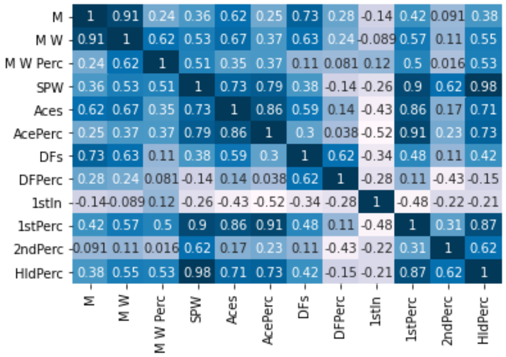
The violin plot shows that the two white dots, which represent the mean/median, do not fall within each other's interquartile ranges (the bold black line). This indicates that the means of ace percentage between above and under are likely significantly different. After performing the independent t-test, I found that there was a significant difference in mean ace percentage between those above and those equal/under 5'9" since the p-value was less than 0.05 (t-stat = 2.51; p-value = 0.01).

Additional Visuals

I constructed a heatmap for the correlation matrix of the numeric variables as well as univariate and bivariate plots for only 7 of the numeric variables since there would be too many plots if all 12 numeric variables were included. *Looking at the heatmap, only considering the magnitude and not the sign of the value, the highest correlation is found between *HldPerc* and *SPW* with 0.98, and the lowest correlation is found between *M W Perc* and *2ndPerc* with 0.016.

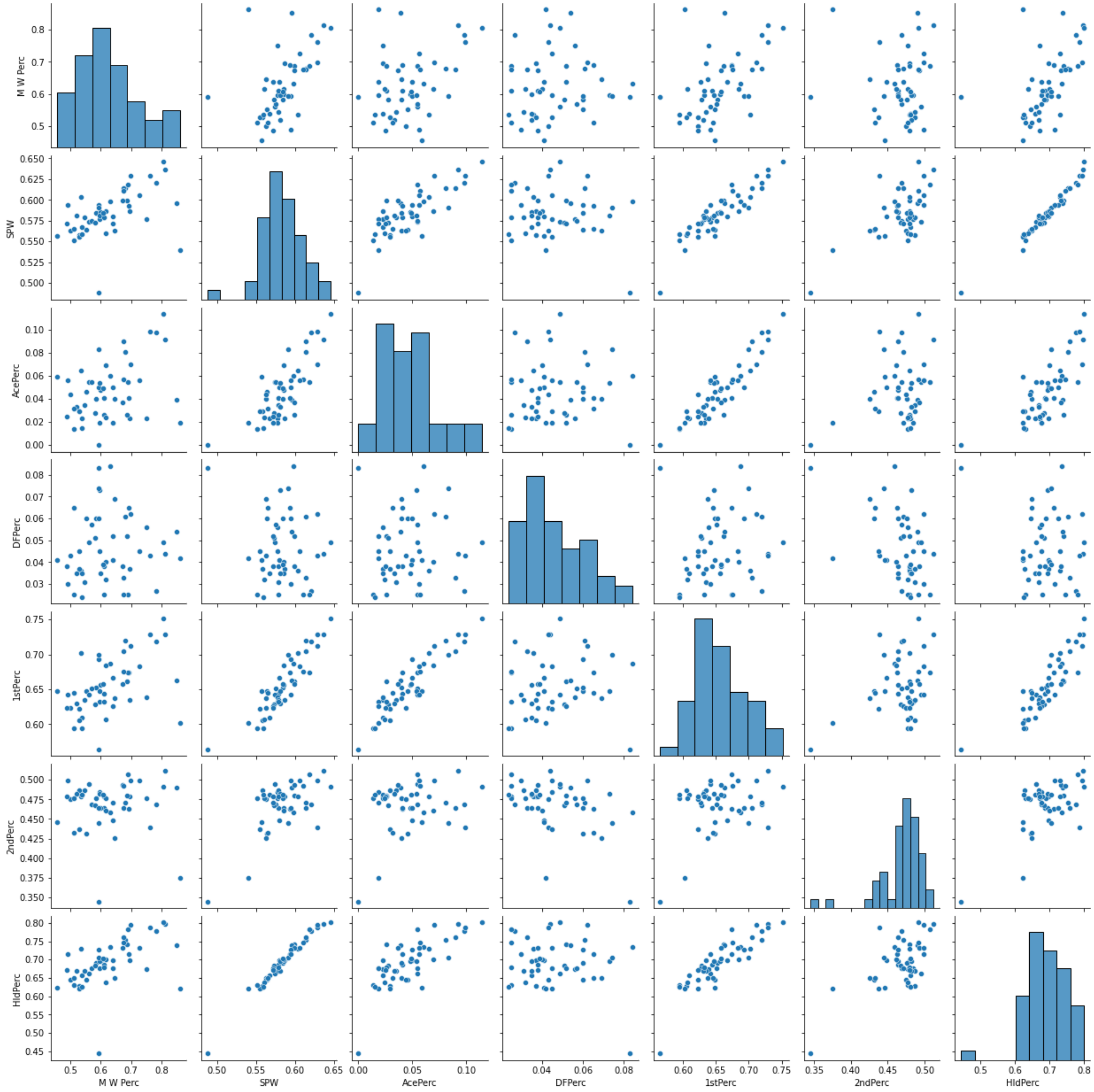
```
# Create heatmap for the correlation matrix (numeric variables)
sns.heatmap(serve.corr(),  annot = True, cbar_kws= {'orientation': 'horizontal'}, cbar = False, cmap = 'PuBu')
```

```
    <matplotlib.axes._subplots.AxesSubplot at 0x7facafb54690>
```



```
# Bivariate and univariate relationship plots
sns.pairplot(serve.filter(['M W Perc', 'SPW', 'AcePerc', 'DFPerc', '1stPerc', '2ndPerc', 'HldPerc']))
```

```
<seaborn.axisgrid.PairGrid at 0x7faca6d4a050>
```



References

https://www.wtatennis.com/stats/2019 (https://www.wtatennis.com/stats/2019) and http://www.tennisabstract.com/cgi-bin/leaders_wta.cgi?f=A2019qqs00w1

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