



Bootstrap



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Bootstrap

- The **Bootstrap** method is similar to **cross-validation**
- Like with cross-validation, the model is **trained** with samples **selected** from the data and **tested** with the observations that were **not selected**
- The **difference** is that in the Bootstrap method:
 - **S sample** observations are drawn **K times**
 - Each of the **K samples** is done “**with replacement**”, which means that the same data can be re-selected
 - While this may seem redundant, each time you draw a new sample, each data point has the **same probability** of being selected
 - Also, there is **no limit** to how many times samples can be drawn
 - So, if a data set has **N observations**, one could draw **N** different random **samples**, thus having as many samples as data points.
 - Bootstrapping is **popular** when the **distribution** of the data is **unknown** or has unusual shapes because the means of the samples extracted are approximately normally distributed



Machine Learning Process

- When partitioning the data into training and test sets, there is some **loss of statistical power** because the training data set is smaller than the full data set
- Therefore, it is recommended to follow this **general process**:
 1. **Partition** the data into **training** and **test** data sets using a particular partitioning method
 2. Develop **various models** using different predictive modeling methods using the training data set
 3. **Test** all the models for predictive accuracy using the “**hold-out**” or test set.
 4. Re-sample, re-train and re-test **multiple times**
 5. **Select** the modeling method with the **best predictive accuracy**
 6. Then **re-train** the model using the selected method but with the **full data set**

Tips

`boot()` {`boot`} → Function that can be used for bootstrapping using various statistics and models. We will not cover bootstrapping in depth in this class, but there are several guidelines in the R script provided for you to explore on your own.



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