LECTURE 5 – **Resampling methods**

Let’s say you want to know if there is any difference in the number of pulsars between a spiral galaxy and an elliptical galaxy.

You randomly select 10 galaxies, 5 of each, and count the number of pulsars in each:

# of pulsars in spiral galaxies: [117, 123, 111, 101, 121]

# of pulsars in ellipical galaxies: [98 104 106 92 88]

H0: There is no difference in the number of pulsars between spiral and ellptical galaxies.

Now what? We cant use any learned test because we do not know if the data is normally distributed, do not have the population parameters and our sample size is too small.

Let’ s do a permutation test (we have to design the whole test by ourselves):

Instead of making assumptions to solve this problem, we will use the actual data we have (and lots of computations) to determine the distribution of the test statistic under the null hypothesis, the null distribution.

Let’s define a suitable test statistic.

In principle, the value of a test statistic should be large when the null hypothesis is false and small when it is true.

For example: M = sum(PS) - sum(PE)

Note: There are many other reasonable choices like the mean differences, ratios, absolute value, squared differences, etc. The mean for example would have been a better idea if the smple sizes were different.

Table, calendar

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Depending on the metric picked, the result changes completely.

The best way is usualy to use the most straight-forward.

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Chart, histogram

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Reshuffling many times from all the data, assigning it to the galaxies randomly and checking the difference between the summation, we get a null distribution where we can check the p-value of 85. Therefore we reject the null hypothesis.

Permutation tests redux

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Measurement: Sampling from reality

Bootstrapping: Sampling from sample

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