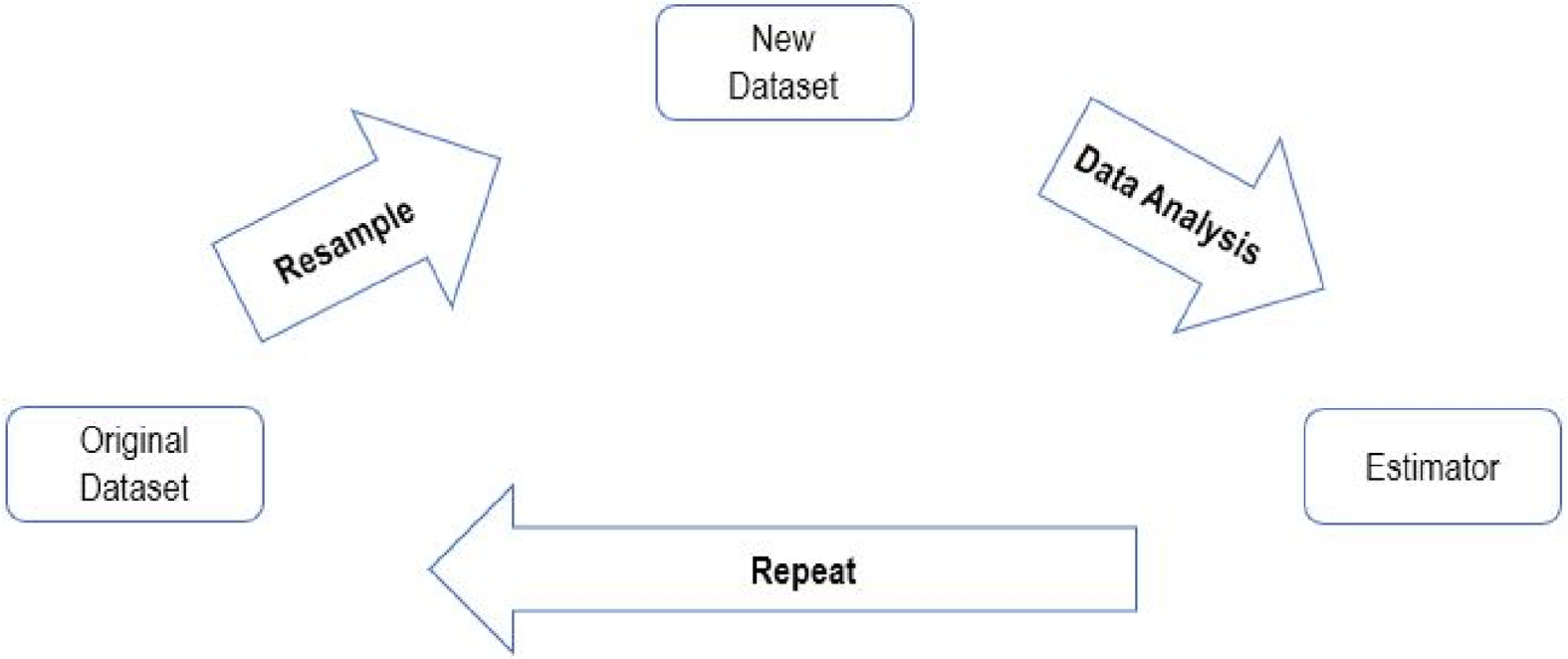
STATISTICAL SIMULATION IN PYTHON

Introduction to resampling methods

Tushar Shanker
Data Scientist

Resampling workflow



Why resample?

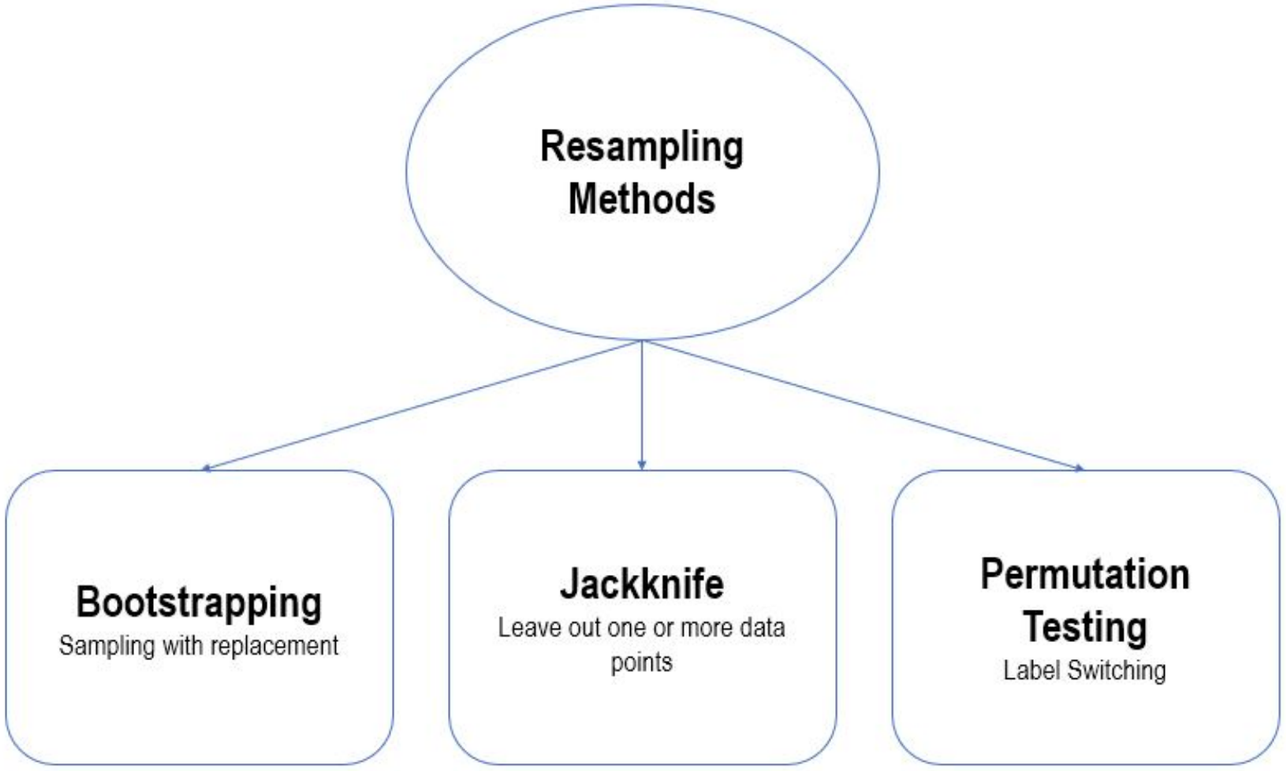
Advantages

- Simple implementation procedure.
- Applicable to complex estimators.
- No strict assumptions.

Drawbacks

- Computationally expensive.

Types of resampling methods



STATISTICAL SIMULATION IN PYTHON

Let's practice!

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Bootstrapping

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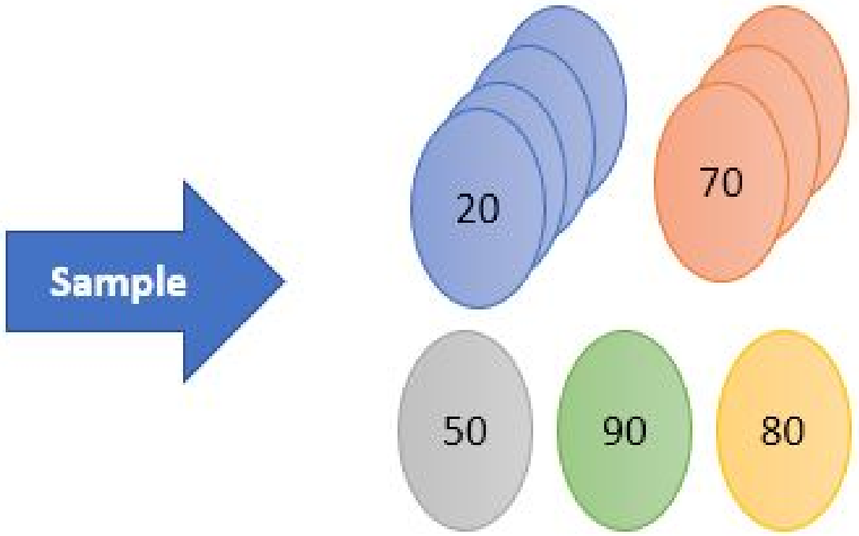
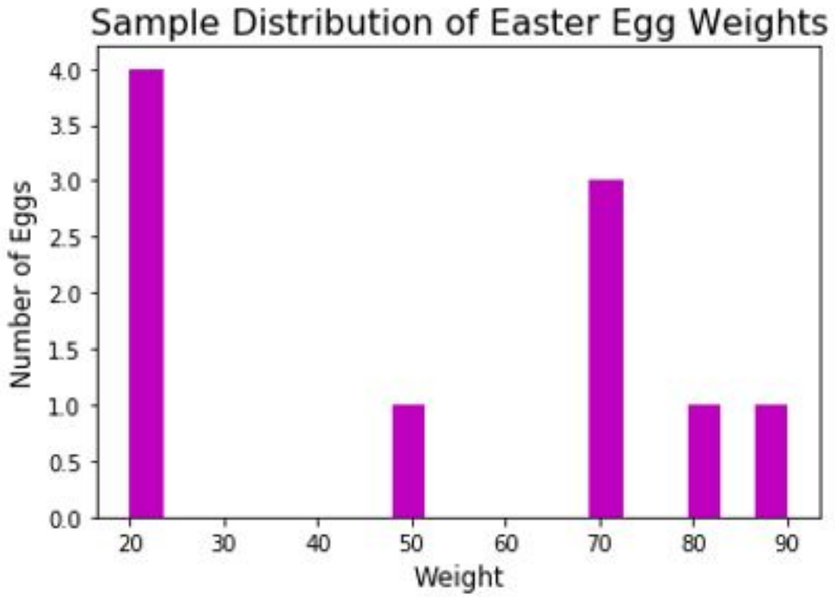
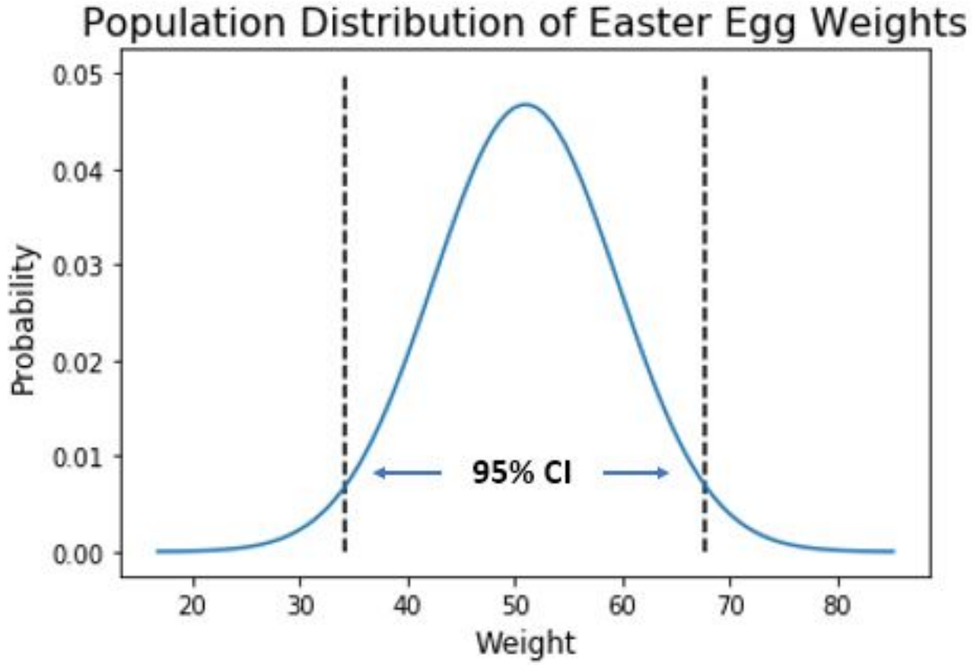
Easter eggs

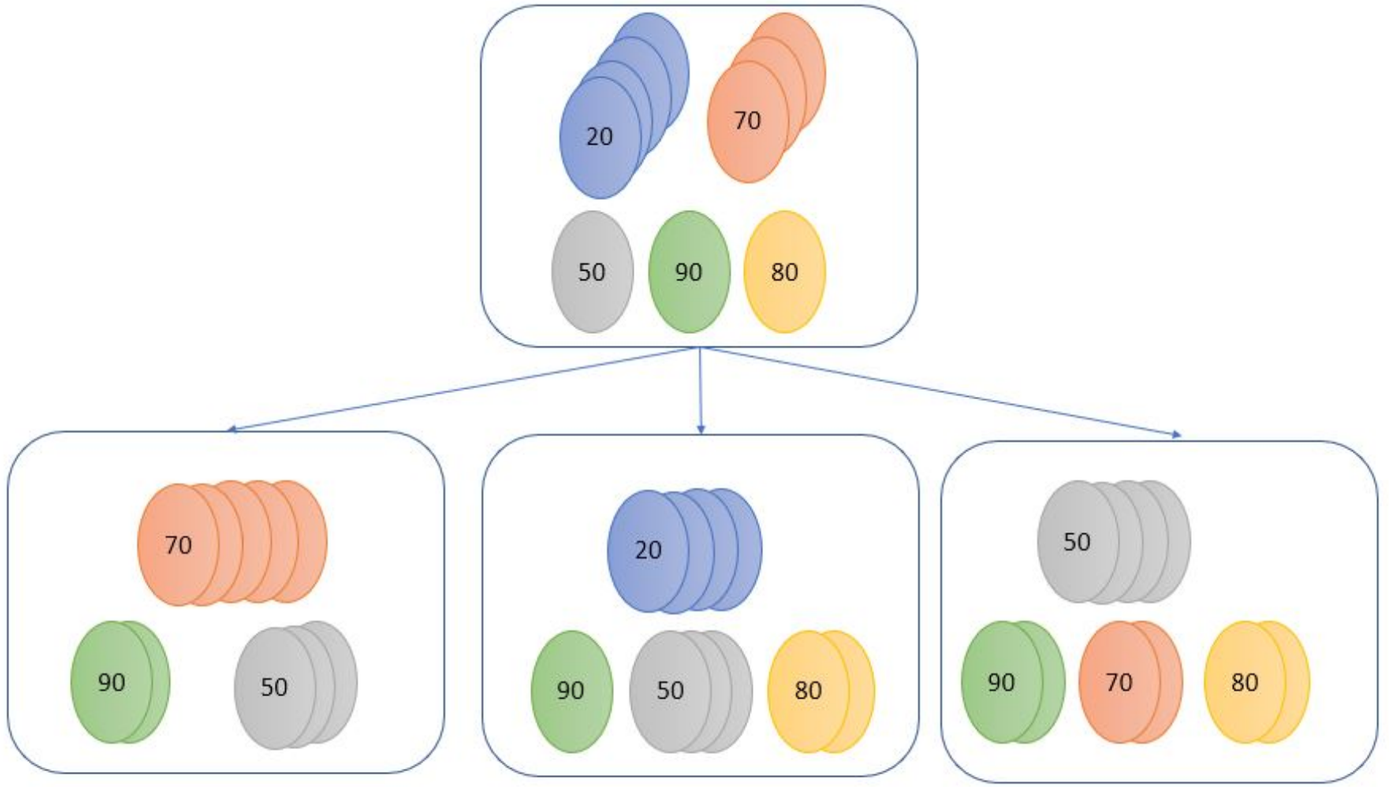


Easter eggs

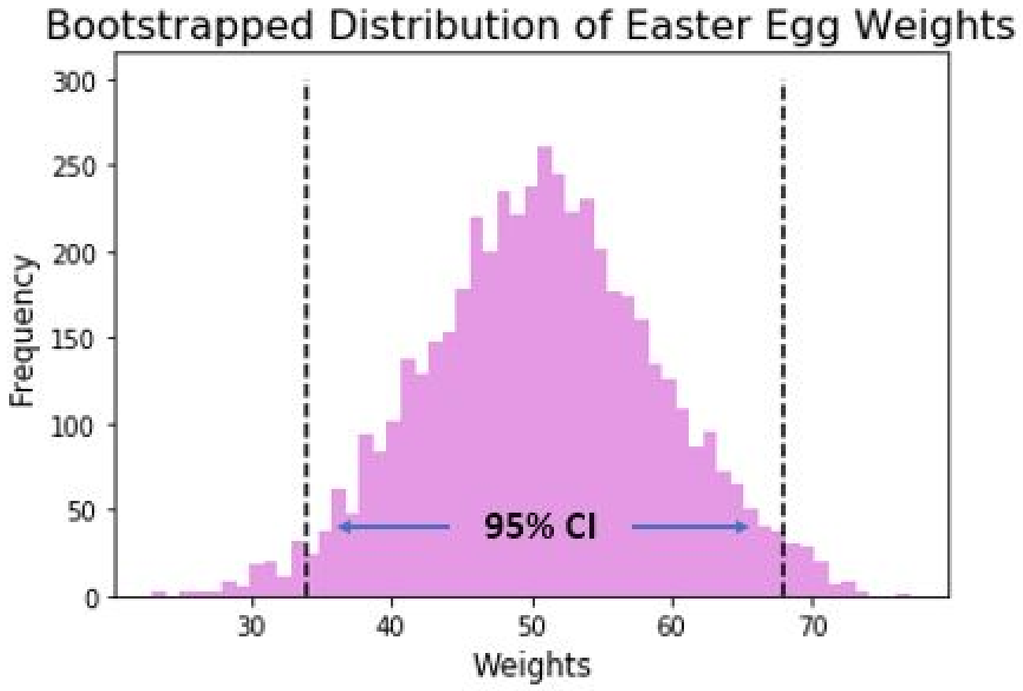

Sample Distribution of Easter Egg Weights
Number of Eggs
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
20
30
40
50
60
70
80
90
Weight


Population Distribution of Easter Egg Weights
Probability
0.00
0.01
0.02
0.03
0.04
0.05
95% CI
20
30
40
50
60
70
80
Weight

Bootstrapping Easter eggs



Bootstrapped distribution



Bootstrap - Good to know

- Run at least 5-10k iterations.
- Expect an approximate answer.
- Consider bias correction.

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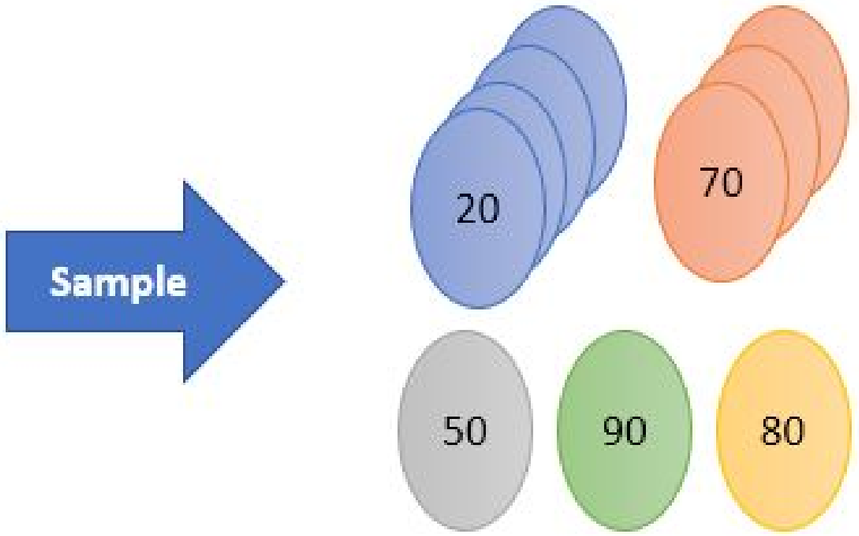
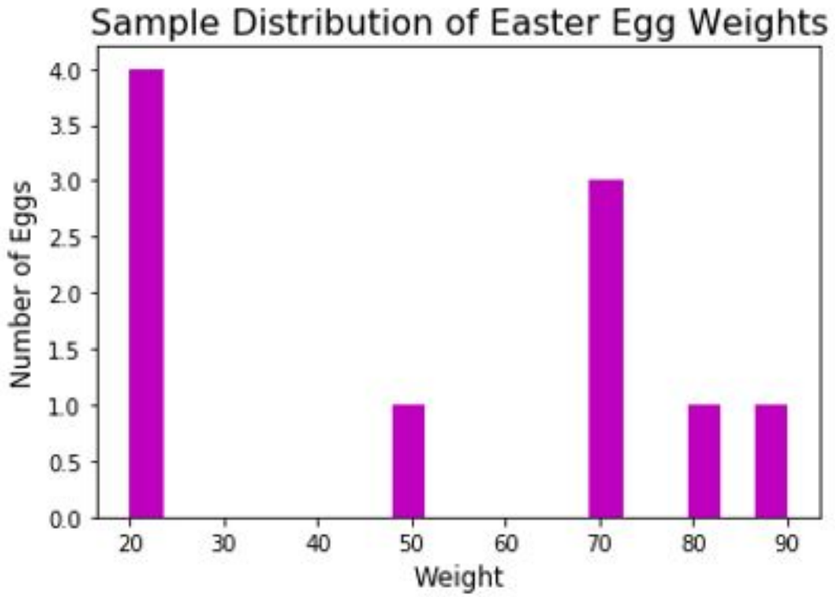
Jackknife resampling

Tushar Shanker
Data Scientist

Easter eggs



Easter eggs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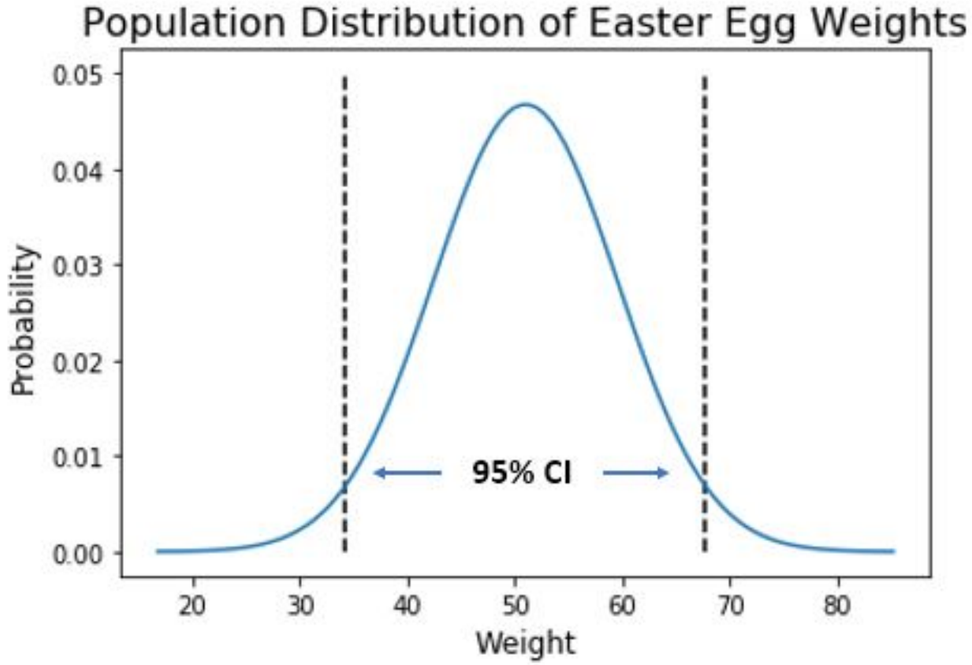
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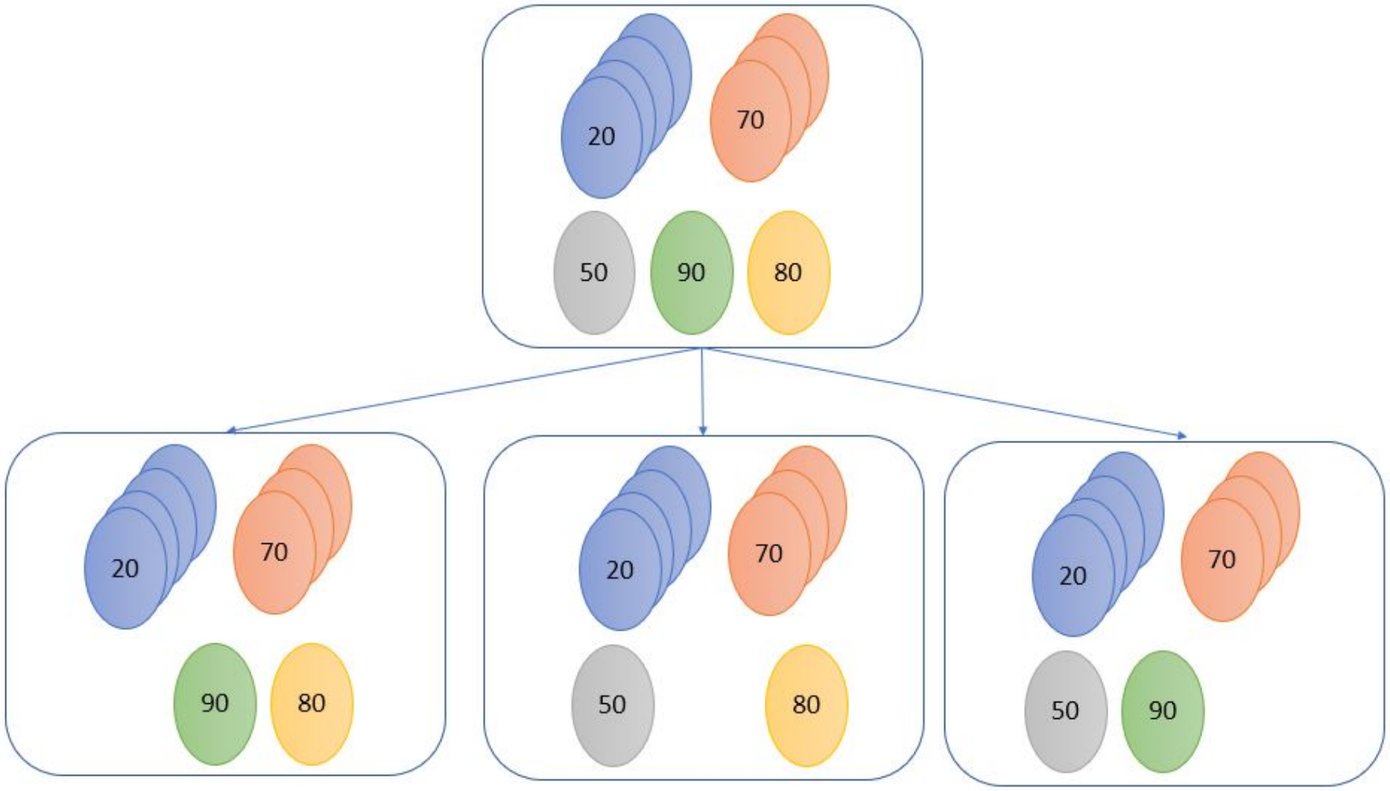
Jackknifing Easter eggs



Jackknife estimate

Jackknife Estimate

$$\hat{\theta}_{jackknife} = \frac{1}{n}\Sigma_{i=1}^{n}\hat{\theta}_i$$

$\hat{\theta}_{jackknife}$: Jackknife Estimate, $\hat{\theta}_i$: Estimate for each Jackknife Sample

Variance of Jackknife Estimate

$$Var(\hat{\theta}_{jackknife}) = \frac{n-1}{n}\Sigma(\hat{\theta}_i - \hat{\theta}_{jackknife})^2$$

$\hat{\theta}_{jackknife}$: Jackknife Estimate $\hat{\theta}_i$: Estimate for each Jackknife Sample

Jackknife vs Bootstrap

Jackknife

- Mean Weight = 51g
- 95% CI = [33.36g, 68.64g]

Bootstrap

- Mean Weight = 50.8g
- 95% CI = [35g, 67.03g]

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Permutation testing

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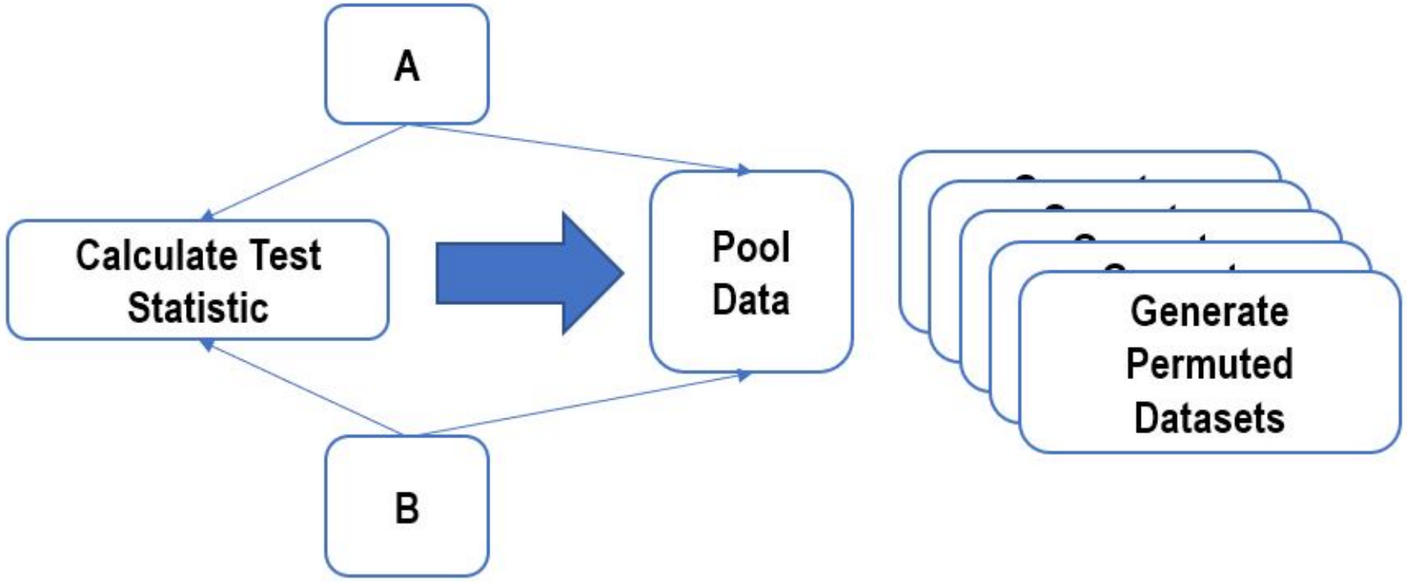
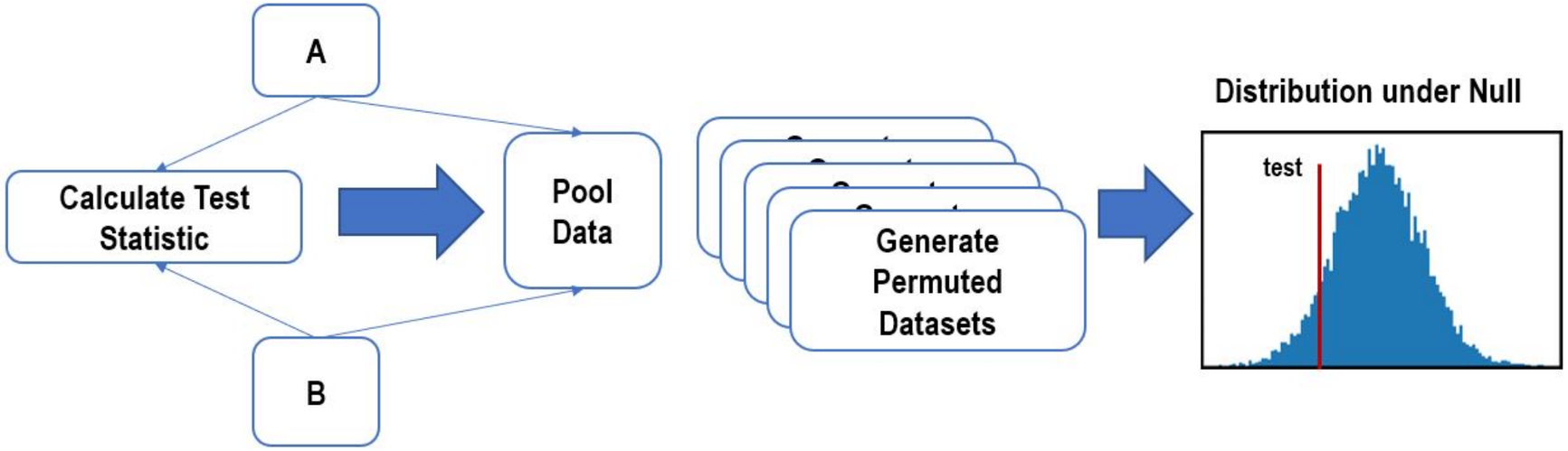
Steps involved



Steps involved



Discussion

ADVANTAGES

- Very flexible
- No strict assumptions
- Widely applicable

DRAWBACKS

- Computationally Expensive
- Custom coding required

Donation website

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