

Lab 1 - Beginner practice guide

Images as arrays, raw pixel comparison, light variation, normalisation, and group evidence.

Submission: upload your executed Lab01_Light_Colour_Histograms_Student.ipynb by 23:59 on the lab day. Keep every figure and printed result visible.

Your working pattern

Notebook part	What you do
Read	Read the short image explanation before each code cell.
Run	Every code cell is complete. Run it from top to bottom.
Observe	Look at the image, histogram, labels, and printed value.
Change one value	Only edit the labelled simple value: an image number, group letter, or experiment index.
Write	Write a short analysis using your own visual and numerical evidence.

You are not asked to write code. Do not change functions or formulas. Your work is to run, compare, make the indicated small change, and explain what you observe.

Before you start

Notebook part	What you do
Open	Open the student notebook, not the instructor solution.
Details	Complete name, student ID, and lab date.
Final check	Restart and run all cells before uploading.

Part 1 - Common templates

Everyone begins with the same six line patterns.

Step 1 - Build the templates

Notebook part	What you do
Read	Each image is a 28 by 28 grid. A bright line appears in a different position for every class.
Run	Run the template cell and keep the grid, shape, number type, minimum, and maximum visible.

Step 2 - Inspect one template

Notebook part	What you do
Read	The selected image is displayed beside a pixel brightness histogram.
Run	Run with selected_template equal to 0.
Change one value	Choose another selected_template from 0 to 5 and run again.
Write analysis A	State the two classes, what stayed the same, what changed, and one printed shape and mean brightness.

Step 3 - Move the same image

Notebook part	What you do
Read	The code moves the image sideways and compares pixels in matching locations.
Run	Run with shift_amount equal to 1.
Change one value	Set shift_amount to 2 and run again.
Write analysis B	Explain why the same line has different values at matching locations after a shift.

Step 4 - Raw-pixel comparison

Notebook part	What you do
Run	Run the complete raw-pixel classifier. It should be correct for unchanged copies.
Write analysis C	Explain why matching pixel locations make the correct template the closest one.

Part 2 - Personal condition

This begins only after you enter your own ID.

Step 5 - Student ID

Notebook part	What you do
Change one value	Replace DEMO-0000 with your own ID; keep quotation marks.
Run	Record scenario code, name, brightness multipliers, shift, and five experiment multipliers.

Step 6 - Personal test images

Notebook part	What you do
Read	The same patterns are changed into two groups. The raw-pixel result is shown overall and for each group.
Run	Keep the image comparison and all three raw percentages visible.
Change one value	Switch display_group from A to B, or select another example_class from 0 to 5.
Write analysis D	State scenario code and name. Quote overall, Group A, and Group B accuracy; identify the lower group and explain it from the image.

Use your own output. Your ID creates a repeatable personal condition. Your reported values must match your notebook.

Part 3 - Repair and investigate

Use the same personal data while changing its preparation.

Step 7 - Normalise the images

Notebook part	What you do
Read	Normalisation makes each image average near zero with spread near one. This reduces an overall light-level difference.
Run	Check that the printed mean is near 0 and spread is near 1.

Step 8 - Test the repaired comparison

Notebook part	What you do
Run	Run the normalised comparison. Keep overall, Group A, and Group B results visible.
Write analysis E	Use at least three percentages. Explain that normalisation can reduce brightness effects but cannot fully repair movement or clipped detail.

Step 9 - Try another light level

Notebook part	What you do
Run	Run first with sweep_index equal to 0.
Change one value	Choose one other sweep_index from 1 to 4 and run again.
Write analysis F	Give both indices, multipliers, raw and repaired accuracy. Explain signal, nuisance variation, and why group results matter.

Final check

Notebook part	What you do
Complete	Name, ID, date, and analyses A to F are present.
Evidence	ID, scenario, figures, group results, repair results, and two sweep runs remain visible.
Submit	Restart and run all cells without errors. Upload by 23:59 on the lab day.