***Types of Data Science:***

Descriptive Analysis:

Goal: Describe or summarize a set of data

* Early analysis when receive new data
* Generate simple summaries about the samples and their measurements (statistics)
  + Measures of central tendency or measures of variability
* NOT for generalizing the results of the analysis to a larger population or trying to make conclusions

Exploratory Analysis:

Goal: Examine the data and find relationships that weren’t previously known

* Explore how different variables might be related
* Useful for discovering new connections
* Help to formulate hypotheses and drive the design of future studies and data collection

\*\* correlation does not imply causation\*\*

Inferential Analysis:

Goal: Use a relatively small sample of data to say something about the population at large

* Provide your estimate of the variable for the population and provide your uncertainty about your estimate
* Ability to accurately infer information about the larger population depends heavily on sampling scheme

Predictive Analysis:

Goal: Use current and historical data to make predictions about future data

* Accuracy in predictions is dependent on measuring the right variables
* Many ways to build up prediction models with some being better or worse for specific cases
  + More data and a simple model generally performs well at predicting future outcomes

\*\* just because one variable may predict another, it does not mean that one causes the other\*\*

Causal Analysis:

Goal: See what happens to one variable when we manipulate another variable

* Gold standard in data analysis (seen often in scientific studies when scientists are trying to determine the cause of a phenomenon)
* Challenge acquiring data for a causal analysis
* Often applied to the results of randomized studies that were designed to identify causation
* Usually analyzed in aggregate and observed relationships are usually average effects
  + Ex: on average giving a certain population a drug may alleviate the symptoms of the disease, this causal relationship may not hold true for every single effected individual.

Mechanistic Analysis:

Goal: Understand the exact changes in variables that lead to exact changes in other variables

* Applied to simple situations or those that are nicely modeled by deterministic equations
* Commonly applied to physical or engineering sciences
  + Biological sciences, are far too noisy to use mechanistic analysis
* Often, the only noise in the data is measurement error