

CLRS-720: Computational Vision Science

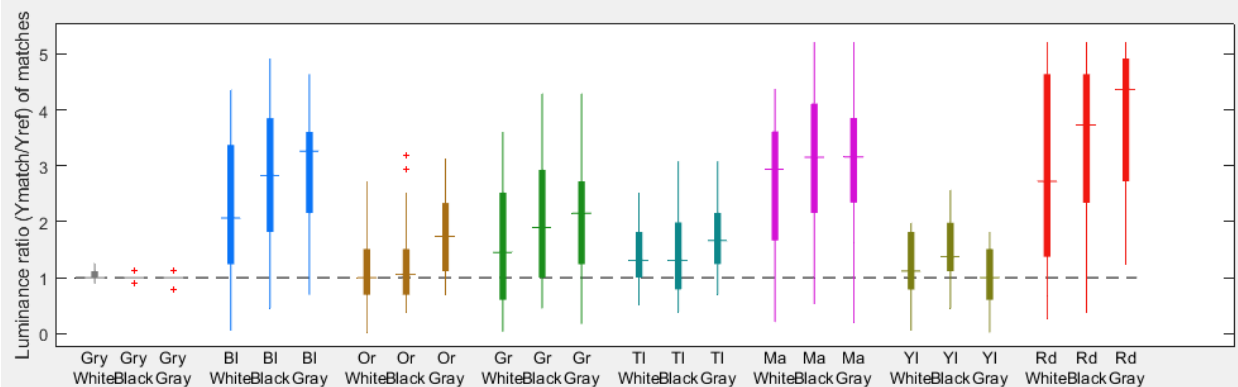
Assignment: Homework 3 - Statistics

Objective: This assignment is designed to familiarize you with the basics of conducting inferential statistical analyses in Matlab.

Instructions: You will submit one MATLAB m-file named `YourNameHW3.m` and one PDF file named `YourNameHW3.pdf` to the appropriate assignment folder in myCourses. Your MATLAB file will include the code used to analyze and plot the data. Your PDF file will include the answers to questions and final plots.

Brightness Matching Data

You will use the .mat file **BrightnessMatchingData.mat** to load the brightness matching data from Lab1 (this is last semesters' class data, which was slightly cleaned for outliers and structure – use this file for consistency). This data table has 336 observations (7 observers*8 reference colors*3 backgrounds*2 repetitions). There are two IVs (Background color: 3 levels in column1; Reference color: 8 levels in column2) and one DV (Luminance ratio of brightness matches in column3). A boxplot of the data should look something like this:



Your null hypothesis (H_0) is that the differences in the plot are due only to random chance. However, based on the plot it looks like there are some systematic differences across IVs, so you will test some alternative hypotheses to determine whether these differences are statistically significant.

1. First, we want to know whether the Gray reference colors (collapsed across all background colors together; hint: subset the datatable in Matlab) had brightness matches different than what we would expect from the actual luminance of the patch (Luminance Ratio = 1). **Which statistical test would you choose and why? Run this test** in Matlab and **write-up the results** including the important statistical output (see class slides for examples of appropriate write-up format). Second, answer the same question, but about the Blue reference colors. Provide **plots** for these results.
2. Next, we want to know whether the Blue ref colors (collapsed across all BG colors) had brightness matches different than the Magenta ref colors (collapsed across all BG colors). **Which statistical test would you choose and why? Run this test** in Matlab and provide an appropriate **write-up the results**. Now answer the same question, but about comparing the Blue vs. Red ref colors. Provide **plots** for these results.
3. Finally, we want to simultaneously compare the influence of the different backgrounds (1-3), the influence of the different reference colors (1-8), and their interaction, on brightness matches. For this question, run a factorial ANOVA using **anovan** in Matlab. You should get a main effect (ME) of BG color, a ME of ref color, and an interaction term (BGcol*REFcol). **Write-up and interpret**

both main effects and the interaction term (just from the statistics from the ANOVA table, which should look like this):

Analysis of Variance					
Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
BGcol	12.356	2	6.1781		
Refcol	230.273	7	32.8961		
BGcol*Refcol	11.283	14	0.806		
Error	330.824	312	1.0603		
Total	584.736	335			

- Use the **multcompare** function with the output from this **anovan**. Your code should be able to produce one interactive figure comparing each of the 3 BGcols together, and a separate interactive figure comparing the 8 REFcols together. Using these figures and the output p-values, answer the following questions (you only need to report p-values here): Which of the background colors are significantly different from each other? Which reference colors are significantly different than the Gray reference color? Is the Blue reference color significantly different than either the Magenta or Red reference color? Is the Magenta reference color significantly different than the Red reference color?