





[Bio-] statistics

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August 2023











How do we get from Data to Distributions?

Measurements: [7, 5, 5, 6, 6, 7, 8, 7, 2, 4, 6, 4, 1, 6, 4, 5, 2, 7, 6, 5, 9, 5, 6, 3, 4, 8, 6, 2, 4, 6, 5, 4, 1, 5, 6, 7, 8, 3, 4, 5, 8, 6, 3, 7, 6, 9]



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• "Where" in parameter space are my samples located?





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- Percentiles
 - The value under which a given percentage of our samples lie
 - Independent of distribution

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Comparing Means of Known Distributions is Reasonable

Comparing Means of Unknown Distributions can be Misleading

• Are two measurements coming from the same distribution, if their mean is

similar?

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-5

A B

Mean(A) = 5.0 Mean(B) = 5.0

Similar means is a necessary condition, but it is NOT sufficient!

• Draw histograms. These distributions look very different!

5 4.0 4.0 3.5 3.5 · 3.0 3.0 · 2 4 Count 2.5 2.5 Count 2.0 8 2.0 5 1.5 1.5 9 1.0 1.0 0.5 · 0.5 -2 6 0.0 + 0.0 0 2 6 8 10 0 2 6 10 8 6 Measurement A Measurement B 5 @zoccolermarcelo

Parametric vs. non-parametric

Normal distribution:

- Can be completely described by mean μ and standard deviation σ

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Allows comparing distributions (e.g., with two-sided/paired t-test)

Ranked distribution:

- Replace each value with its "rank"
- Rank = index of value in sorted list
- Robust to outliers
- Independent of underlying distribution

Value	Rank
10	1
15	2
3	0
97	3

Graph adapted from: M. W. Toews - Own work, based (in concept) on figure by Jeremy Kemp, on 2005-02-09, CC BY 2.5, https://commons.wikimedia.org/w/index.php?curid=1903871

from scipy import stats @|CzechBIAS

stats.shapiro(measurements)

ShapiroResult(statistic=0.964,
pvalue=0.161)

