

Brief Overview of Statistical Hypothesis Testing

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Outline

- Brief overview description of statistics
- The problems that I work on
- Applications in academia and industry
- Future careers

Statistics is a SCIENCE (not really a Math)



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From MthSc 309!

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Consider testing a binomial parameter

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Warning: They may give rise to different decisions.

Particle-counting experiment

Testing a binomial parameter:

- $P(X=x) = \binom{n}{x} \theta^x (1-\theta)^{n-x}$.
- A particle goes on to either a red (red=1) or a green (green = 0) light with theoretically equal probability 0.5
- The subject tries to 'influence' particles to go the red light
- To test:

$$H_0 : \theta = 0.5 (\text{has no influence}) \quad \text{vs} \quad H_1 : \theta \neq 0.5 (\text{has influence})$$

- $n = 104,900,000$ trials resulting in $x = 52,263,000$ successes
 $MLE : (x/n = 0.500177)$

Particle-counting experiment

Results:

- $p\text{-value} = Pr_{\theta=0.5}(X \geq x) \approx 0.0003$, which implies that there is strong evidence against the null H_0 .
- The posterior probability under the objective prior $Pr(H_0 | x) \approx 0.94$, which seems to support the null H_0 .

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- **Question:** Bad results! Does the subject have influence on the particles?
- This is the current research that I am working on!

Applications in academia and industry

- The keystone of most statistical applications
- Hot research in academic areas
- The natural sciences (laboratory experiments)
- The social sciences (analyzing data)
- Real life problems
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Some professors in statistics

- Xiaoqian Sun (my advisor)
- Colin M Gallagher
- Karunarathna B Kulasekera
- Robert B Lund
- Chanseok Park
- Calvin Williams
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Have some fun to your
research!