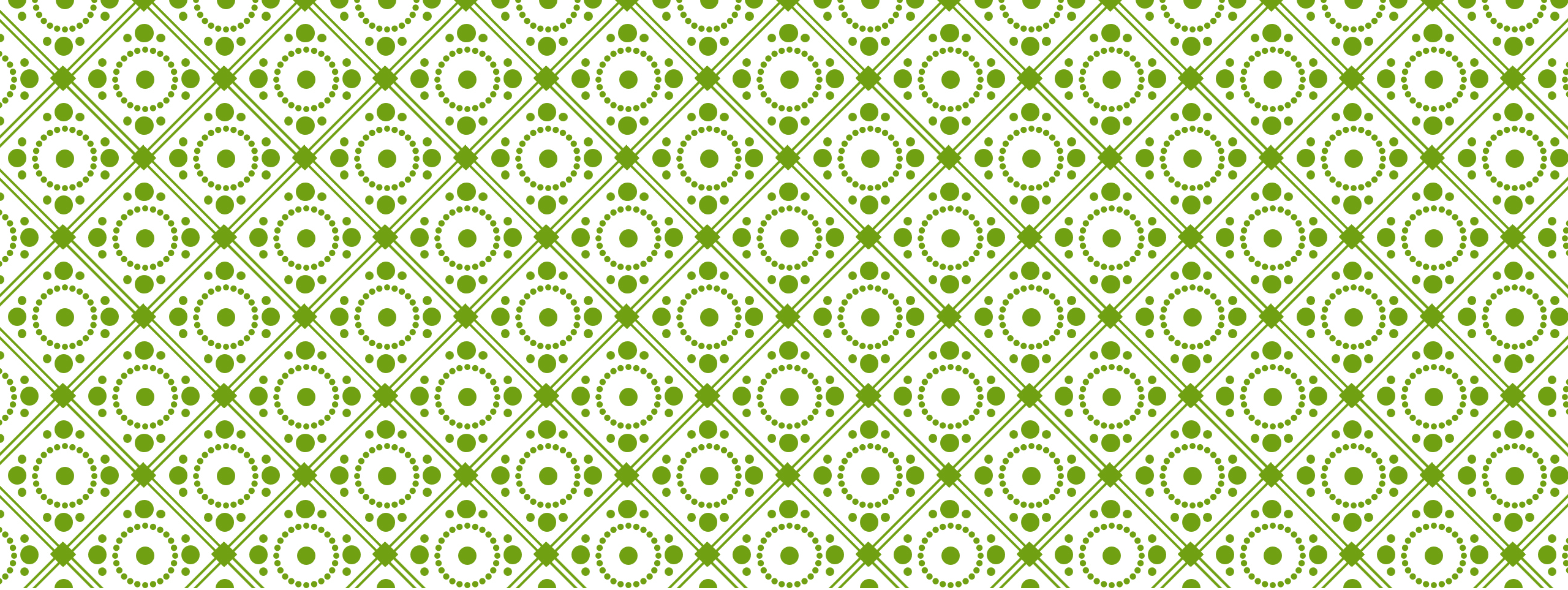


RESAMPLING JACKKNIFE

Komputasi Statistika MAS246

JACKKNIFE

- Metode jackknife pertama kali ditemukan oleh Quenouille (1949) yang digunakan untuk memperkirakan bias dari suatu estimator dengan menghapus beberapa observasi sampel.
- Metode jackknife juga dikenal sebagai metode 'leave-one-out' karena didasarkan pada penghapusan satu pengamatan secara berurutan dari kumpulan data dan menghitung estimator untuk masing-masing n sampel ini (masing-masing berukuran $n-1$). Artinya, terdapat tepat n perkiraan jackknife yang diperoleh dalam sampel berukuran n.
- Standar error dari estimator kemudian dapat dihitung sebagai standar deviasi dari perkiraan n jackknife.

JACKKNIFE

- Metode statistik untuk memperkirakan dan menghilangkan bias dan untuk mendapatkan perkiraan yang kuat dari standard error dan interval kepercayaan
- Dibuat dengan menghapus subkumpulan data secara sistematis satu per satu dan menilai variasi yang dihasilkan

Bias: A statistical sampling or testing error caused by systematically favoring some outcomes over others

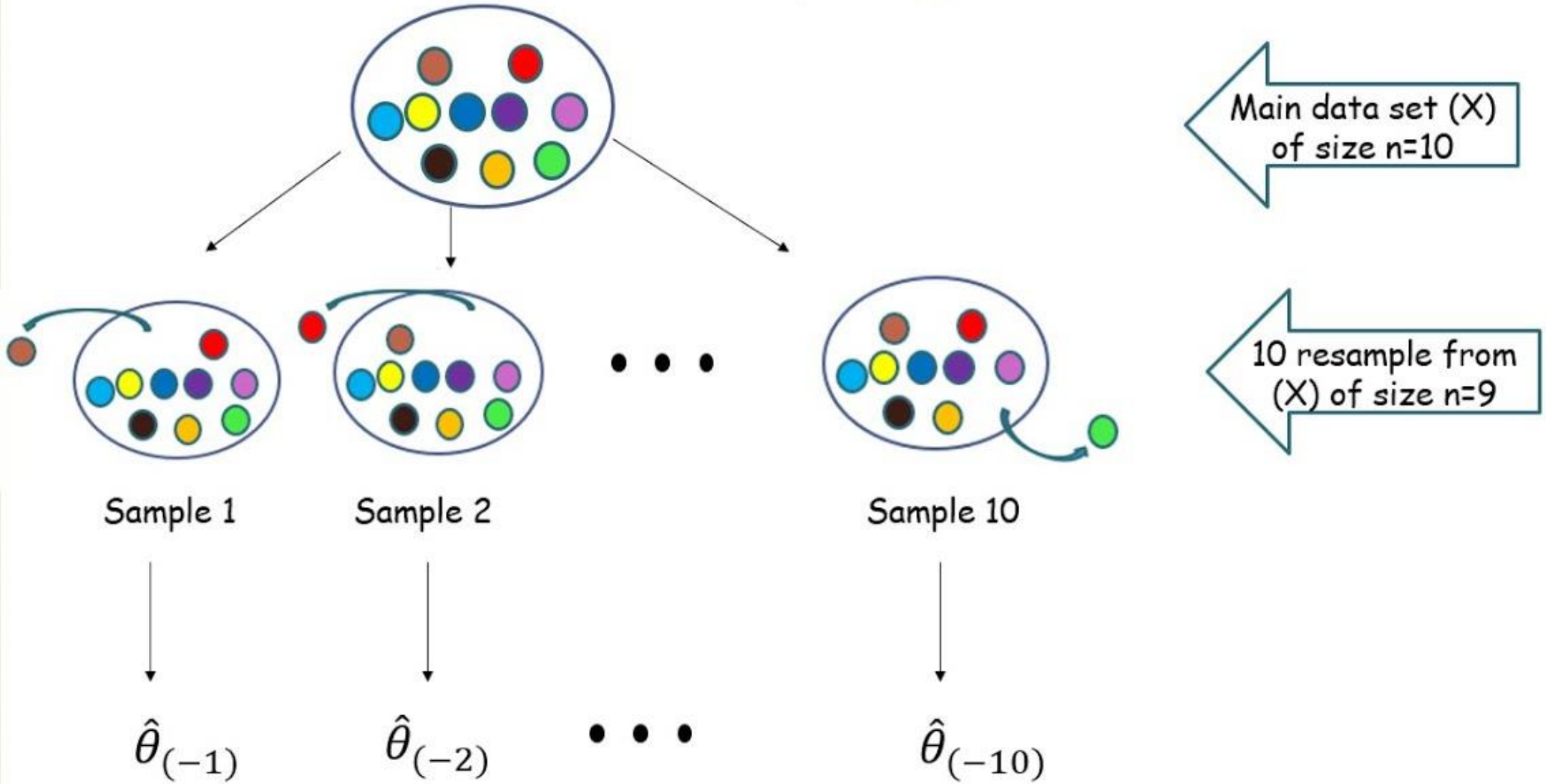
HISTORY OF JACKKNIFE

- The jackknife technique was developed by Maurice Quenouille (1924-1973) in 1949 and refined in 1956.
- John Tukey expanded on the technique in 1958 and proposed the name “jackknife” because, like a physical jack-knife (a compact folding knife)

STEPS IN JACKKNIFE

- ✓ We consider that we have a sample of data, X of size n
- ✓ Construct a jackknife sample $X_{(-j)}, j = 1,2, \dots, n$ which is the set of observations without j-th observation from X
- ✓ Compute the estimate $\hat{\theta}_{(-j)}$ from each jackknife sample
- ✓ Get a jackknife estimate of the parameter as $\hat{\theta}_{jack} = \frac{1}{n}\sum_{j=1}^{n} \hat{\theta}_{(-j)}$
- ✓ Estimate the standard error using the formula of sample standard deviation to n estimates from jackknife sample
- ✓ Compute other requirements, like 95% CI or bias

Jackknife resampling



BIAS & STANDARD ERROR OF JACKKNIFE

Bias

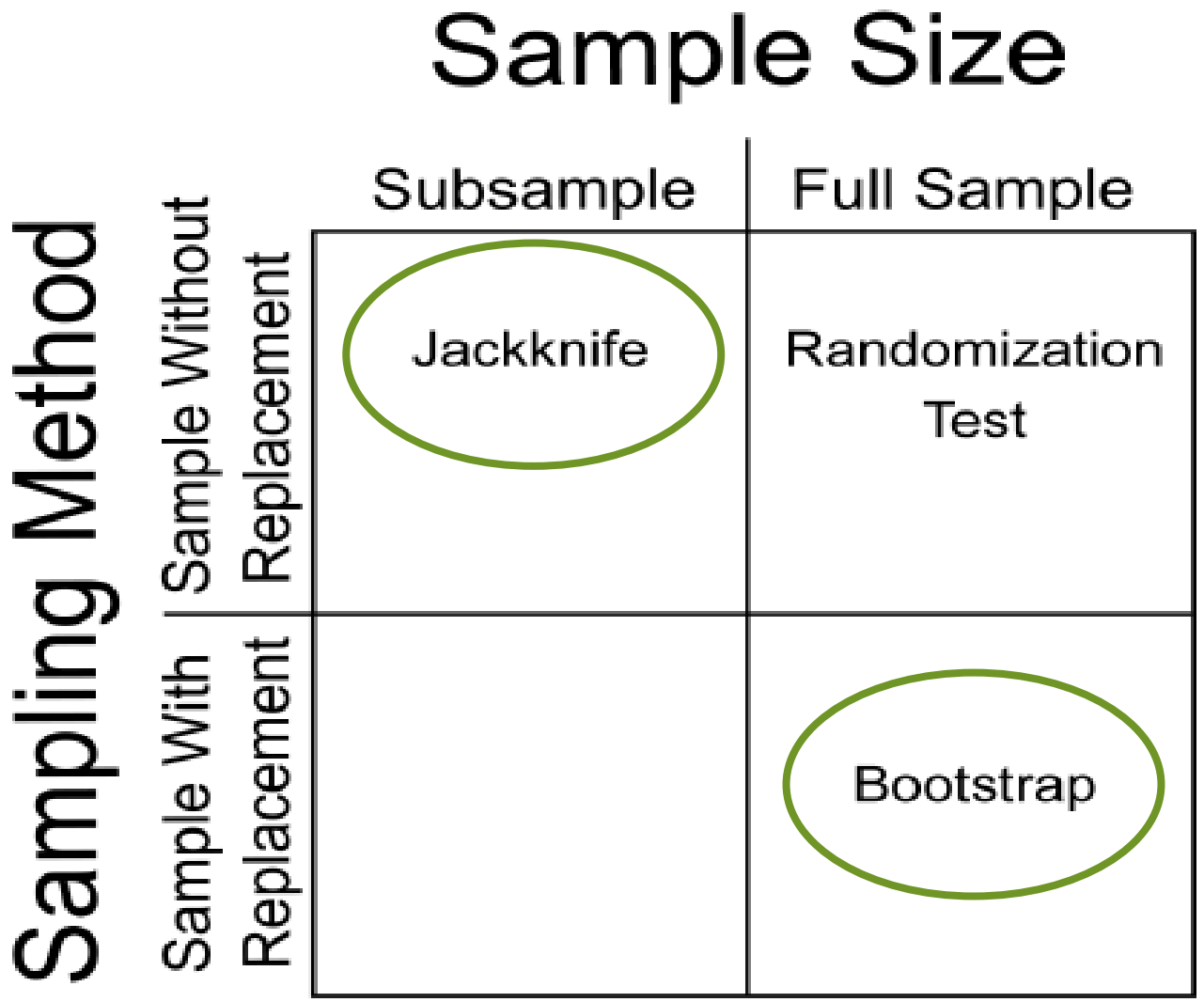
However, the jackknife estimate of bias is defined by

$$Bias_{jack} = (n-1)\left(\hat{\theta}_{jack} - \hat{\theta}\right)$$

Standard error

The jackknife estimate of the standard error is defined as

$$se_{jack} = \left[\frac{n-1}{n}\sum_{j=1}^{n}\left(\hat{\theta}_{(-j)} - \hat{\theta}_{jack}\right)^2\right]^{\frac{1}{2}}$$


Sample Size
Subsample
Full Sample
Sampling Method
Sample Without Replacement
Sample With Replacement
Jackknife
Randomization Test
Bootstrap

A COMPARISON OF THE BOOTSTRAP & JACKKNIFE

Bootstrap

- Menghasilkan hasil yang sedikit berbeda saat diulang pada data yang sama (saat memperkirakan standard error)
- Tidak terikat pada distribusi teoretis

Jackknife

- Less general technique
- Explores sample variation differently
- Yields the same result each time
- Similar data requirements

FAILURE OF JACKKNIFE

- If the estimator is not smooth, then the jackknife method may fail miserably
- Jackknifing is sensitive to outliers, contaminated os skewed distribution

JACKKNIFE PROS AND CONS

Advantages

- Useful method for estimating and compensating for bias in an estimator.
- Like the bootstrap, the methodology does not require knowledge of the theoretical form of an estimator's standard error.
- Is generally less computationally intensive compared to the bootstrap method.

Disadvantages

- The jackknife method is more conservative than the bootstrap method, that is, its estimated standard error tends to be slightly larger.
- Performs poorly when the estimator is not sufficiently smooth, e.g., the median.

TERIMA KASIH