**Homework #3**

**Deadline: November 29, 2024 @23:59**

**Submissions: (1) PDF version of this file**

**(2) .ipynb file; template in this link**

[**https://colab.research.google.com/drive/1OJZBrQXyv37Fy88vaSX8em6\_9tqRl8Yg?usp=sharing**](https://colab.research.google.com/drive/1OJZBrQXyv37Fy88vaSX8em6_9tqRl8Yg?usp=sharing)

**Download data in colab**

**IMPORTANT! (1) Before submitting the python file, please make sure it can be successfully compiled and correctly in its format name**

**(2) The scores will be 0 for all students whose source codes are very similar to each other.**

1. (10 points) Image Augmentation (no need to put in COLAB)

From image classification in object recognition lecture, the self-learning features are capable of learning object patterns using deep neural networks. However, you may require large number of datasets for a model to learn. Study image augmentation, which can be used to expand the size of the training dataset. **Design 5 modified versions of an original image** using knowledge from image processing class, so you can use them for model learning. **Implement 5 different image variations for general object classification task** using the example and the template below.

The example below is a modified version of an original image using rotation which can have variations in terms of orientation angle of an image from 0-360 degrees.

You should use a kitty image and one additional selected image and displayed in the table below. Also once call your python file, it should show the results of your 5 different modified versions of the original image.

|  |  |  |
| --- | --- | --- |
| **Original image** | **Kitty.jpg**  A picture containing cat, wall, indoor, white  Description automatically generated | **Your selected image** |

|  |  |  |
| --- | --- | --- |
| **No.** | **Modification Techniques & applied images (kitty.jpg and your selected image)** | **Purpose and variations** |
| 1 | Example: Rotation  A picture containing cat, indoor, white, box  Description automatically generated | Rotation can imitate the real dataset that the object can be varied in orientations.  **Variations**: angles in range of [0,360) |
| Code:  def rotated(image, angle):  return imutils.rotate(image, angle=angle) | |
| 2 |  |  |
| Code: | |
| 3 |  |  |
| Code: | |
| 4 |  |  |
| Code: | |
| 5 |  |  |
| Code: | |
| 6 |  |  |
| Code: | |

2) Pyricularia Oryzae, rice blast fungus can cause rice blast disease. To identify the possibility of the occurrence of rice blast disease, the density of the spores of Pyricularia Oryzae can be calculated. Plant pathologist knows that you studied image processing, so they have asked you to help them automatically count the number of spores using image processing. They have provided two image samples below for you to develop an algorithm to count them. You should provide your results in terms of num\_count and resulted\_image (labeled count) (you can use cv2.rectangle(…) and cv2.putText(…) functions) as the example shown below

**Note:** your algorithm does not have to be 100% accurate; you should explain your results.

|  |  |
| --- | --- |
| **Original image** | **Your results / number of counted spores** |
| A picture containing outdoor  Description automatically generated  pyri02.png | **EXAMPLE**  **A picture containing text, several  Description automatically generated**  **num\_count = 12** |

2.1) Describe steps of your algorithm

|  |  |
| --- | --- |
| **Steps** | **Description and purposes** |
| 1 |  |
| 2 |  |
| 3 |  |
|  |  |
|  |  |

2.2) Results

|  |  |
| --- | --- |
| **Original image** | **Your results / number of counted spores** |
| A picture containing outdoor  Description automatically generated  pyri01.png |  |
| A picture containing outdoor, flying, nature  Description automatically generated  pyri02.png |  |
| A close-up of a microscope  Description automatically generated  pyri03.png |  |
| A close-up of a microscope  Description automatically generated  Pyri04.png |  |

2.3) Analyze the results.

*Hint: in terms of how accurate is your technique, any further improvement can be done?*

3. The "Gemini star" refers to the brightest stars within the constellation of Gemini, which is one of the twelve zodiac constellations. Gemini is best known for its two brightest stars, **Castor** and **Pollux**, which are often called the "twins" due to the mythology behind the constellation.

A starry sky with many stars

Description automatically generated

Fig. 3.1 Gemini stars

The **line of stars in Gemini** stretches from **Pollux** and **Castor** down to their "feet," represented by dimmer stars. The formation appears like two parallel stick figures standing side by side, connected by their heads.

A constellation of the stars

Description automatically generated

Figure 3.2 The **line of stars in Gemini**

To achieve this, use image processing techniques about erosion and dilation techniques from morphological image processing, enhance a specific star in an astronomical image. The challenge is to extract the main star (or stars) by reducing background noise and enhancing the desired features.

**The final result should show only the stars of Gemini to shine bright without others as seen in Fig. 3.2, without a connection line**. The stars should maintain its original size or similar.

|  |  |
| --- | --- |
| **The Original image** | **Your Result Image** |
| !gdown 1F4gZPU5KUboFBJ7cVPHIrJyfrRcwJj92 |  |

|  |
| --- |
| **Explain Your Code about Erosion and Dilation below** |
|  |