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Image Processing Toolboxes and Image Augmentation for Research Work

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Abstract: ***The goal of Image processing is to analyze and modify a digital image in order to increase its quality or extract some information. Image processing now plays a significant role in many different areas of technology and Research. Pattern recognition, machine learning, IOT, and other fields benefit greatly from image processing. There are numerous platforms available for image processing.***

Some of them are licensed versions, while others are open source. The research is expanding quickly as this pandemic demonstrates the practical application of software in this situation [1]. This paper will provide a detailed picture of various image processing tools.

Keywords: GPU, image augmentation, deep network.

I. INTRODUCTION

The basic principles of image processing based on MATLAB GUI. The MATLAB toolbox includes MATLAB code, data, apps, examples, and documentation. By creating a toolbox, MATLAB generates a single installation file (. mltbx) that enables us or others to install our toolbox. Functions are collected in toolbox to simplify the complexity of the program. This is simple research on MATLAB toolbox and different image augmentation techniques. The process of training discriminative convolutional neural networks requires the addition of additional data (CNNs). It has been demonstrated that a number of augmentation techniques, including horizontal flips, random cropping, and principal component analysis (PCA), effectively capture significant aspects of natural images.

Graphic user interface refers to the computer operation user interface displayed in a graphic way, and is the interface between the computer and its users. A wide range of image types, such as high dynamic range, gigapixel resolution, embedded ICC profile, and tomographic, are supported by the Image Processing Toolbox. Users can explore photos and movies, analyse a section of pixels, modify colour and contrast, make contours or histograms, and control regions of interest by using visualisation capabilities. Certain Image Processing Toolbox functions have been made able to execute image processing operations. GPU acceleration can be provided a simple way using for researchers in image processing workflows. To meet design criteria and performance objectives, these strategies can be used singly or in combination.

II. IMAGE PROCESSING OPERATION FOR GPU

To run a supported image processing operation on a GPU: Data should be transferred from the CPU to the GPU. An array from MATLAB® to the GPU can be transferred using the gpuArray (Parallel Computing Toolbox) function. Create GPU Arrays from Existing Data has further details (Parallel Computing Toolbox). Utilize the GPU to do the image processing function. The list of all toolbox functions that have been GPU-enabled can be seen in Functions Supporting GPU Computing.

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The transfer learning is the process to adapt a pretrained GoogLeNet to classify a new collection of images by using Deep Network Designer. This process makes easy image classification. Because a learned features can be applied to a new task using a smaller number of training images.

This example shows how to use Deep Network Designer to adapt a pretrained GoogLeNet network to classify a new collection of images. This process is called transfer learning and is usually much faster and easier than training a new network, because you can apply learned features to a new task using a smaller number of training images. To prepare a network for transfer learning interactively, use Deep Network Designer.

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1) Deep Learning Toolbox™ provides a framework for designing and implementing deep neural networks with algorithms, pretrained models, and apps. You can use convolutional neural networks (ConvNets, CNNs) and long short-term memory (LSTM) networks to perform classification and regression on image, time-series, and text data. You can build network architectures such as generative adversarial networks (GANs) and Siamese networks using automatic differentiation, custom training loops, and shared weights[6]. With the Deep Network Designer app, you can design, analyze, and train networks graphically. The Experiment Manager app helps you manage multiple deep learning experiments, keep track of training parameters, analyze results, and compare code from different experiments. You can visualize layer activations and graphically monitor training progress.

2) Image Augmentation is a data augmentation method that generates more training data from the existing training samples. Image Augmentation is especially useful in domains where training data is limited or expensive to obtain like in biomedical applications [3]. Data augmentation is an essential technique for improving generalization ability of deep learning models. Recently, Auto Augment has been proposed as an algorithm to automatically search for augmentation policies from a dataset and has significantly enhanced performances on many images recognition tasks. However, its search method requires thousands of GPU hours even for a relatively small dataset. In this paper, we propose an algorithm called Fast Auto Augment that finds effective augmentation policies via a more efficient search strategy based on density matching.

Difference Image Augmentation Techniques are shown in Table 1:

Table1. Different image augmentation method

Affine Transform	Example	Transformation Matrix	
Translation		$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ t_x & t_y & 1 \end{bmatrix}$	t_x specifies the displacement along the x axis t_y specifies the displacement along the y axis.
Scale		$\begin{bmatrix} s_x & 0 & 0 \\ 0 & s_y & 0 \\ 0 & 0 & 1 \end{bmatrix}$	s_x specifies the scale factor along the x axis s_y specifies the scale factor along the y axis.
Shear		$\begin{bmatrix} 1 & sh_y & 0 \\ sh_x & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	sh_x specifies the shear factor along the x axis sh_y specifies the shear factor along the y axis.
Rotation		$\begin{bmatrix} \cos(q) & \sin(q) & 0 \\ -\sin(q) & \cos(q) & 0 \\ 0 & 0 & 1 \end{bmatrix}$	q specifies the angle of rotation.

III. RESULT

```
CUDADevice with properties:

                      Name: 'NVIDIA GeForce GTX 1650'
                     Index: 1
      ComputeCapability: '7.5'
         SupportsDouble: 1
          DriverVersion: 11.6000
         ToolkitVersion: 11.2000
    MaxThreadsPerBlock: 1024
      MaxShmemPerBlock: 49152
    MaxThreadBlockSize: [1024 1024 64]
           MaxGridSize: [2.1475e+09 65535 65535]
             SIMDWidth: 32
           TotalMemory: 4.2946e+09
       AvailableMemory: 3.3191e+09
  MultiprocessorCount: 14
         ClockRateKHz: 1515000
          ComputeMode: 'Default'
  GPUOverlapsTransfers: 1
KernelExecutionTimeout: 1
       CanMapHostMemory: 1
        DeviceSupported: 1
        DeviceAvailable: 1
         DeviceSelected: 1
```

Figure1. Details of system by GPU

IV. GENERATE A CODE FROM DATA FILE

Steps for read a .csv file in matlab

1) *Step1:* Scan and ignore a variable number of description lines at the beginning of the csv file.
2) *Step2:* Identify the variables name from the csv file
3) *Step3:* Initialise the variables
4) *Step4:* Make an array to read the whole csv file depending upon length and size of the data
5) *Step5:* Make another array from the table

```
one week
time, temp
19-Aug-2021 10:32:35, 81
20-Aug-2021 10:40:28, 72
22-Aug-2021 10:19:36, 98
23-Aug-2021 11:00:02, 70
24-Aug-2021 10:54:27, 90
25-Aug-2021 11:03:00, 87
```

```
T_matlab=6×2 table
            time             temp
    _____________________    ____

    19-Aug-2021 10:32:35      81
    20-Aug-2021 10:40:28      72
    22-Aug-2021 10:19:36      98
    23-Aug-2021 11:00:02      70
    24-Aug-2021 10:54:27      90
    25-Aug-2021 11:03:00      87
```

Figure2. csv file to. Mat

Generate and run a MEX (MATLAB executable) by using the codegen command. A MEX is compliled C/C++ code that you can run inside the MATLAB environment. By default, the codegen command produces a MEX[5].

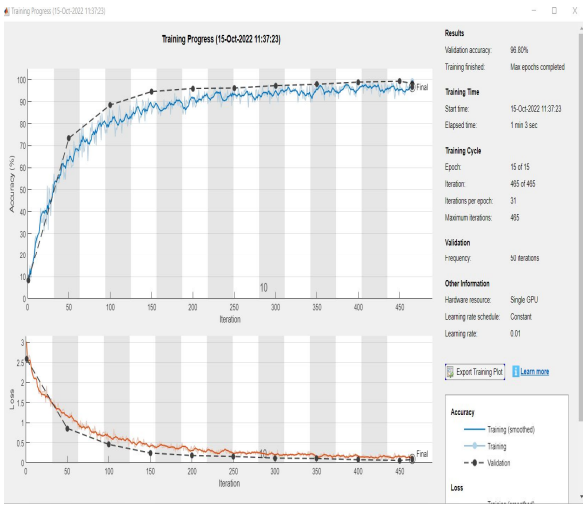


Figure3. Data augmentation output by deep network toolbox

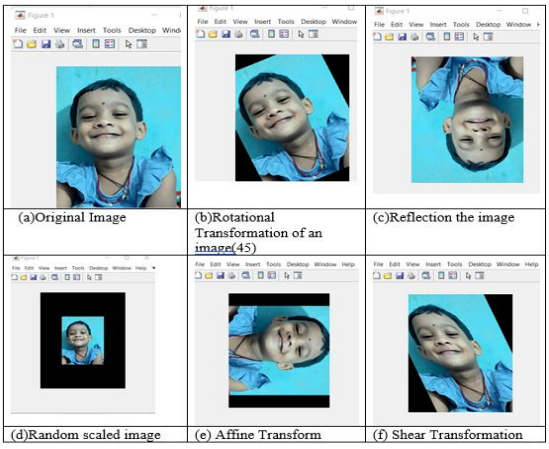


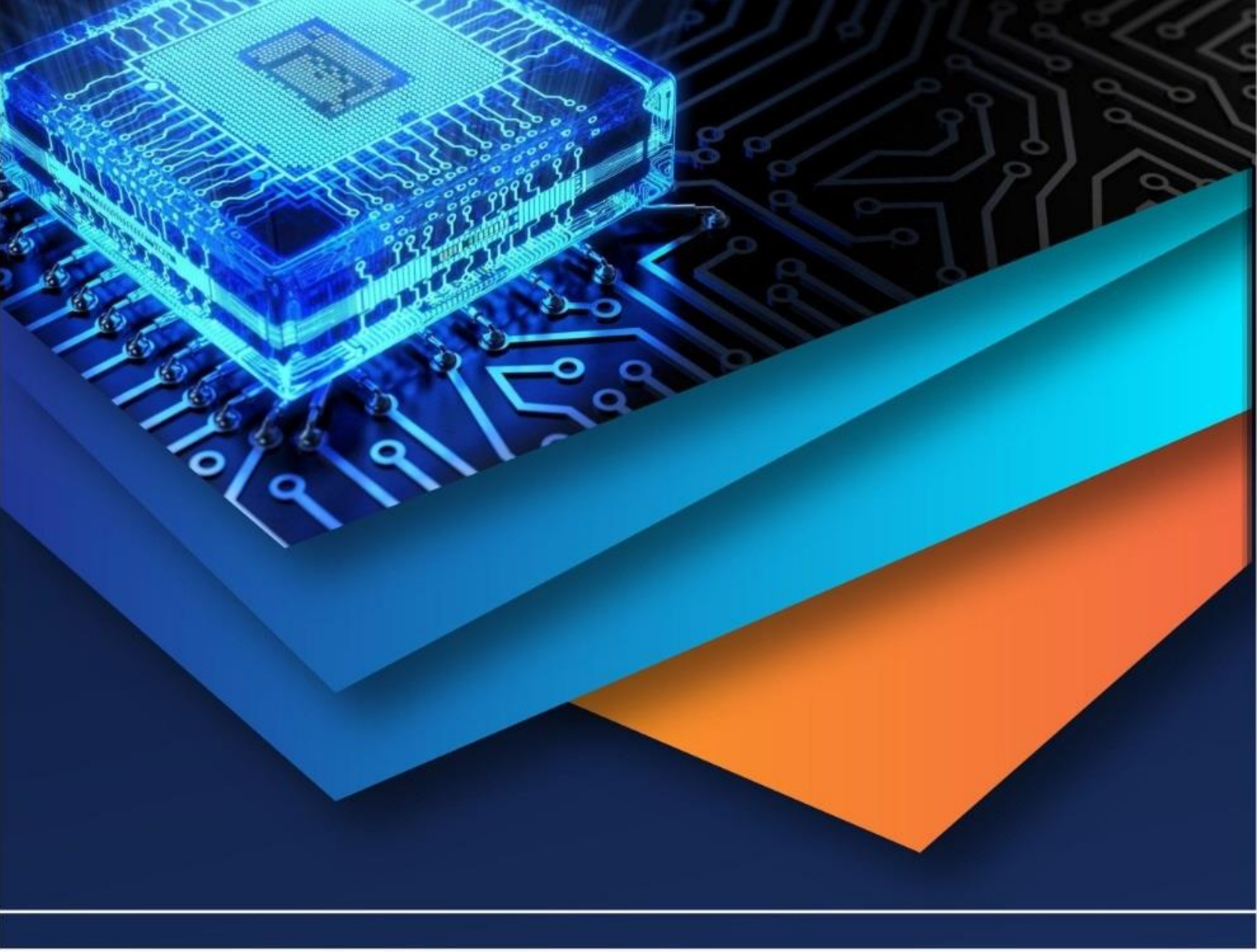
Figure 4: Image augmentation by different technique.

V. CONCLUSION

Despite the fact that deep learning in medical imaging has frequently employed data augmentation, little research has been done to ascertain which augmentation algorithms best capture medical picture statistics and produce better discriminative models. This study analyses augmentation techniques and demonstrates that a model's success is dependent on how well an enhanced training set preserves the characteristics of the original medical images. Image processing's goal is to analyse and modify a digital image in order to increase its quality or extract some information. Image processing now plays a significant role in many different areas of businesses. Pattern recognition, machine learning, IOT, and other fields benefit greatly from image processing. There are numerous platforms available for image processing. Some of them are licenced versions, while others are open source. The research is expanding quickly as this pandemic demonstrates the practical application of software in this situation.

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