INTRODUCTION TO MATPLOTLIB

Quantitative comparisons: bar-charts

Ariel Rokem
Data Scientist

Olympic medals

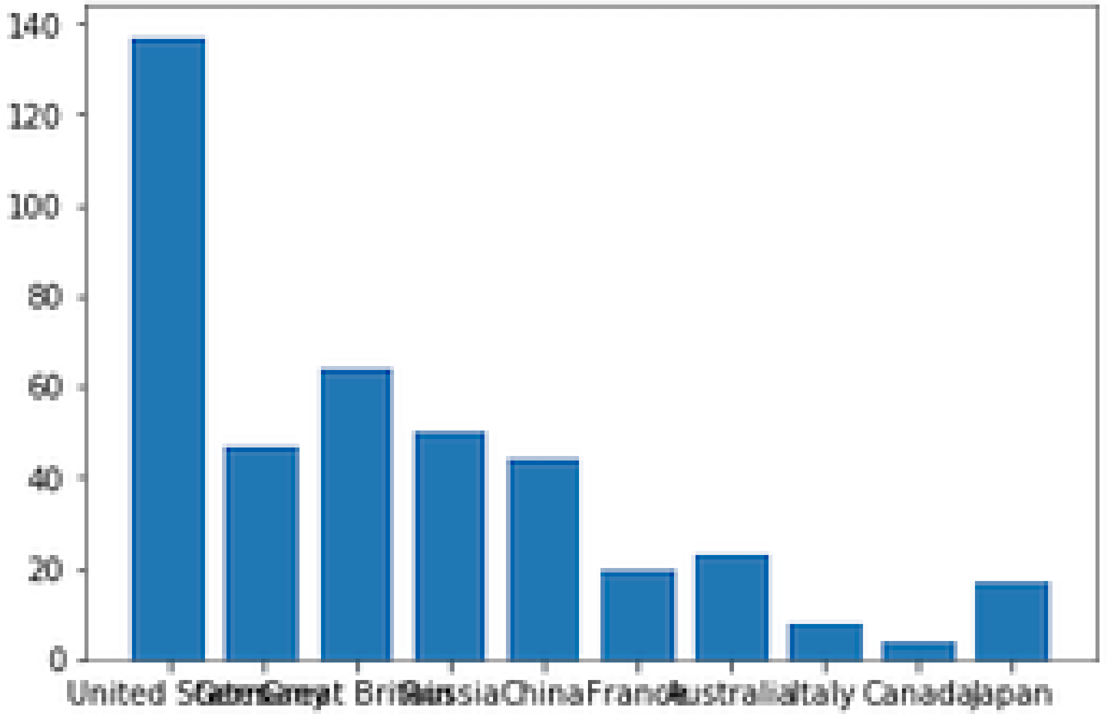
	Gold	Silver	Bronze
United States	137	52	67
Germany	47	43	67
Great Britain	64	55	26
Russia	50	28	35
China	44	30	35
France	20	55	21
Australia	23	34	25
Italy	8	38	24
Canada	4	4	61
Japan	17	13	34

Olympic medals: visualizing the data

```
medals = pd.read_csv('medals_by_country_2016.csv', index_col=0)

fig, ax = plt.subplots()

ax.bar(medals.index, medals["Gold"])
plt.show()
```

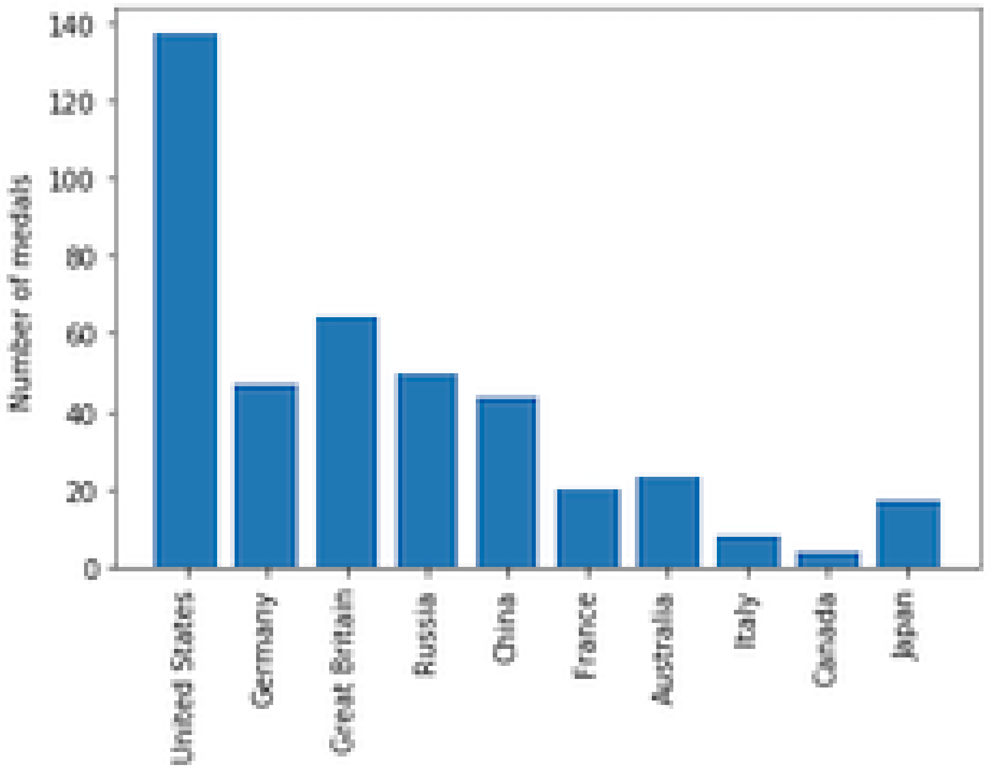


Interlude: rotate the tick labels

```
fig, ax = plt.subplots()
ax.bar(medals.index, medals["Gold"])

ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")

plt.show()
```

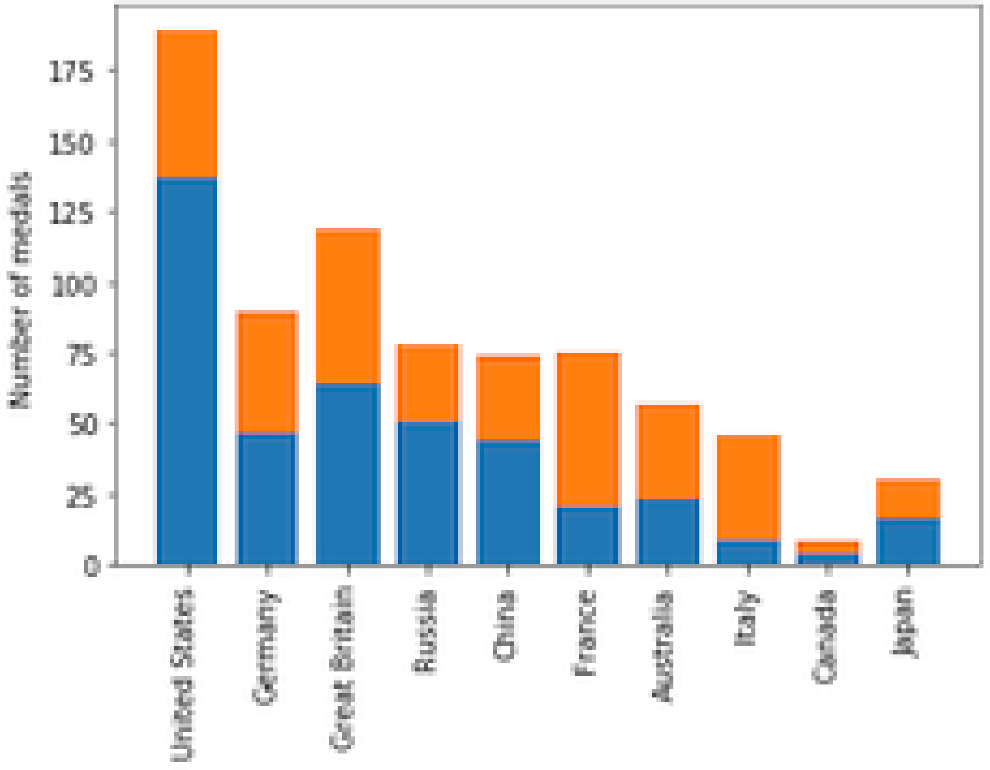


Olympic medals: visualizing the other medals

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])

ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"])

ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
plt.show()
```



Olympic medals: visualizing all three

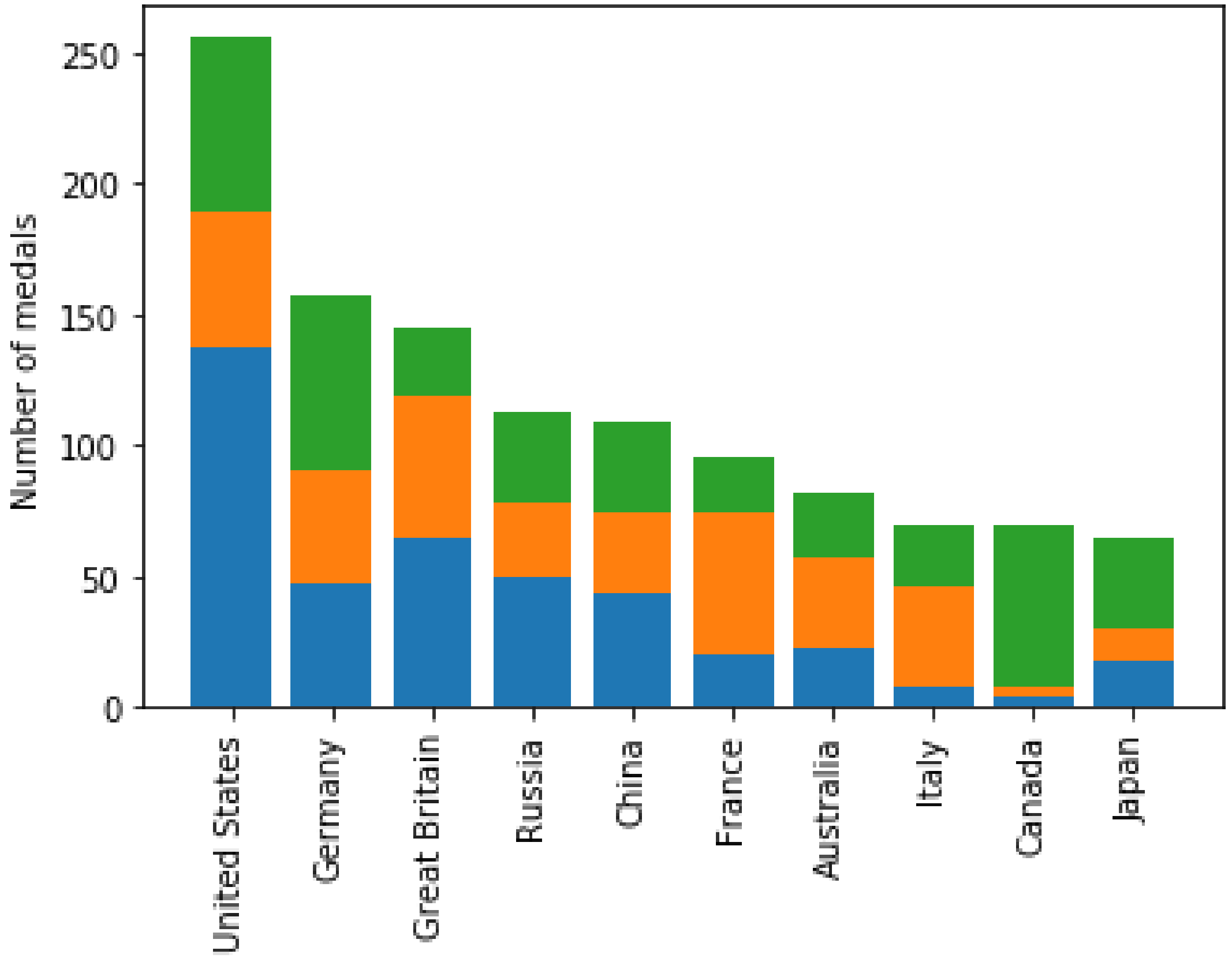
```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])

ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"])

ax.bar(medals.index, medals["Bronze"],
       bottom=medals["Gold"] + medals["Silver"])

ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
plt.show()
```

Stacked bar chart



Adding a legend

```python
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"])
ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"])
ax.bar(medals.index, medals["Bronze"],
       bottom=medals["Gold"] + medals["Silver"])

ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")
```

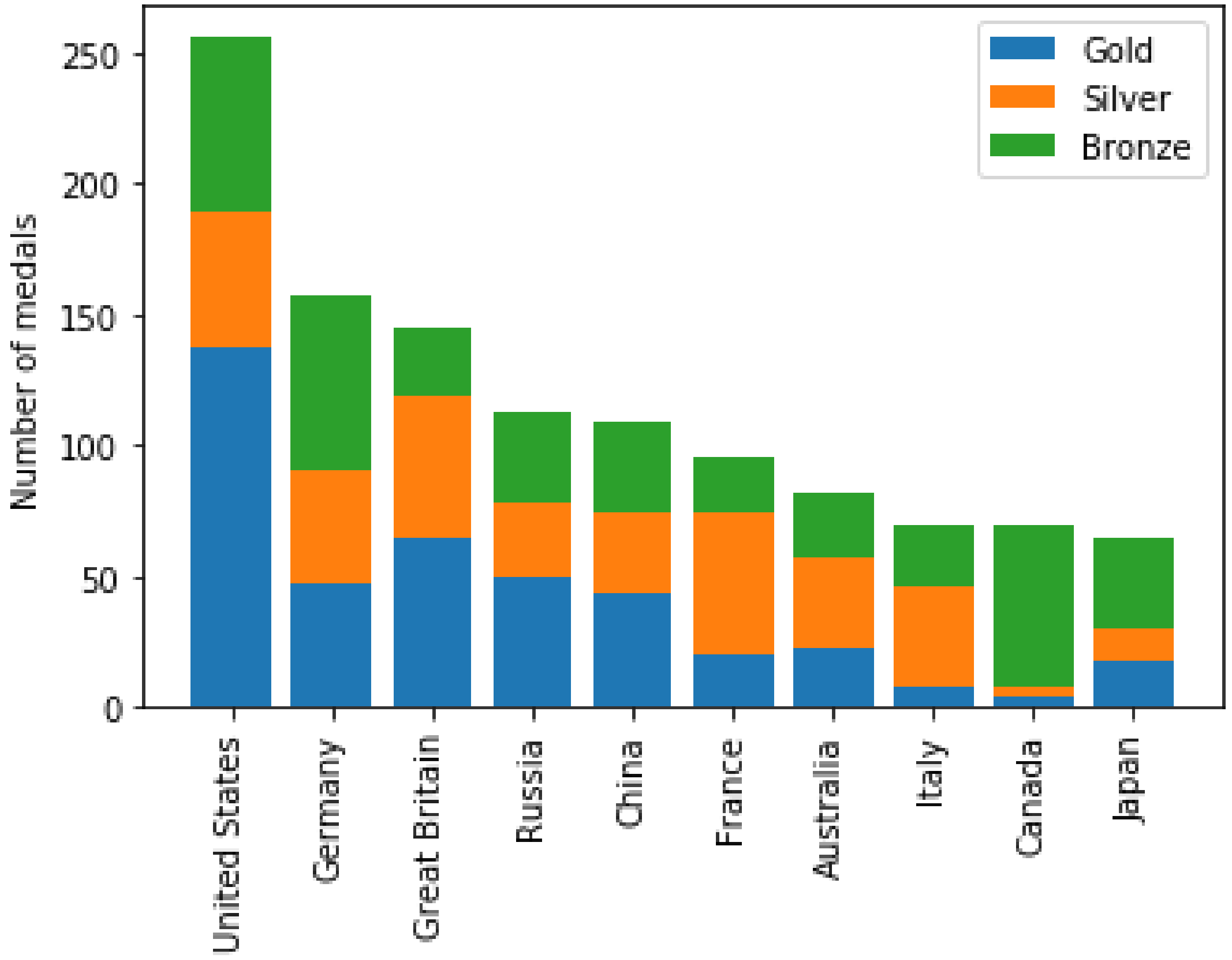
Adding a legend

```
fig, ax = plt.subplots
ax.bar(medals.index, medals["Gold"], label="Gold")
ax.bar(medals.index, medals["Silver"], bottom=medals["Gold"], label="Silver")
ax.bar(medals.index, medals["Bronze"],
       bottom=medals["Gold"] + medals["Silver"], label="Bronze")

ax.set_xticklabels(medals.index, rotation=90)
ax.set_ylabel("Number of medals")

ax.legend()
plt.show()
```

Stacked bar chart with legend



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Create a bar chart!

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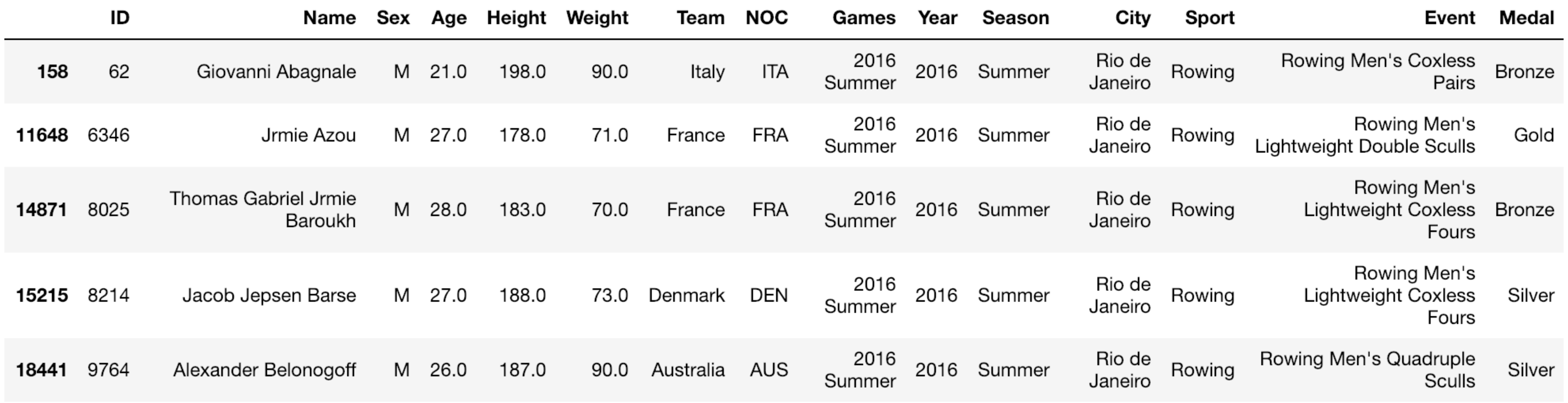
Quantitative comparisons: histograms

Ariel Rokem
Data Scientist

Histograms



	ID	Name	Sex	Age	Height	Weight	Team	NOC	Games	Year	Season	City	Sport	Event	Medal
158	62	Giovanni Abagnale	M	21.0	198.0	90.0	Italy	ITA	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Coxless Pairs	Bronze
11648	6346	Jrmie Azou	M	27.0	178.0	71.0	France	FRA	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Lightweight Double Sculls	Gold
14871	8025	Thomas Gabriel Jrmie Baroukh	M	28.0	183.0	70.0	France	FRA	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Lightweight Coxless Fours	Bronze
15215	8214	Jacob Jepsen Barse	M	27.0	188.0	73.0	Denmark	DEN	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Lightweight Coxless Fours	Silver
18441	9764	Alexander Belonogoff	M	26.0	187.0	90.0	Australia	AUS	2016 Summer	2016	Summer	Rio de Janeiro	Rowing	Rowing Men's Quadruple Sculls	Silver

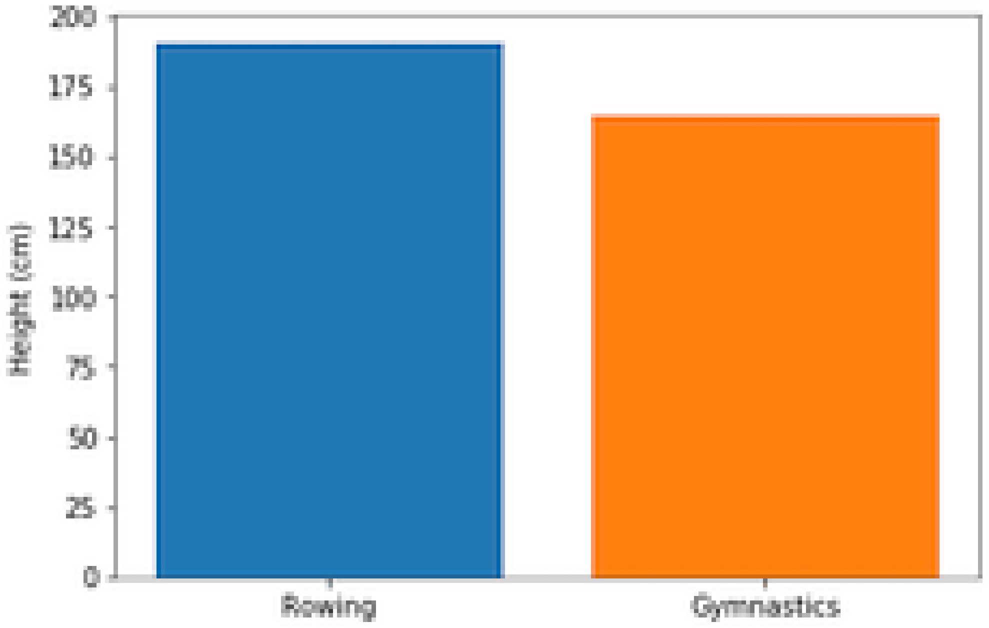
A bar chart again

```
fig, ax = plt.subplots()

ax.bar("Rowing", mens_rowing["Height"].mean())

ax.bar("Gymnastics", mens_gymnastics["Height"].mean())

ax.set_ylabel("Height (cm)")
plt.show()
```



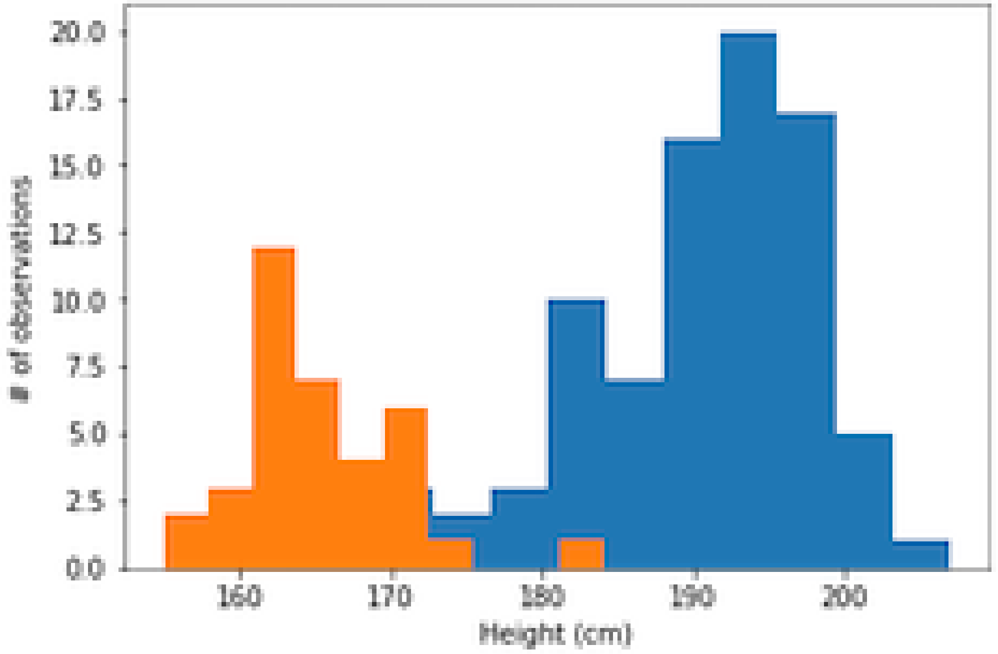
Introducing histograms

```
fig, ax = plt.subplots()

ax.hist(mens_rowing["Height"])

ax.hist(mens_gymnastic["Height"])

ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
plt.show()
```



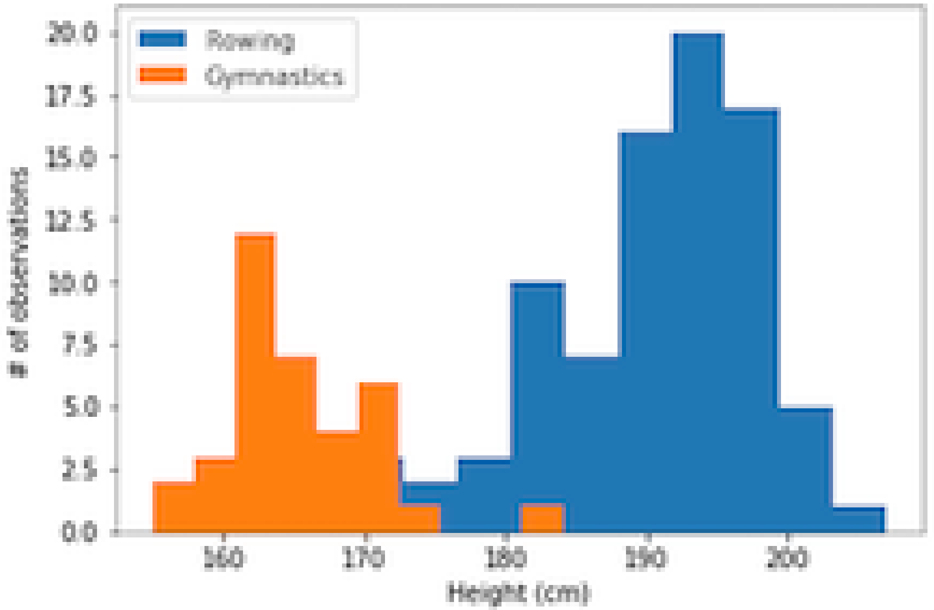
Labels are needed

```
ax.hist(mens_rowing["Height"], label="Rowing")

ax.hist(mens_gymnastic["Height"], label="Gymnastics")

ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")

ax.legend()
plt.show()
```

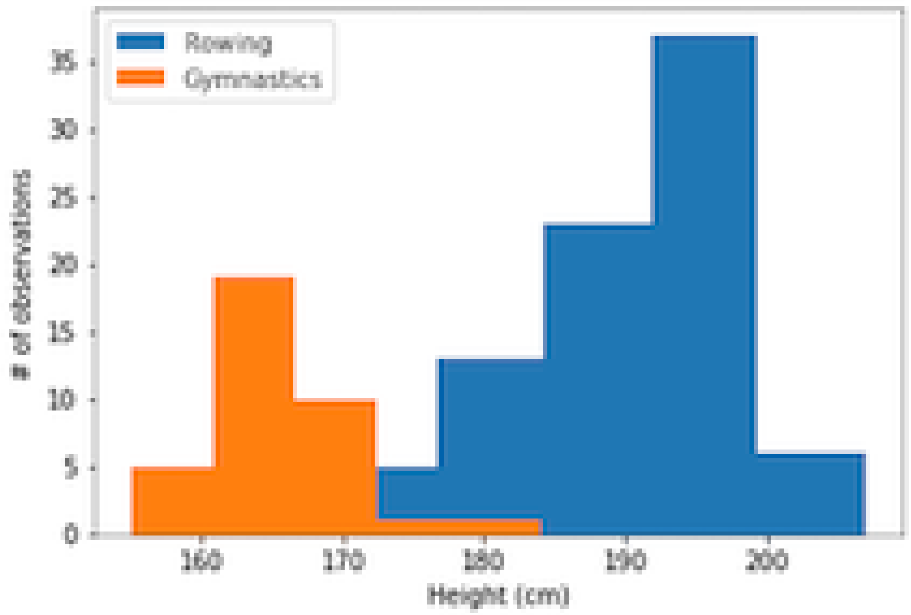


Customizing histograms: setting the number of bins

```
ax.hist(mens_rowing["Height"], label="Rowing", bins=5)

ax.hist(mens_gymnastic["Height"], label="Gymnastics", bins=5)

ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
ax.legend()
plt.show()
```

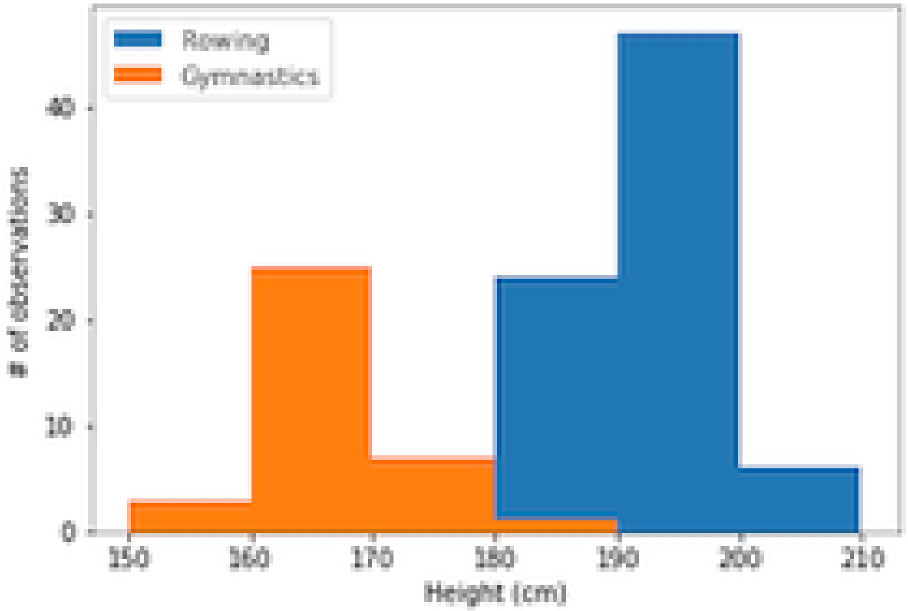


Customizing histograms: setting bin boundaries

```
ax.hist(mens_rowing["Height"], label="Rowing",
        bins=[150, 160, 170, 180, 190, 200, 210])

ax.hist(mens_gymnastic["Height"], label="Gymnastics",
        bins=[150, 160, 170, 180, 190, 200, 210])

ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
ax.legend()
plt.show()
```



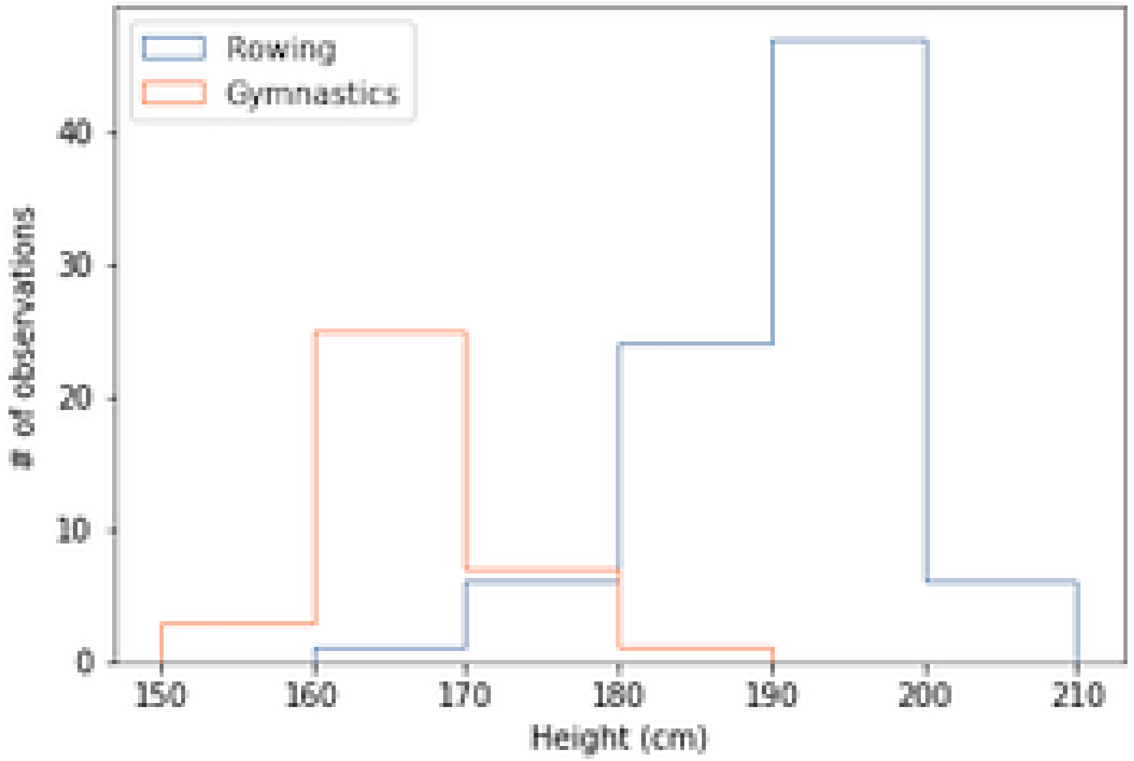
Customizing histograms: transparency

```
ax.hist(mens_rowing["Height"], label="Rowing",
        bins=[150, 160, 170, 180, 190, 200, 210],
        histtype="step")

ax.hist(mens_gymnastic["Height"], label="Gymnastics",
        bins=[150, 160, 170, 180, 190, 200, 210],
        histtype="step")

ax.set_xlabel("Height (cm)")
ax.set_ylabel("# of observations")
ax.legend()
plt.show()
```

Histogram with a histtype of step



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Create your own histogram!

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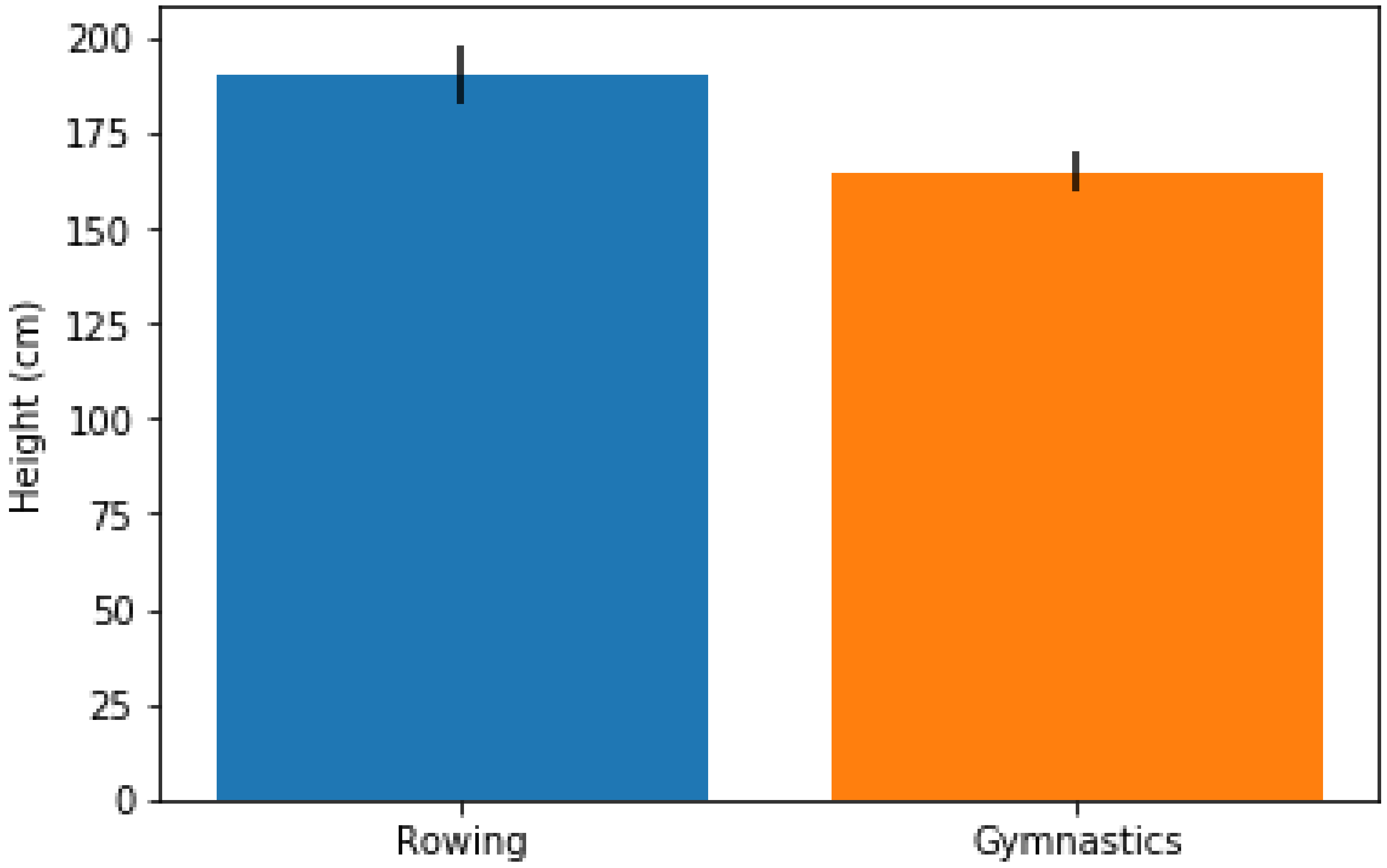
Statistical plotting

Ariel Rokem
Data Scientist

Adding error bars to bar charts

```
fig, ax = plt.subplots()

ax.bar("Rowing",
       mens_rowing["Height"].mean(),
       yerr=mens_rowing["Height"].std())

ax.bar("Gymnastics",
       mens_gymnastics["Height"].mean(),
       yerr=mens_gymnastics["Height"].std())

ax.set_ylabel("Height (cm)")

plt.show()
```

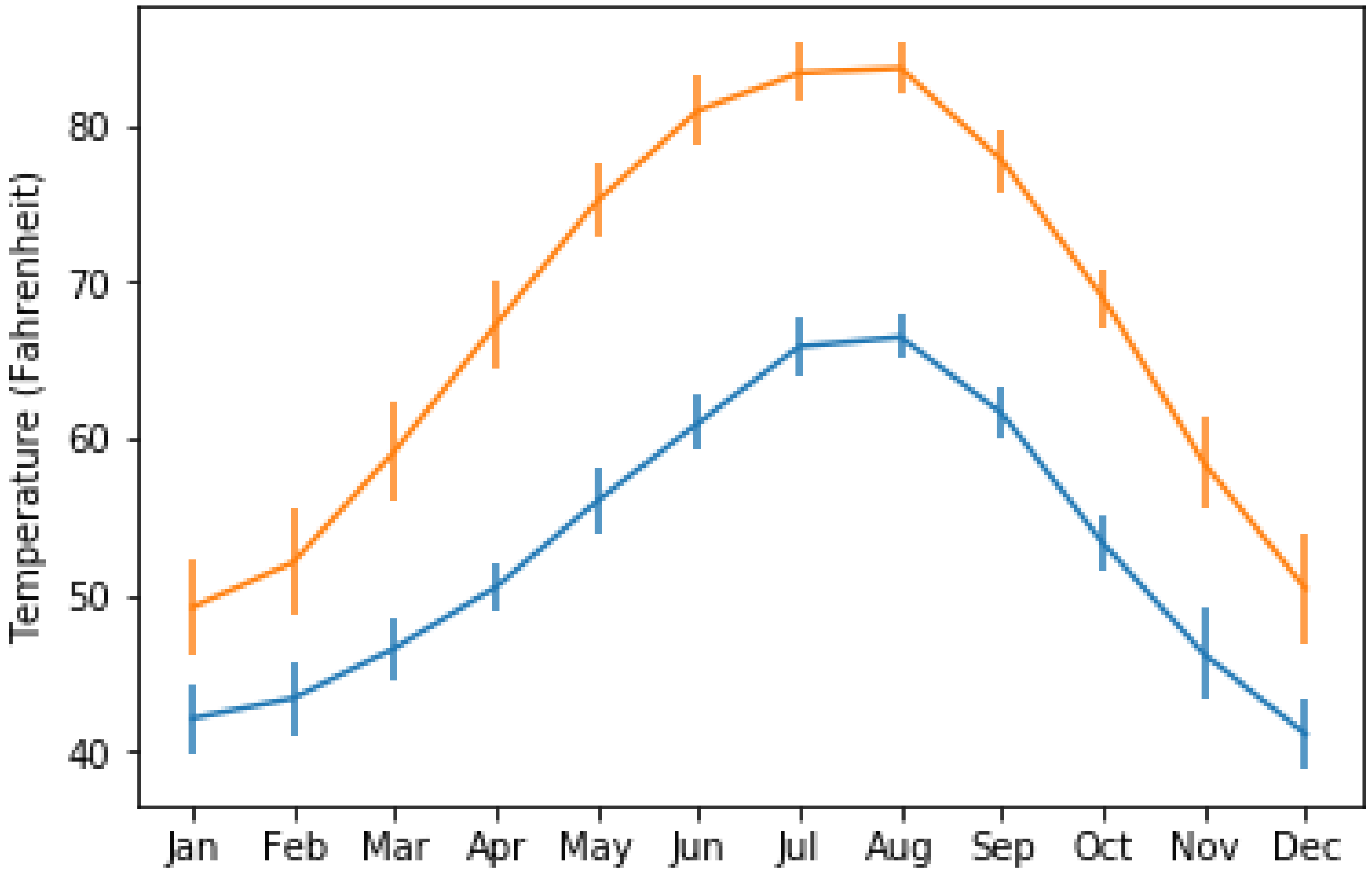
Error bars in a bar chart



Adding error bars to plots

```
fig, ax = plt.subplots()

ax.errorbar(seattle_weather["MONTH"],
            seattle_weather["MLY-TAVG-NORMAL"],
            yerr=seattle_weather["MLY-TAVG-STDDEV"])

ax.errorbar(austin_weather["MONTH"],
            austin_weather["MLY-TAVG-NORMAL"],
            yerr=austin_weather["MLY-TAVG-STDDEV"])

ax.set_ylabel("Temperature (Fahrenheit)")

plt.show()
```

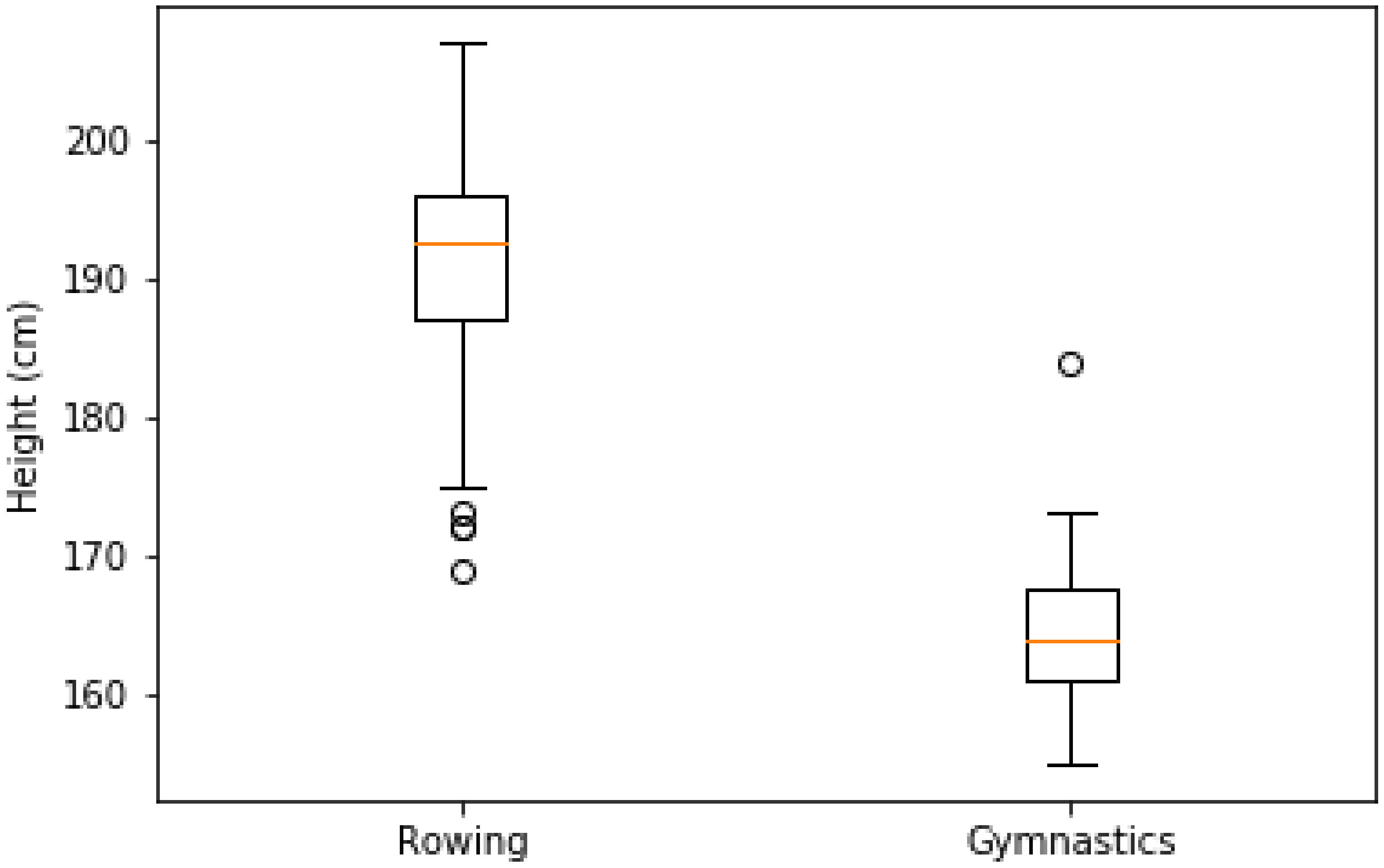
Error bars in plots



Adding boxplots

```
fig, ax = plt.subplots()

ax.boxplot([mens_rowing["Height"],
            mens_gymnastics["Height"]])

ax.set_xticklabels(["Rowing", "Gymnastics"])
ax.set_ylabel("Height (cm)")

plt.show()
```

Interpreting boxplots



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Try it yourself!

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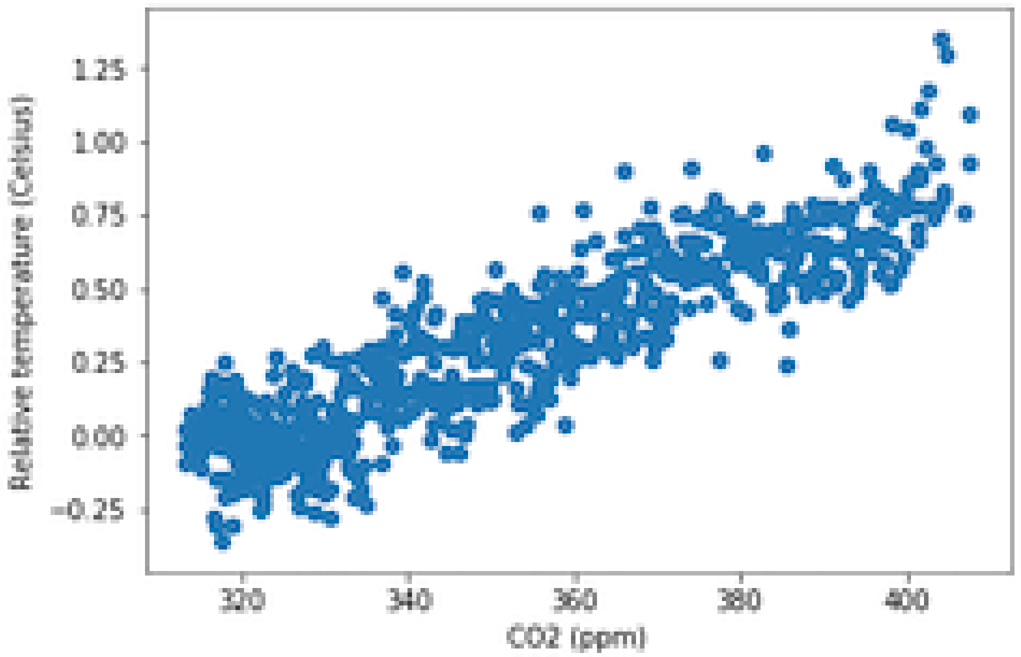
Quantitative comparisons: scatter plots

Ariel Rokem
Data Scientist

Introducing scatter plots

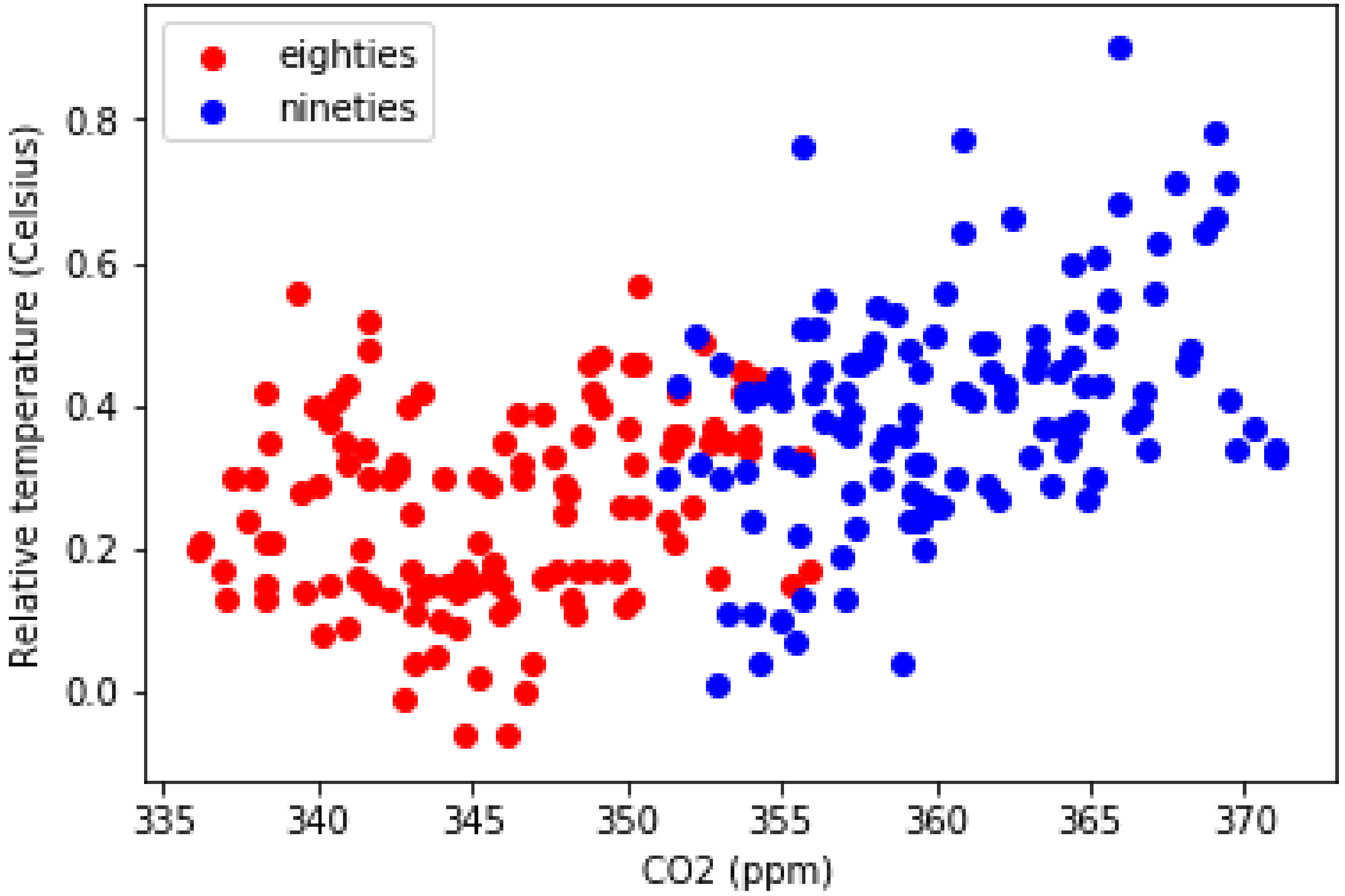
```
fig, ax = plt.subplots()

ax.scatter(climate_change["co2"], climate_change["relative_temp"])

ax.set_xlabel("CO2 (ppm)")
ax.set_ylabel("Relative temperature (Celsius)")
plt.show()
```



Customizing scatter plots

```
eighties = climate_change["1980-01-01":"1989-12-31"]
nineties = climate_change["1990-01-01":"1999-12-31"]

fig, ax = plt.subplots()

ax.scatter(eighties["co2"], eighties["relative_temp"],
           color="red", label="eighties")

ax.scatter(nineties["co2"], nineties["relative_temp"],
           color="blue", label="nineties")

ax.legend()

ax.set_xlabel("CO2 (ppm)")
ax.set_ylabel("Relative temperature (Celsius)")

plt.show()
```

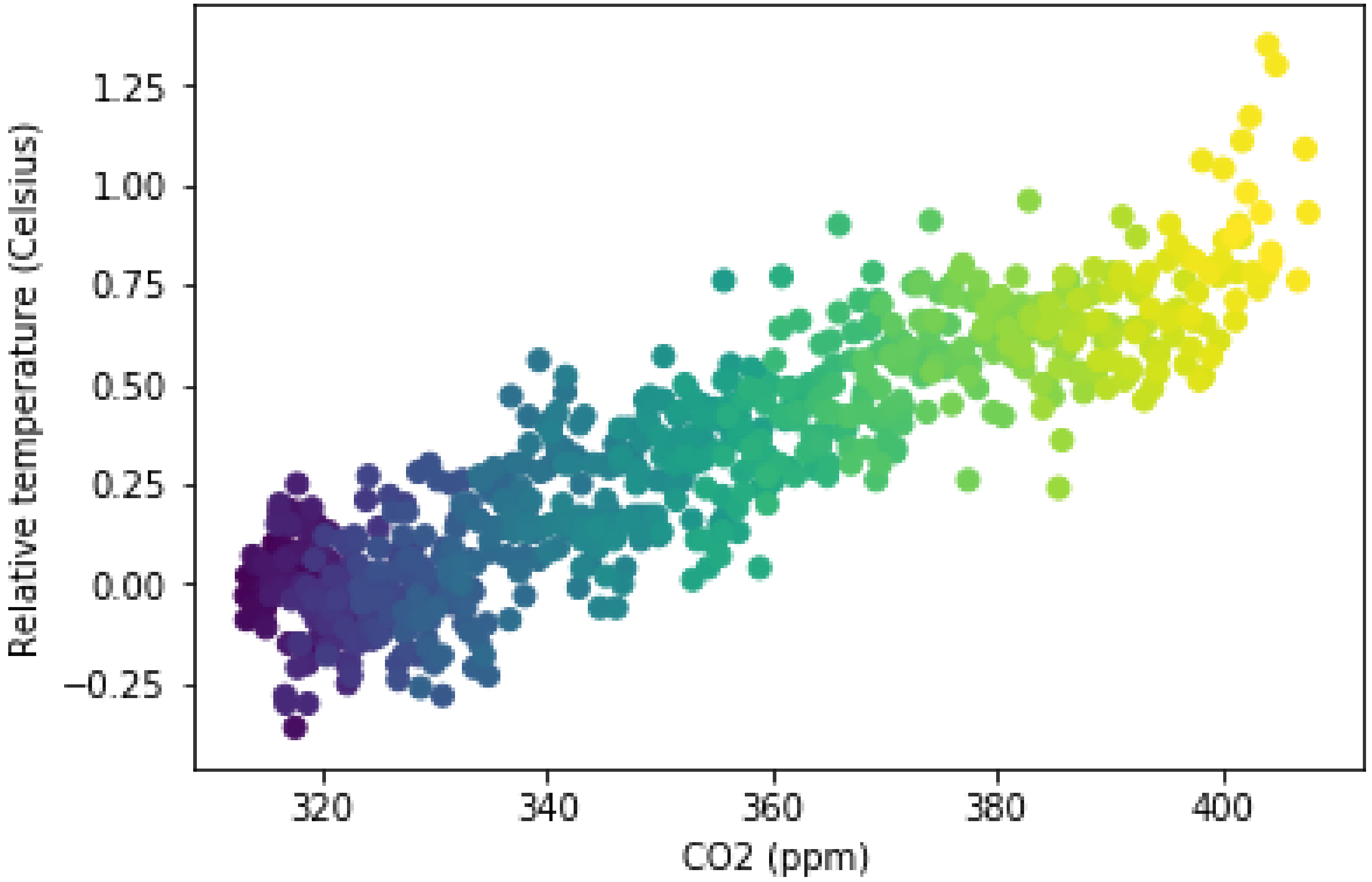
Encoding a comparison by color



Encoding a third variable by color

```
fig, ax = plt.subplots()

ax.scatter(climate_change["co2"], climate_change["relative_temp"],
           c=climate_change.index)

ax.set_xlabel("CO2 (ppm)")
ax.set_ylabel("Relative temperature (Celsius)")
plt.show()
```

Encoding time in color



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Practice making your own scatter plots!