Mini Project

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ABSTRACT

Project development, in a true sense, has been included in the curriculum to make the students well versed with various technologies and the basic criteria for management of resources in a company or industry. The educational institutions sole aim is to improve the technical knowledge and to have a hand on experience to make them realistic in thinking. Like no learning is proper without implementation, similarly the terms and procedures we learn are of no use until and unless we bring them in practical applications. To summarize, project development teaches us team spirit and advances our technical knowledge.

The document provides information about the things we learned at Graphic Era Deemed To be University, Dehradun.

Problem Statement

Image Mosaic Generator

Introduction

A Imagemosaic is an image split into a grid of rectangles, with each replaced by another image that matches the target (the image you ultimately want to appear in the Imagemosaic).

In other words, if you look at a Imagemosaic from a distance, you see the target image but if you come closer, you will see that the image actually consists of many smaller images. This works because of how the human eye works. An image mosaic generator can be made by using **Python Programming Language**.

About Python Programming Language

Python is a high-level, general-purpose and a very popular programming language. Python programming language (latest Python 3.10.0) is being used in web development, Machine Learning applications, along with all cutting edge technology in the Software Industry. Python is currently the most widely used multi-purpose, high-level programming language.

Python allows programming in Object-Oriented and Procedural paradigms.

Python language is being used by almost all tech-giant companies like – Google, Amazon, Facebook, Instagram, Dropbox, Uber... etc.

The biggest strength of Python is huge collection of standard library which can be used for the following:

Machine Learning

GUI Applications (like Kivy, Tkinter, PyQt etc.)

Web frameworks like Django (used by YouTube, Instagram, Dropbox)

Image processing (like OpenCV, Pillow)

Web scraping (like Scrapy, BeautifulSoup, Selenium)

Test frameworks

Multimedia

Scientific computing.

Prerequisites:

Before starting with this Python project with source code, you should be familiar with the computer vision library of Python that is OpenCV, PIL and Pandas.

PIL, Pandas and numpy are the Python packages that are necessary for this project in Python.

How to create Photomosaics?

Read the tile images, which will replace the tiles in the original image.

Read the target image and split it into an M×N grid of tiles.

For each tile, find the best match from the input images.

Create the final mosaic by arranging the selected input images in an M×N grid

Requirements : PIL(Python Imaging Library), Numpy, Pandas.

Inputs: A set of source images, A target image

Output: A mosaic image that mimics the target image based on the set of source images.

Image Representation

There are many ways to represent an image but the most popular way is by using the RGB (Red, Green, Blue) colour scheme. In this colour scheme, an image is basically represented as a tensor of dimension [m, n, 3], where m is the height of the image, n is the width, and 3 refers to the RGB. The value in each of the tensor cells is ranging from 0 (off) to 255 (brightest).

Build the Average RGB Database

The first step to create the mosaic image generator is by building a database which contains the average RGB value for each of the source images. So, for each of the source image, we calculate the average value for each of the RGB layer and then store it in a database, or in this case, a CSV file.

However, we can't get many colour variations if we only rely on the raw source images. One way to tackle this problem is by performing some preprocessing to our raw source images. By doing this, we can have several additional data points for each of the source image.

Averaging Color Values

Every pixel in an image has a color that can be represented by its red, green, and blue values. In this case, you are using 8-bit images, so each of these components has an 8-bit value in the range [0, 255]. Given an image with a total of N pixels, the average RGB is calculated as follows:

$$(r,g,b)_{avg} = \left(\frac{(r_1+r_2+....+r_N)}{N}, \frac{(g_1+g_2+....+g_N)}{N}, \frac{(b_1+b_2+....+b_N)}{N}\right)$$

Generate a list of relevant filenames for each pixel 'batch'

Given the average RGB dataset and the target image, the first thing we have to do is generate a list of relevant source image filenames for each of the target image's pixels. we can just try to find a relevant source image for each 'batch' of the pixels by 'Pixel Batching' approach. 'Pixel Batching' approach is the same as the brute-force approach.

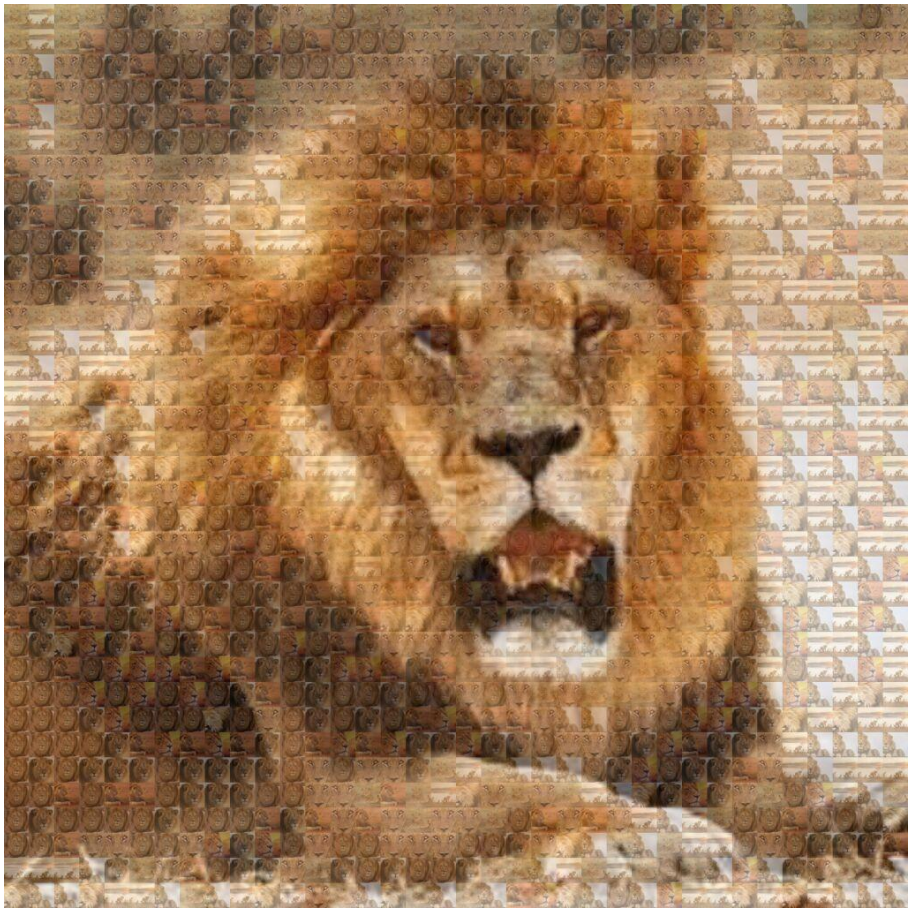
Resize the tensor

Now, our zeros tensor has been 'filled' with relevant source image in each of the pixel 'batch'. The last thing we have to do is resize this tensor into its expected original size, that is the size of the target image. OR we can also resize it into our desired size.

Sample Input and output

Input

Output



Small Pictures Added To make Mosaic

Result Analysis

In this Python project with source code, we learned about colors and how we can extract color RGB values and create a color Database. We learned how to handle events like initialize zero tensor and saw how to read CSV files with pandas and perform operations on data. This is used in numerous image editing and drawing apps.

References

- GeeksForGeeks
- Datadrive
- Wikipedia , google photos
- YouTube

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