

Lab 7 Manual

Lab 7 Outline

Part 1: Experimenting with Python [35 mins]

1. CSE8AImage library
2. Implementing red filter
3. Index calculation

Part 2: Quiz [15 mins]

Now that you have completed the lab, you will take a short mandatory quiz on the lab material. To take the quiz. This will be a **timed (15 mins)**, multiple choice quiz on the lab material. If you completed the lab, you will be able to answer all of the questions on the quiz.

You can take the quiz anytime on Thursday, but please make sure you submitted by 11:59PM. If you need OSD accommodation, please reach out to one of the tutors during the lab session and ask for an untimed quiz.

Image importing and exporting

The CSE8AImage library provides useful functions for you to handle image files. Two important functions that we will be using in the following PAs are described below.

Function Name	Input Parameters	Description
load_img(filename)	filename: A string containing the <u>filepath</u> or filename where the image is	This function takes in a string containing the <u>filepath</u> or filename where the image is and the function returns the 2D list representation of the image
save_img(img, filename)	img: The 2D list representation of an image filename: A string containing the filename where the image should be saved	This function takes in a 2D list representation of an image and a string containing the <u>filepath</u> or filename where the image should be stored and proceeds to store the image in the given <u>filepath</u> and filename. The function returns None.

Your task in this lab exercise is to fill in two lines in `basic.py` that labelled with `#TODO` so that when you call `try_library("input.png", "save.png")` inside interactive python console with `python -i basic.py`:

- the height and width of the image are printed to terminal
- a new file named *save.png* is created

(You can just save the original image, or do any modification you want and save it.)

Implement red filter

Task 2: Implement red filter

In the [Stepik reading](#), we have learned the mechanism behind a red filter.

Recall that a single pixel is a **3-tuple** of the form (R, G, B), where R, G and B are integers between 0 and 255 that represent the intensity of a given color: red, green, and blue, respectively. When we apply a **red filter**, we want only the red component of this **3-tuple** to remain. So, (R, G, B) becomes (R, 0, 0). In other words, we set G and B (green and blue) to 0, and keep the red value the same. Let's start with a single pixel.

In this lab, you would then implement the red filter function as described in the reading. In the starter code, input image is loaded as a 2D list of tuples, which hold the RGB values of individual pixels. We then use a nested for loop to visit every tuple. **Your task is to fill in the #TODO line so that this function applies red filter to the image.**

You can test your code by doing following step:

1. open the interactive python console in the terminal with `python -i red_filter.py`.
2. Load image file into a 2D list of tuples: `image = load_img('input.png')`
3. Run your function: `red_filter(image)`
4. Save 2D list into an image file to visualize: `save_img(image, 'red_filter.png')`

What you would expect:

input.png:



red_filter.png

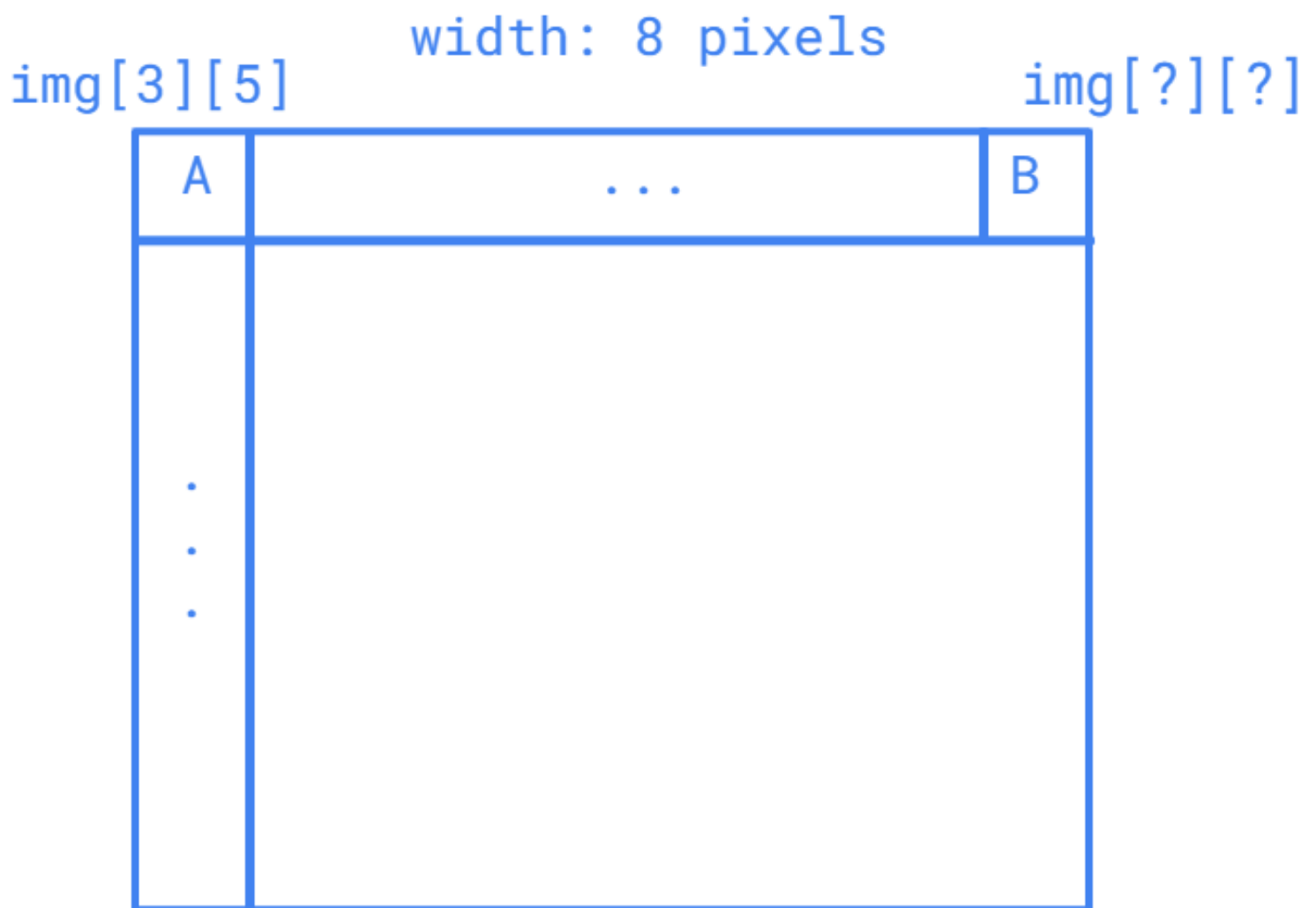


Calculating index

Calculating Index

When manipulating pixels in an image, we often need to handle 2D list of tuples. Therefore, being familiar with the index calculations of intended pixel positions is crucial for correct implementation.

Let's say you are looking at a region of an image. The upper left pixel (A) is located at row index 3 and column index 5 (i.e. `img[3][5]`). Knowing that the region is **8-pixel** long in its width, **can you calculate the index of the upper right pixel (B)?**



Notice that A and B are on the same row, so they should have the same row index.

Mirror/Flip an Image

When we are mirroring/flipping an image, for an arbitrary pixel in the original image, we often times

want to find the index of the corresponding symmetric pixel after we mirror/flip the original image horizontally/vertically.

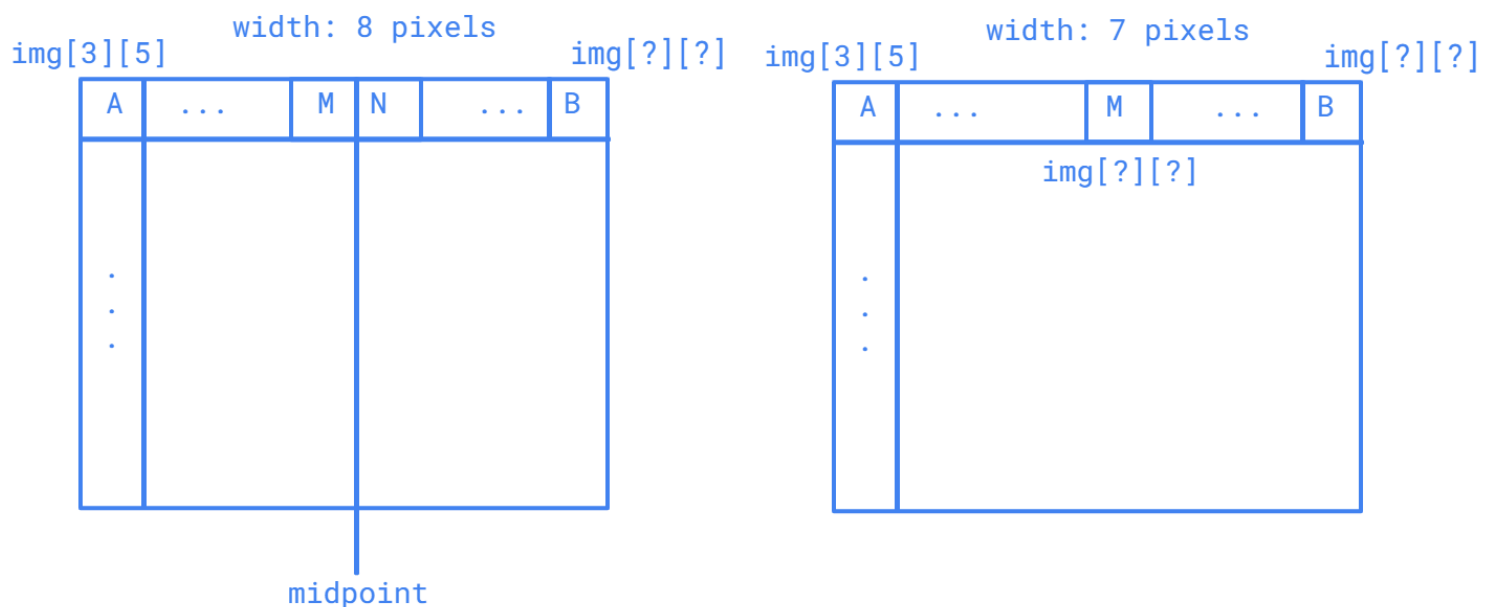
As we only need to loop over **half of the original image**, the first step is usually to find out the index of the **middle pixel(s)**.

Let's say we are flipping an image horizontally (left to right), so we look for the middle point in its width. If the image has an even width, there will be two pixels in the middle. However, if the image has an odd width, there will be only one middle pixel.

For the following two cases, think about the questions and calculate the indices by yourself:

(1) What are the indices of middle pixels M and N, given that the image has a width of 8 pixels? (even case)

(2) What is the index of middle pixel M, given that the image has a width of 7 pixels? (odd case)



Now, try to generalize the above two cases -- in each row, if our for loop starts at pixel A `img[i][j]`, and the region width is `w` pixels, where should the for loop end? (Remember we only loop over half of the column indices in each row!)

Index of Symmetric Pixel

Question Submitted Nov 18th 2021 at 10:09:19 am

Let's say we're now flipping an image vertically (top to bottom).

You are given a 2D list `img`, the index of two pixels `A`, `P`, a width value, and a height value:

`img` = a 2D list of tuples

j = column index of A, P

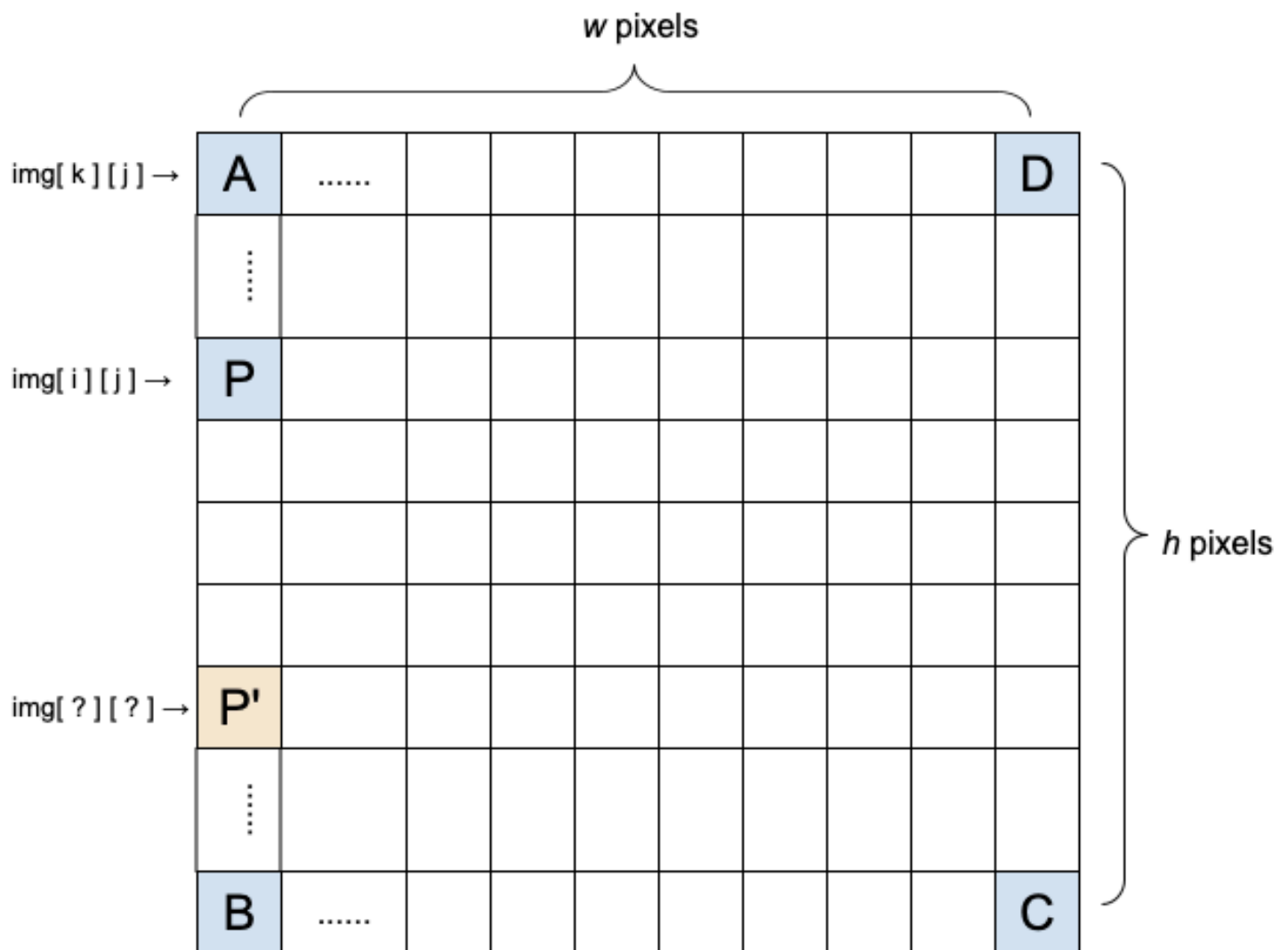
k = row index of A

i = row index of P

w = number of pixels from A to D (including A and D themselves)

h = number of pixels from A to B (including A and B themselves)

After flipping, P' is the corresponding symmetric pixel of P . Notice that the distance from A to P and the distance from B to P' should be the same. Use this trick to find out the indices of P' . (This lab exercise is not graded and you have multiple attempts.)



Answer format is **[row_index][column_index]**

☒ `[2k+h-1-i][j]`

☐ `[k+h-1-i][j]`

☐ $[2k+h-i][j]$

☐ $[k+h-1][j]$

Check-off

Now you are done with the lab activity. Please check off with the tutors in your lab session.

You can do the timed lab quiz any time on Thursday, but it's recommended to finish the quiz right after the lab activity.

If you need any accommodation on the lab quiz, please also reach out to our tutors!