



SciPy India

Inferential Statistics with Python

—

Rounak Banik

github.com/rounakbanik/inferential_stats_pycon

rounakbanik / inferential_stats_pycon

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The code repository for the proposed talk on Inferential Statistics at SciPy India 2017

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rounakbanik [Change notebook names.](#)

Latest commit abad755 3 minutes ago

.ipynb_checkpoints

Add Correlation Notebook.

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Add Sampling Notebook.

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01- Descriptive Primer.ipynb

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03- Hypothesis.ipynb

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04-Correlation.ipynb

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README.md

Add racial discrimination to README.

3 months ago

Contents

1. Descriptive Statistics Primer

Central Tendencies, Measures of Spread, Binomial and Normal Distributions, Normalcy Test, Z-Scores and p-values.

2. **Sampling**

Estimation of Population Proportion and Mean, The Central Limit Theorem

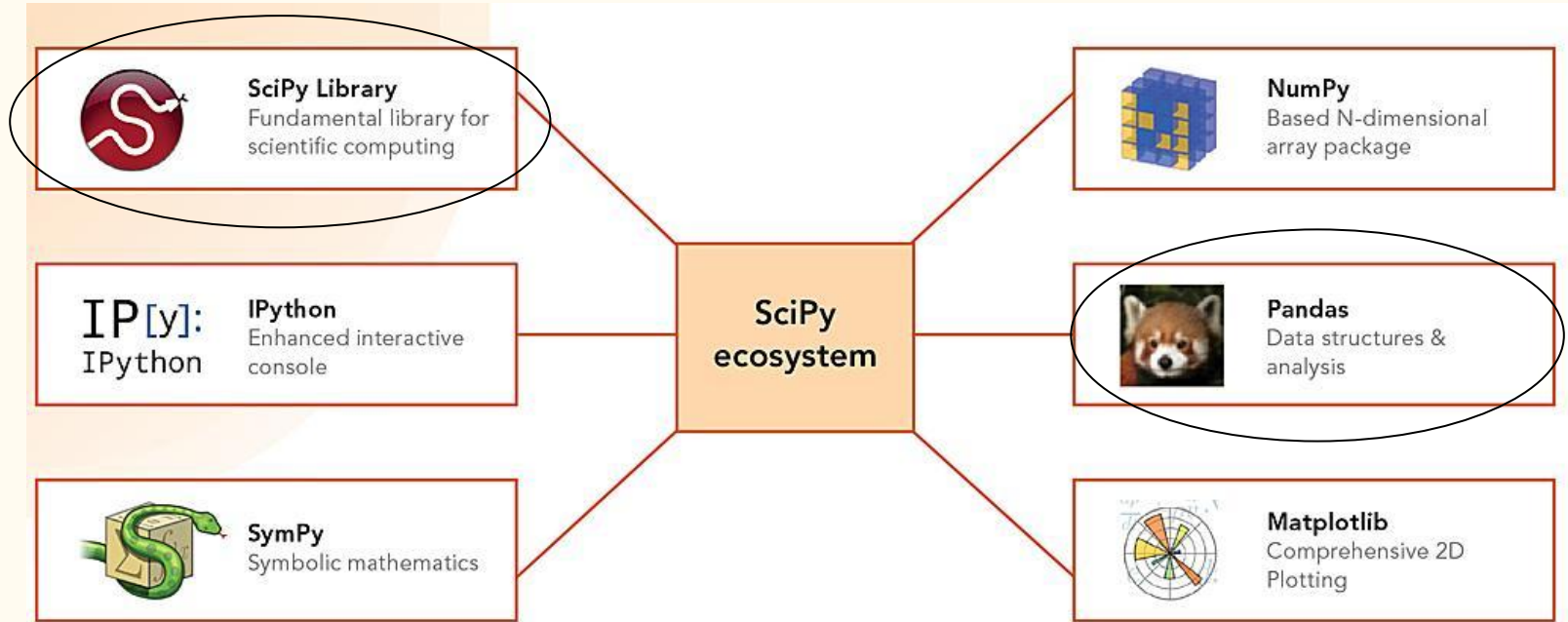
3. **Hypothesis Testing and Statistical Tests**

Null and Alternate Hypotheses, One and Two Sample Significance Tests, Chi-Squared Significance Tests

4. Ethics and Standards in Inferential Statistics

Sampling Bias, Statistical v/s Practical Significance, Misusing p-values

Tools



Sampling





Credit Card Frauds

What fraction of credit card transactions are fraudulent?

Olympian Weights

What is the average weight of an Olympian athlete?

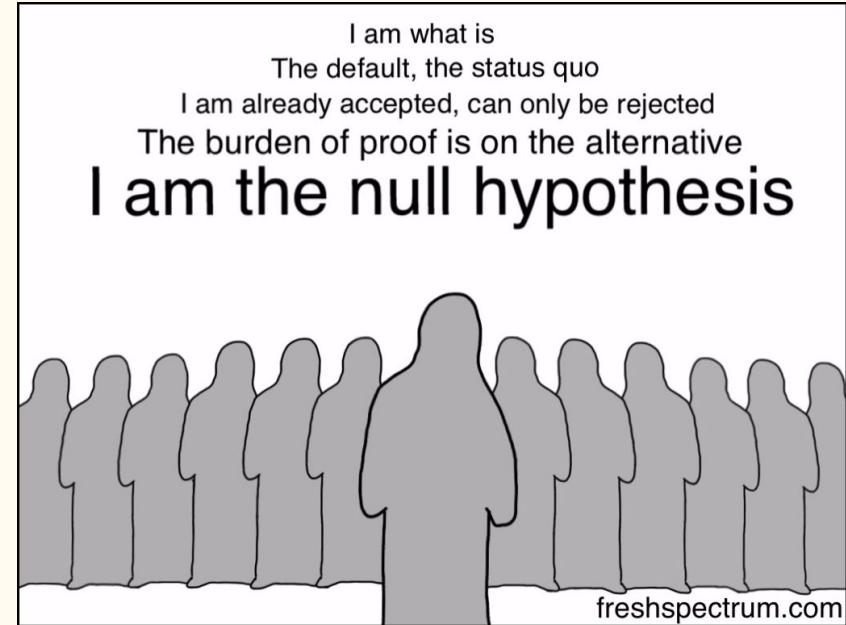


Hypothesis Testing

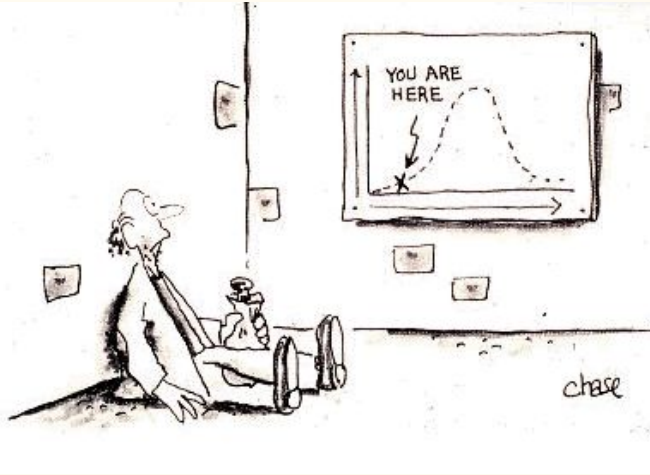


Terminology

1. Null and Alternate Hypotheses
2. Significance Level
3. Statistical Test
4. P-Values



Steps



1. Formulate the Null and the Alternate Hypothesis.
2. Decide on the Statistical Test to use.
3. Calculate the p-value
4. Compare p-value to the significance level, alpha. Reject/Accept Null Hypothesis based on the comparison.
5. Summarize the result

Suicide by Gender

In India, are men as likely as women to commit suicide?





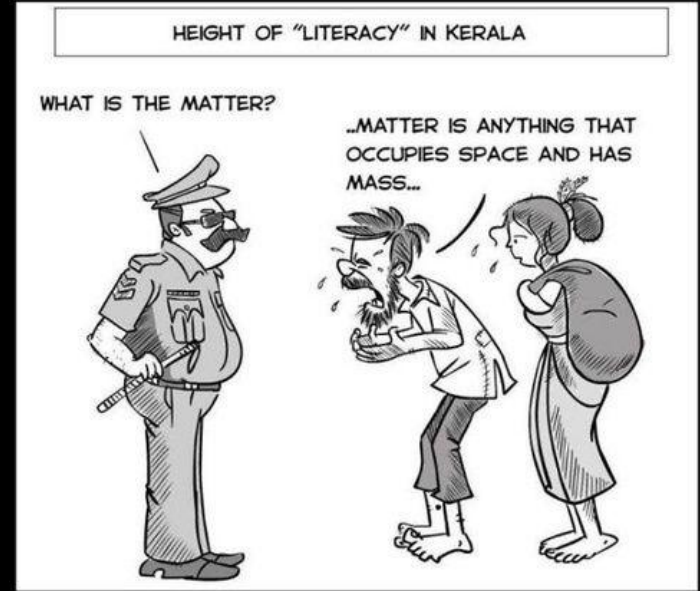
NBA Player Heights

What is the average height of NBA players?



Literacy Rates

How do the literacy rates in Delhi and Punjab compare?





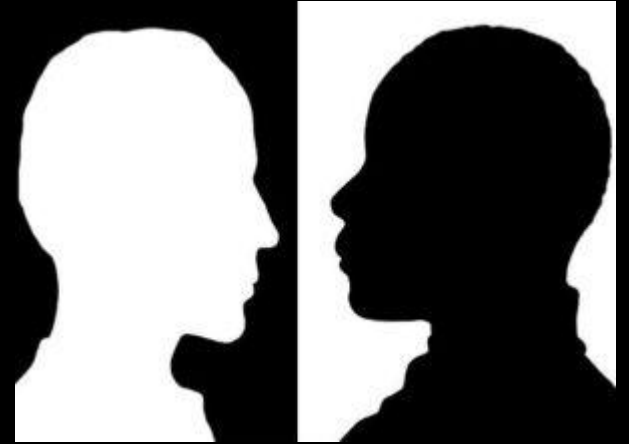
Airbnb Destinations

Do men and women prefer certain countries for Airbnb bookings?



Racial Discrimination

Are blacks as likely to get an interview call as whites?

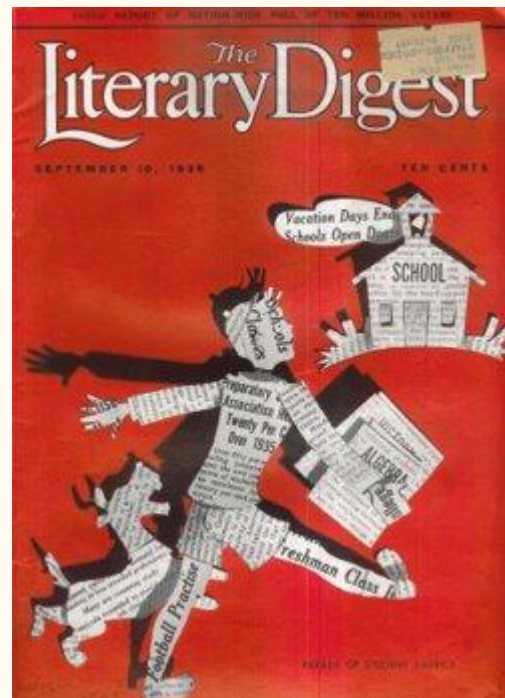


Ethics and Standards

Quality and Quantity

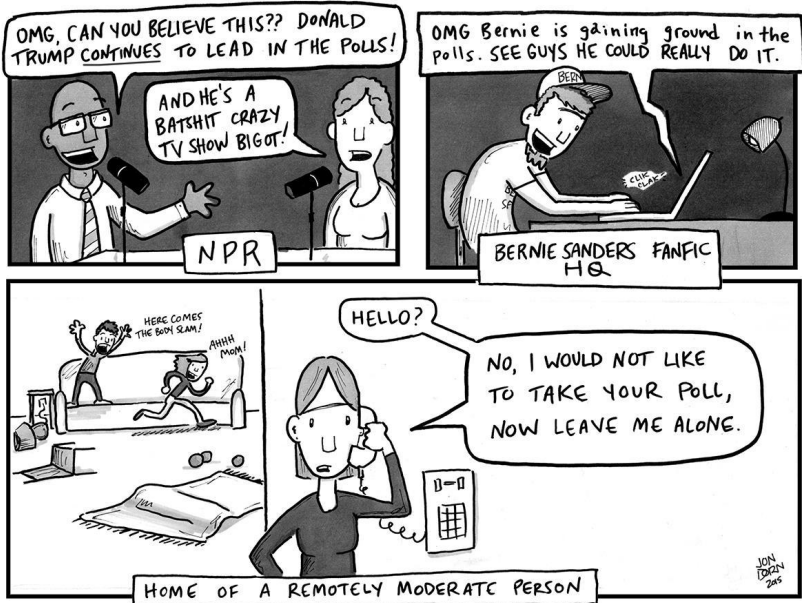


Nominee	Franklin D. Roosevelt	Alf Landon
Party	Democratic	Republican
Home state	New York	Kansas
Running mate	John Nance Garner	Frank Knox
Electoral vote	523	8
States carried	46	2
Popular vote	27,752,648	16,681,862
Percentage	60.8%	36.5%



Sampling Bias

SAMPLING BIAS by JON DORN



1. Deterministic bias
2. Small number of observations
3. Selection bias
4. Confirmation bias
5. Inaccuracy

Statistical and Practical Significance

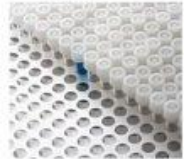
Magnitude-based inferences

Limitations of NHST



Academic journal bans p-value significance test

Written by [Web News Editor](#) on 25 March 2015. Posted in [News](#)



An editorial published in the academic journal *Basic and Applied Social Psychology* (BASP) has declared that the null hypothesis significance testing procedure (NHSTP) is 'invalid', and have banned it from future papers submitted to the journal.

In significance testing, a null hypothesis typically posits that changing the input to a system does not change the resulting output. To determine whether a result is statistically significant, a researcher has to calculate a p-value, which is the probability of observing an apparent effect given that the null hypothesis is true. If the p-value is less than 0.05 it is conventionally deemed a statistically significant result.

'We believe that the $p < 0.05$ bar is too easy to pass and sometimes serves as an excuse for lower quality research,' BASP authors David Trafimow and Michael Marks of Mexico State University write in their editorial. They go on to say that they hope other journals will follow suit.

Confidence intervals are also banned, since they do not provide a strong case for concluding that the population parameter of interest is likely to be within the stated interval. 'Bayesian alternatives, however, are neither required nor banned' from the journal.

The use of p-values to judge whether research is 'significant' has been thought by many statisticians to be problematic, ever since the idea was introduced by Ronald Fisher in the 1920s. In 2005, Stanford School of Medicine professor John Ioannidis wrote a well-known paper, 'Why Most Published Research Findings Are False', stating that reliance on p-values alone was 'ill-founded'.

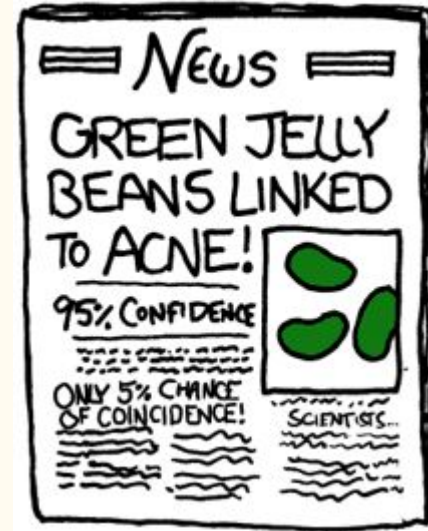
More recently, in November 2014, Royal Society Fellow David Colquhoun published 'An investigation of the false discovery rate and the misinterpretation of p-values' stating: 'If you use $p < 0.05$ to suggest that you have made a discovery, you will be wrong at least 30% of the time'.

The American Statistical Association (ASA) argues that banning p-values altogether will have other 'negative consequences' in a formal statement regarding the editorial. 'The statistical community is aware of problems associated with the use and interpretation of inferential methods,' it says. 'However, the journal proposes to fall back entirely on descriptive statistics and use "larger sample sizes than is typical in much psychology research." We believe this policy may have its own negative consequences and thus the proper use of inferential methods needs to be analyzed and debated in the larger research community.'

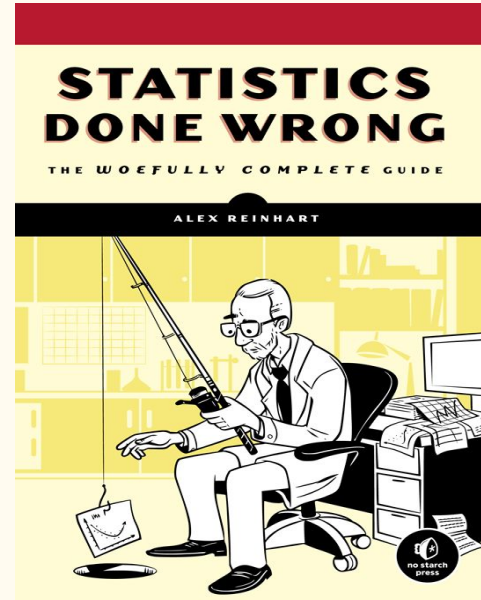
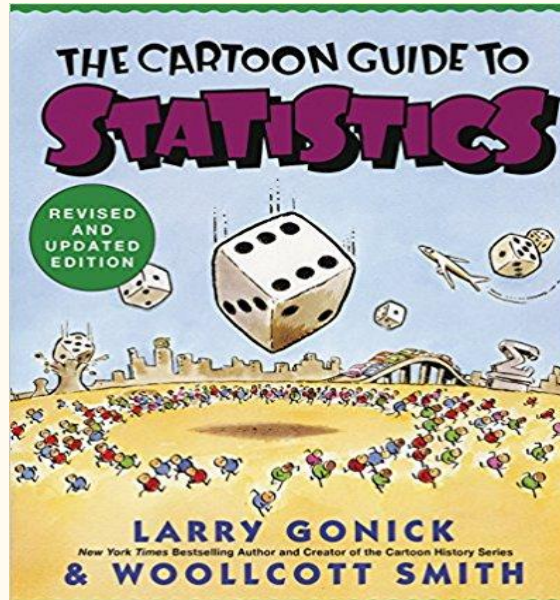
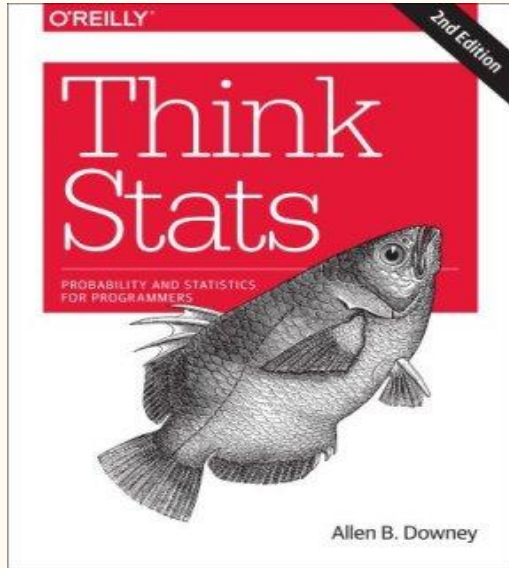
RSS president, Peter Diggle, said: 'The RSS welcomes and shares the BASP editors' concerns that inferential statistical methods are open to mis-use and mis-interpretation, but does not feel that a blanket ban on any particular inferential method is the most constructive response.'

In our Opinion section, Peter Diggle, Stephen Senn, Andrew Gelman, Geoff Cummings and Robert Grant give their initial reaction to the issues raised.

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Further Reading



The End

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