

Kolmogorov Smirnov Test for Testing Population Means

Final Project ST541

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Project Objectives

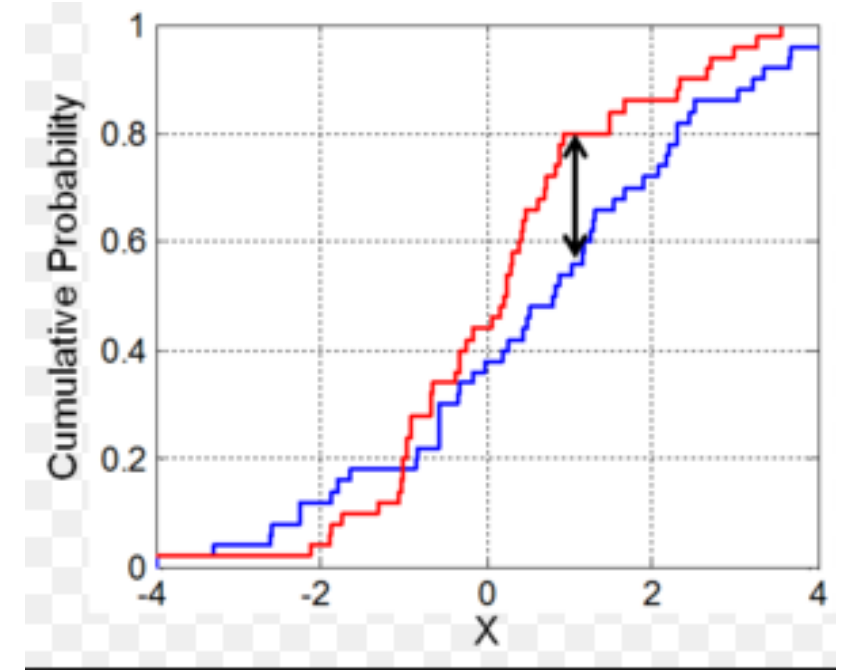
- Is the Kolmogorov Smirnov (KS) test asymptotically exact for testing the means of two distributions?
- Is the Kolmogorov Smirnov (KS) test asymptotically consistent for testing the means of two distributions?



Kolmogorov Smirnov Test

- Testing two sample distributions
 - Null Hypothesis: $H_0: F_Y = F_X$
- Test Statistics : $D = \sup_y |\hat{F}_Y(y) - \hat{F}_X(x)|$

- $\sqrt{\frac{mn}{m+n}} D \rightarrow^d K$





First Question (Testing the Exactness)

- Null hypothesis: $\mu_Y = \mu_X$
- Distributions with the population mean of 0.5:
 1. *Normal*($\mu = \frac{1}{2}, \sigma^2 = 1$)
 2. *exponential*($\lambda = 2$)
 3. *beta*($\alpha = 2, \beta = 2$)
 4. *gamma*($\alpha = 2, \beta = \frac{1}{4}$)

rejection_rate_10	rejection_rate_50	rejection_rate_100	dist1	dist2
0.042	0.885	1	normal	exponential
0.089	0.999	1	normal	beta
0.063	0.951	1	normal	gamma
0.049	0.658	0.951	exponential	beta
0.015	0.218	0.425	exponential	gamma
0.021	0.199	0.366	beta	gamma





Second Question (Testing Consistency)

- Null hypothesis: $\mu_Y = \mu_X$
- Distributions:
 1. *Normal* ($\mu = \frac{1}{2}, \sigma^2 = 1$), Population mean = $\frac{1}{2}$
 2. *exponential* ($\lambda = 1$), Population mean = 1
 3. *beta* ($\alpha = 2, \beta = 1$), Population mean = $\frac{2}{3}$
 4. *gamma* ($\alpha = 2, \beta = 1$), Population mean = 2

rejection_rate_10	rejection_rate_50	rejection_rate_100	dist1	dist2
0.037	0.777	0.997	normal	exponential
0.095	0.998	1	normal	beta
0.353	1	1	normal	gamma
0.066	0.98	1	exponential	beta
0.215	0.984	1	exponential	gamma
0.816	1	1	beta	gamma



Conclusion

- KS test is not asymptotically exact for testing the means 
- KS test is asymptotically consistent for testing the means 
- Link to my repository: <https://github.com/ST541-Fall2018/haddadis-project-KStest.git>

Thank You