

Biases in Classification

DSA 261

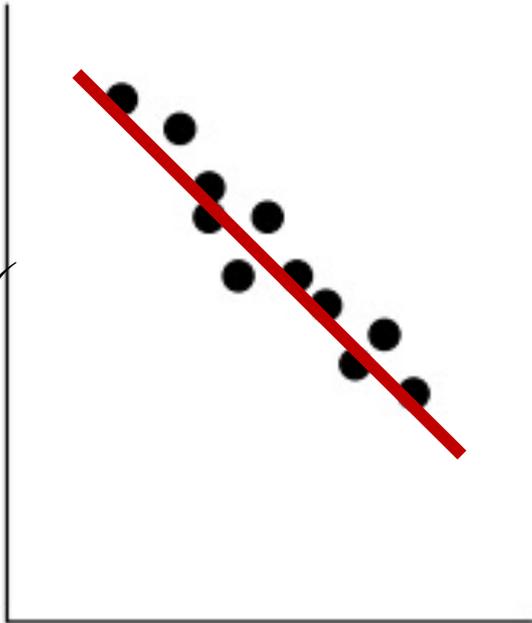
With Dr. Grant

Last time in class

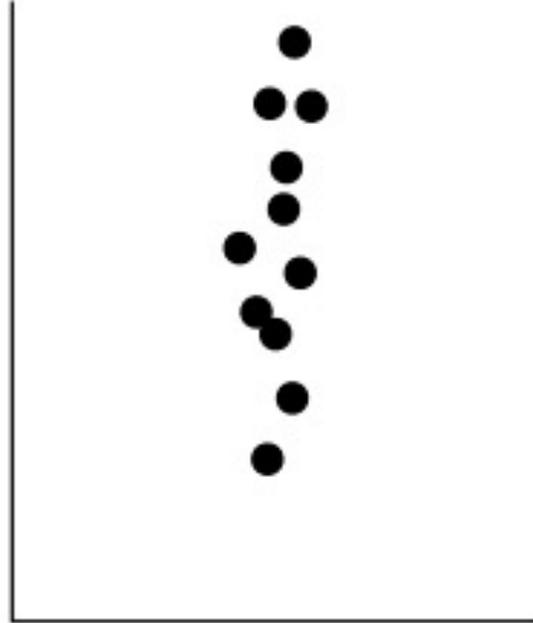
- We introduced linear classification with python sklearn.
- You created scatter plots and plotted decision boundaries.
- You interpreted the learned conclusions from different data sets.
- We discussed correlations.

Y

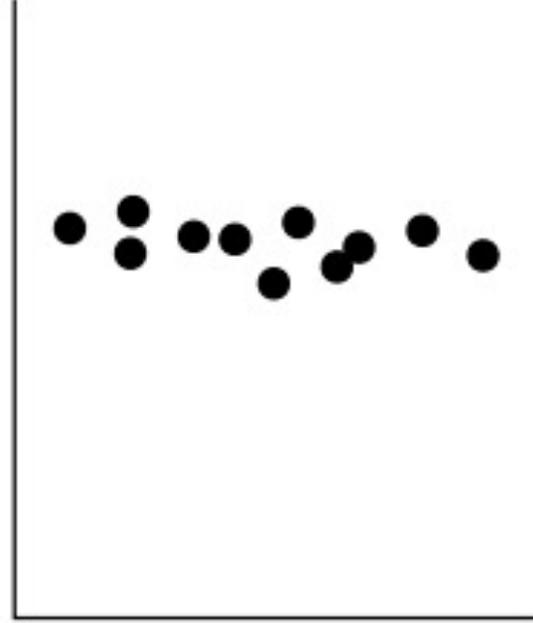
Negative
Correlation



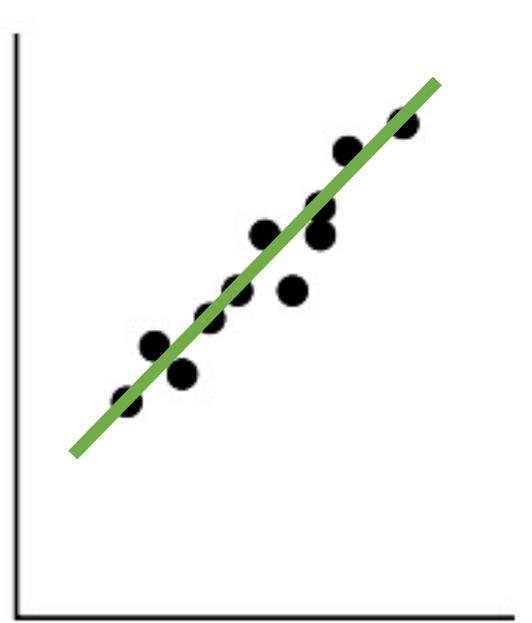
No
Correlation



No
Correlation



Positive
Correlation



x

Trends in data

In real world data it is not so simple

We use Pearson's Correlation coefficient to determine the trends.

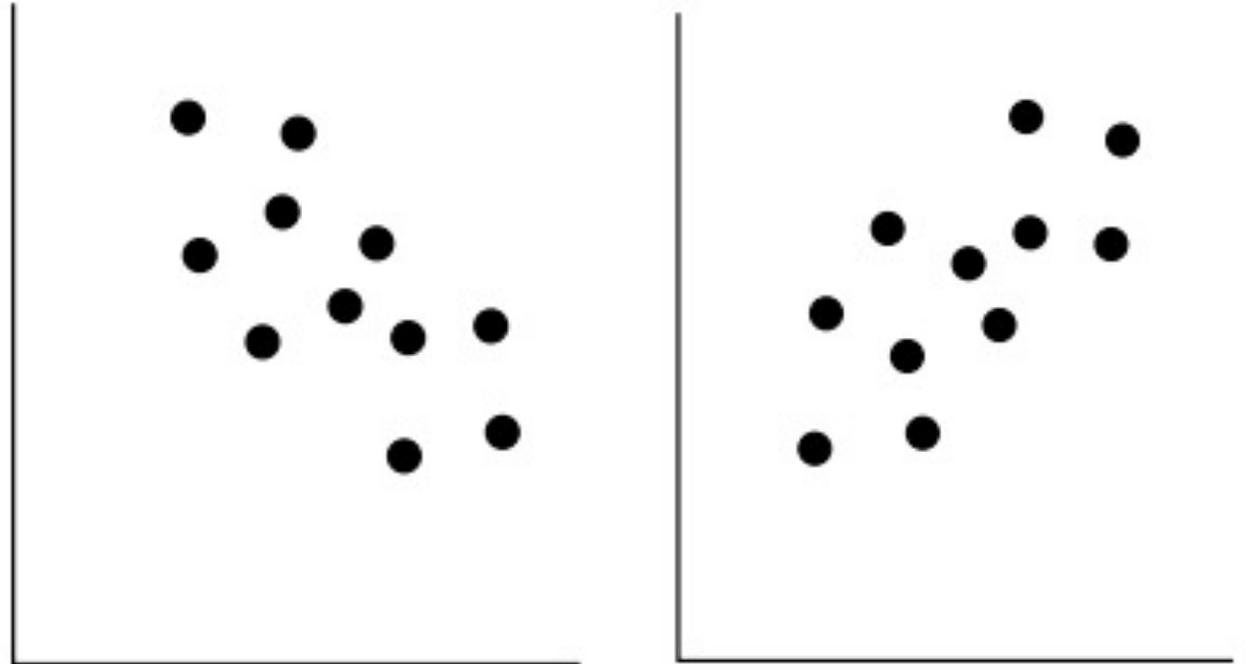
$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

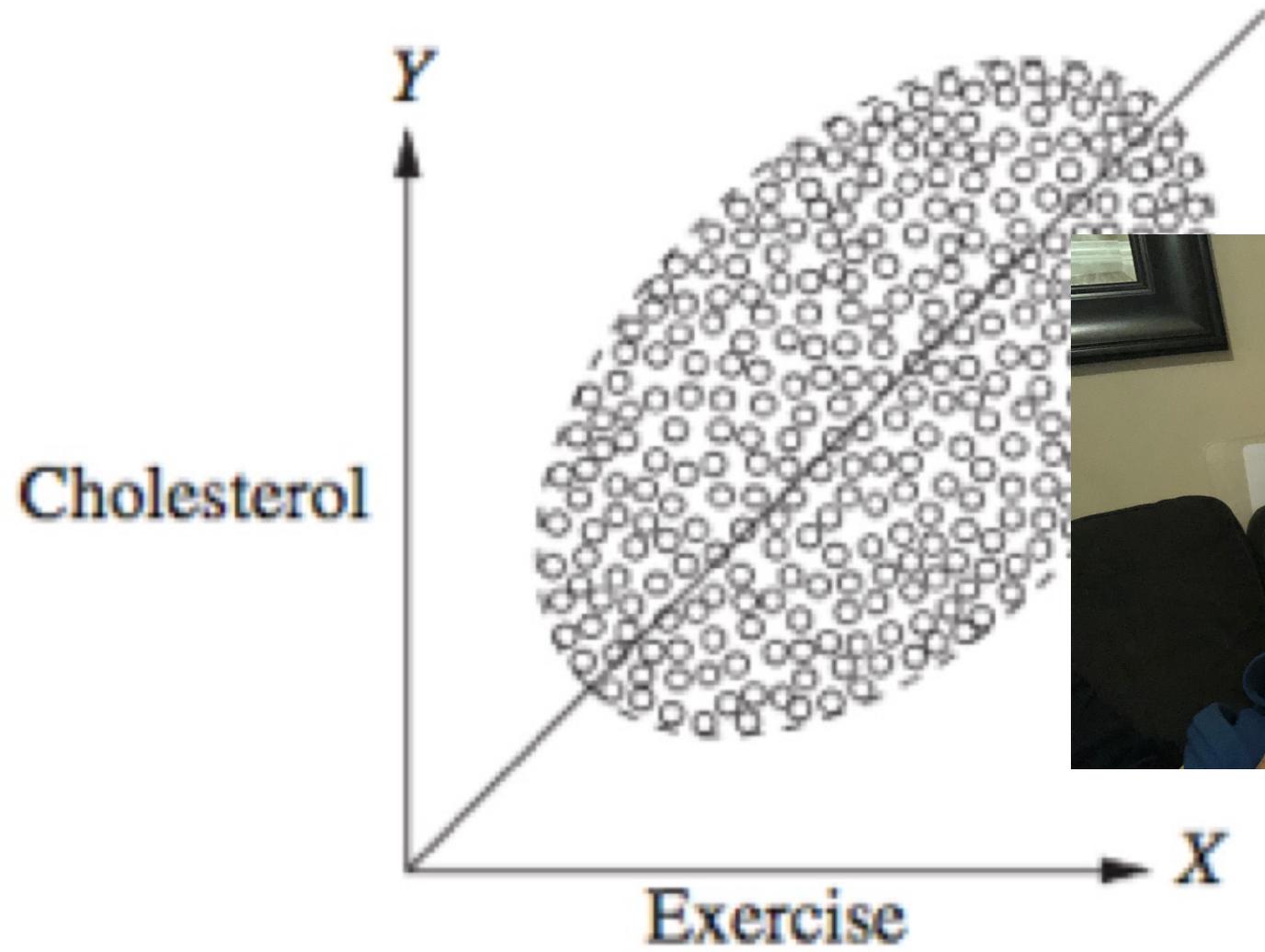
Correlations can be weak

$0 < |r| < 0.3$ weak correlation

$0.3 < |r| < 0.7$ moderate correlation

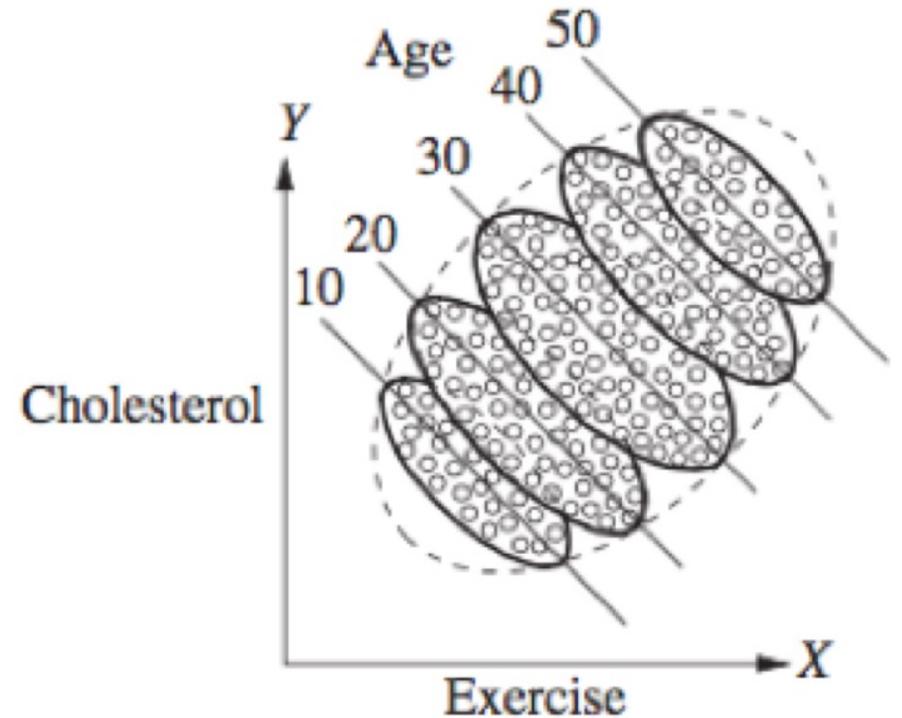
$|r| > 0.7$ Strong correlation





Trends in data can be misleading.

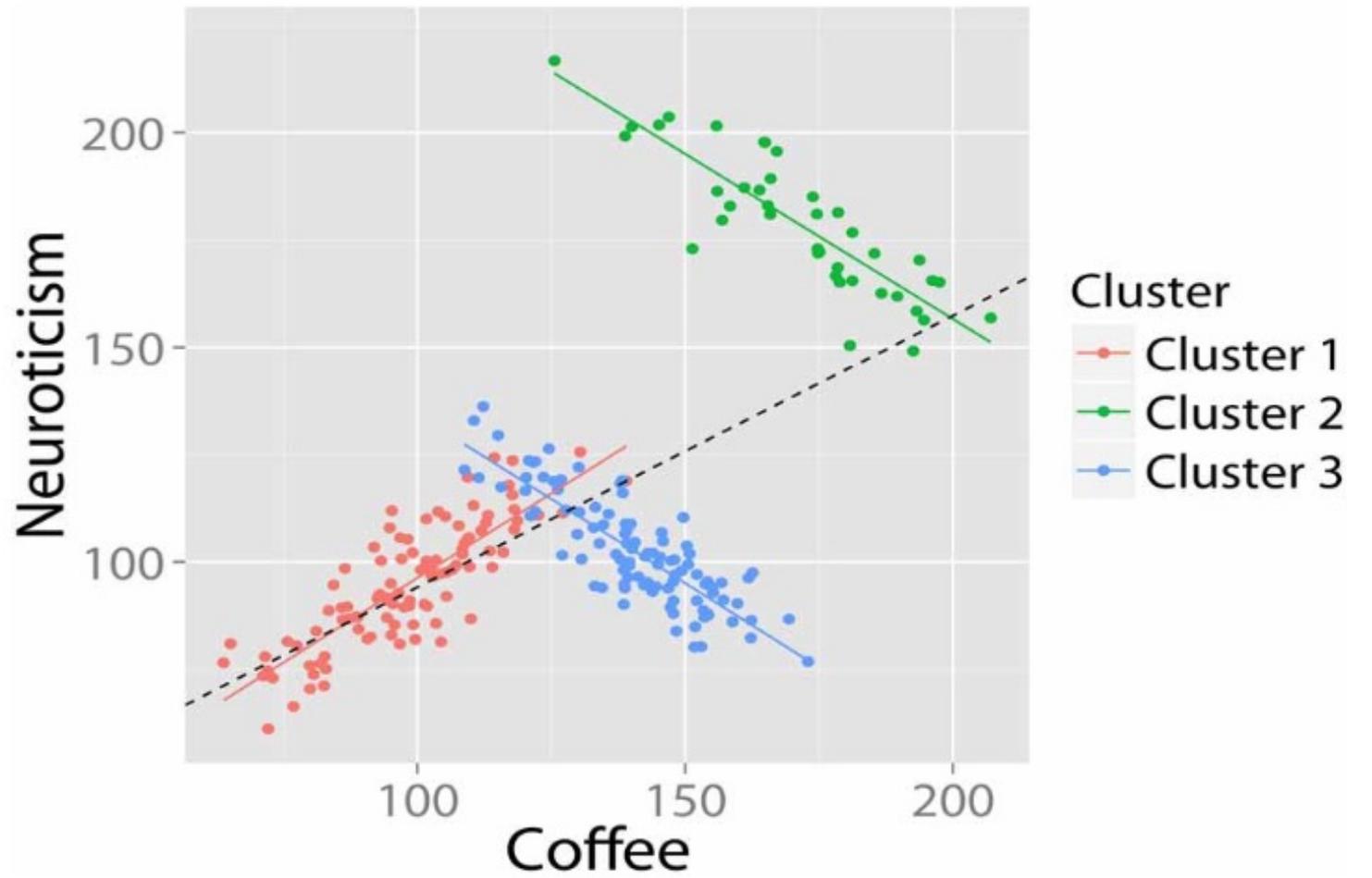
When we separate the data by another parameter, we uncover a more descriptive trend.



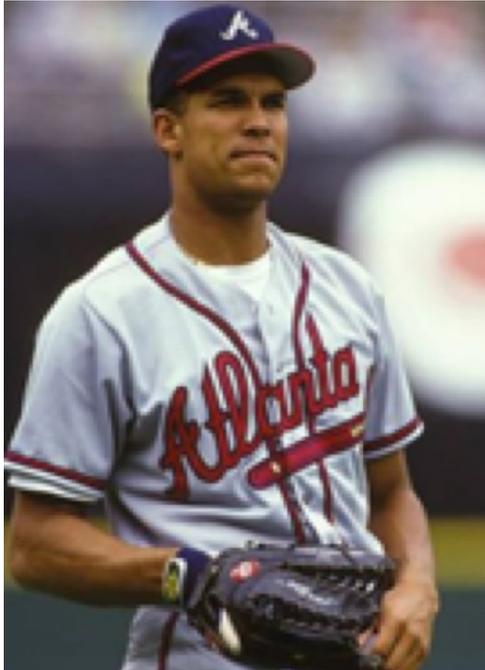
Simpson's Paradox

- When a trend between two variables is reversed in *all* subgroups of the data.
- If the trend is reversed for *some* subgroups, it is a mix effect.

Mix Effect



Simpson's Paradox (Rate-based)



| | Hits / At Bats | | | |
|---------------|----------------|--|--|--|
| | | | | |
| David Justice | | | | |
| Derek Jeter | | | | |

Mix Effects (Rate-based)

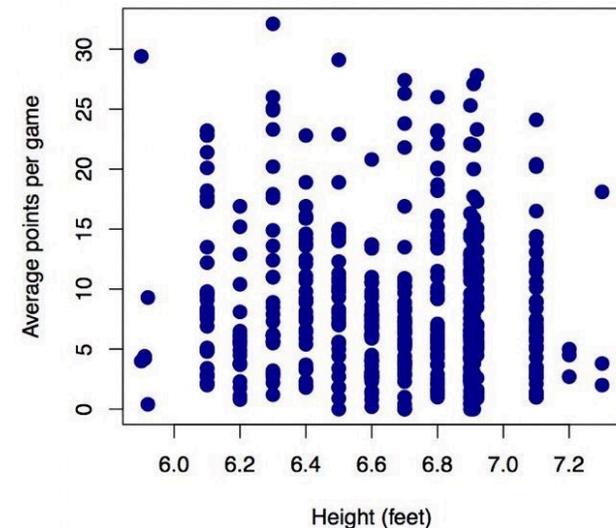
| | Applicants | Admitted |
|--------------|-------------------|-----------------|
| Men | 8442 | 44% |
| Women | 4321 | 35% |

| Department | Men | | Women | |
|------------|------------|------------|------------|------------|
| | Applicants | Admitted | Applicants | Admitted |
| A | 825 | 62% | 108 | 82% |
| B | 560 | 63% | 25 | 68% |
| C | 325 | 37% | 593 | 34% |
| D | 417 | 33% | 375 | 35% |
| E | 191 | 28% | 393 | 24% |
| F | 373 | 6% | 341 | 7% |

Berkson's paradox

- When traits are negatively correlated in a population selected on those traits.

"Height does **not** correlate with performance in the NBA"



Berkson's paradox

"Good Movies make bad books."

