International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-10, Issue-01, Apr 2024

Implementation of Greyscale Normalization Using ML for Biometrics in CNN

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Abstract: These days, machine learning is a popular field and is widely recognized as an application of artificial intelligence (AI). Secure mathematical algorithms are used in machine learning to build computers in a constructive manner. The algorithms use specific arithmetical techniques to obtain the freedom of a participated value and estimate the output for this. The field of AI has achieved significant strides in closing the gap between human and technological capabilities. One type of deep learning algorithm is a convolutional neural network (CNN), which takes an input image, applies the rules to different parts of the image, and then determines which part of the image is different from the other. Compared to otherclassification algorithms, a CNN requires less pre-processing.[1]

Keywords- Machine Learning, Artificial Intelligence, Image Identification, ConvolutionalNeural Network (CNN)

I. INTRODUCTION

A convolutional neural network (CNN), is a learning technique used to analyze visual descriptions. It uses nominal preprocessing and learns filters from hand-engineered systems. CNNs contribute significantly to image categorization by providing more compensation than other algorithms. The term “convolutional” arises from the Latin word “convolvere,” meaning “to roll together.”[1] CNNs decode descriptions and examine visual elements, creating RGB color images with three layers of channels or mediums. The network filters the image by joining squares to improve the performance while processing data, forming CNN functions.[2] The number is a part of a two-dimensional, that generates the image volume and identifies the initial figure using the different image processing models. It can also be possible to refer to the image recognition system for portable computers as the capacity of laptops, tablets, and other comparable electronic and electrical equipment or technologies to analyze and reason what individuals "see" in video or photos as in. This crucial activity, often known as "image categorization" or "picture tagging,"[10]

II. AIM AND OBJECTIVE

a) Aim

The main goal of the project is to develop and put into use a web-based platform that makes it easier for users to test and simplify popular convolutional neural network (CNN); model architectures for grayscale normalization in image processing. This process simplifies algorithms and gets rid of complications related to hardware requirements. It creates space for people who are new to image processing to learn more easily. This is so because an image is compressed to the bare minimum of pixels in grayscale. The CIFAR-10 small photo problem is used dataset in computer vision and deep learning.A recently developed technique for CNNs trains the network into two stages first it is trained on balance data, and then its output layers are adjusted.[3]

b) Objective

- The main objective of convolutional layers, which Convolutional layers help CNNs learn to recognize patterns and features, in images by applying a collection of filters to the inputdata to identify particular patterns.
- The layers get deeper, they can automatically learn the spatial classifications of features beginning with basic patterns likeedges and for more complex designs.
- Because an image's visual features can vary greatly, hierarchical learning is especially well-suited for image classification. This architecture can used for suitable image in real time, which makes it appropriate for applications like image recognition.

DOI : 10.35291/2454-9150.2024.0266

- It is extensively generated by training and testing the data in industry and has numerous image classification benchmarks.

III. LITERATURE SURVEY

Paper 1: Challenge on single image superresolution dataset and study:

The paper examines the latest advancements in single-image superresolution technology, particularly stemming from the study and introduces a comprehensive dataset tailored for example-based superresolution. This challenge, which featured six competitions and attracted numerous participants with various proposed solutions, stands out as the inaugural event of its kind. The recently obtained DIVerse 2K dataset was utilized for the challenge, offering a diverse collection of high-resolution images.The study evaluates the solutions presented in the challenge using a range of metrics on the suggested DIV2K dataset, contrasting them with conventional approaches found in the existing literature. Furthermore, the research conducts various experiments and draws conclusions on several intriguing aspects of the subject matter. Ultimately, it asserts the NTIRE challenge has significantly propelled the field of single-image superresolution, achieving the most promising results to date across widely recognized benchmark datasets such as Set5, B100, and Urban100 within the DIV2K framework.[4]

Paper 2: Predicting the sequence specificities of dna and rna binding proteins by deep learning:

Understanding the specificities of DNA and RNA binding proteins holds significant importance in constructing models for biological regulatory processes and pinpointing causal disease variants. This research acquired the achieveness of discerning these specificities from experimental data through the application of deep learning techniques. The techniques provide a scalable, adaptable, and cohesive computational strategy for pattern recognition. This approach as DeepBind, which has implemented into a standalone software tool. This software operates entirely automatically and possesses the ability to have the marking per experiment. DeepBind generates specificities that are easily visualizable, either as a weighted collection of position weight matrices or as a 'mutation map,' offering insights into the affect of signals variations on binding within a particular sequence.[9]

Paper 3: Prediction of protein cellular localization using deep learning :

The purpose of the paper is to predict the protein structure and function based on the localization of the protein in the cell is essential for understanding the translocation process of the cell and has direct relevance to drug discovery. Different methods for prediction of localization, offer a cost- effective alternative to laborious experimental approaches. Our deep learning approach increases prediction accuracy while decreasing the time needed to predict the localization site for uncharacterized protein sequences. Using both general biological properties of the protein sequences and compartment-specific properties, which are supplemented by physiological sequence characteristics. Proteins are extracted from UniProt protein sequences and relevant features are extracted for each protein in the dataset. Different proteins specific models can be used for the selections of different models. In this study, It concludes the bacterial taxonomy-specific deep learning model, which integrates 1v1 and 1v2 models, as well as feature selection using linear SVM rank and heavy auto-encoding. 10-fold cross validation on our dataset achieves an impressive 97.81%.[5]

IV. EXISTING SYSTEM

Various techniques exist for normalizing grayscale images, and the classification of image recognition is important for portable computers, laptops, and similar electronic devices to understand the content. Feature extraction and representation, also known to as "image categorization" or "picture tagging," play a vital role in multimedia processing. Despite its importance, identifying optimal features that effectively encapsulate the essence of images remains a tough task in computer vision. Regrettably, there has been relatively little research dedicated to addressing this issue in recent years.[1]

V. COMPARATIVE STUDY

Sr No.	Author	Project Title	Publication	Technology	Purpose
1.	Divya kothari, Mayank Patel, Ajay Kumar Sharma	Implementation Of Grey Scale Normalization in Machine Learning & Artificial Intelligence for Bioinformatics using Convolutional Neural Networks	IEEE, 2021	CNN, ResNet, Kernal Convolution, AlexNet	This article provides insights into the advancements in ML and AI for bioinformatics, particularly in the relation of image processing with CNN models to increase the network performance.
2.	Eirikur Agustsson, Radu Timofte	Challenge on single image superresolution dataset and study	IEEE, 2017	CNN, AlexNet	It exceeds the traditional algorithms and general CNN in small datasets

DOI : 10.35291/2454-9150.2024.0266

3.	B. Alipanahi, A. Delong, M. T. Weirauch, and B. J.Frey	Predicting thesequence specialities of dnaand rna bindingproteins by deep learning	IEEE,2015	DeepBind	Developing the model requires a knowledge of the sequence characteristics of the DNA and RNA binding proteins.
4.	Jose Juan AlmagroArmenteros, Casper Kaae Sønderby, SorenKaae Sonderby,Henrik Nielsen andOle Winther	Prediction of protein cellular localization using deep learning	IEEE,2017	IEEE,2017	This paper proposes a trainingsample expansion strategy and parallel network features extraction

Fig 1: Comparative Table

VI. PROBLEM STATEMENT

In the field of image processing, grayscale normalization is the procedure of modifying the intensity levels of pixels. This adjustment aims to enhance features and maintain uniformity in analysis when dealing with various images. Grayscale normalization typically entails the development of techniques or algorithms to standardize pixel intensities, taking into account factors like image contrast, brightness, and overall quality. The primary objective is to enhance the efficiency of subsequent image processing tasks, such as ensuring the consistent preprocessing of images. To improve the image efficiency and the ratio of the image which is processed through thedifferent layers.

VII. PROPOSED SYSTEM

The method automatically classifies images based on their RGB characteristics, using Matplotlib in Python and tensor flow preprocessing of the data. These layers, known as channels or mediums, represent the intensities of the colors. Each pixel in the RGB image corresponds to a triplet of values, defining the intensity of each color component. This process of pattern analysis, known as convolution, include the basic of CNN operations. These convolutions involve the application of a convolution kernel to the input matrix, often implemented as a dot product operation. The system architecture consists of the different layers of CNN which takes the input of the image then goes to max pooling layer for filtering the image and thenflatten the image through 128 units.[3]

VIII. ALGORITHM

1. Load the libraries:

```
import os, np, matplotlib.pyplot, plotly.graph_objs,
tensorflow.keras
```

2. Set up paths to the image directories:

```
rgb_batch ←np.repeat(grayscale_batch[...,np.newaxis],
print(rgb_image.shape) def
_load_pretrained(model, url, inchans←3)state_dict
←model_gray.load_url(url)
```

3.Import the image:

```
num_images = [ ]for d in dirs:
num_images.append(len(os.listdir(images_path + d)))
```

4. Preprocessing and features extraction ofthe image:

```
dims = [ ] for d in dirs:
for f in os.listdir(images_path + d):
dims.append(imread(images_path + d + '/' +f).shape)
```

5. Divide the dataset into traning and testing:

```
X_train←X_train.reshape(X_train.shape[0],number_pix)
X_test←X_test.reshape(X_test.shape[0], number_pix)
X_train←X_train/255 X_test←X_test/255
```

6. Initialize the CNN and KernalConvolutional Model:

```
datagen = ImageDataGenerator(rescale=1/255,
shear_range=0.3, zoom_range=0.3,
horizontal_flip=True
validation_split=0.2
```

7. Coming up with the accuracy by vgg16:

```
model = Sequential([Conv2D(32, (4, 4),
activation='relu', input_shape=img_shape),
MaxPool2D((2, 2)), Conv2D(64, (4, 4),
activation='relu'),MaxPool2D((2,2)),Flatten(
),Dense(64,activation='relu'),Dropout(0.5),D
ense(len(labels),activation='softmax')])
```

8. Evaluate the model with predictions:

```
conv1_weight ←state_dict['conv1.weight']
state_dict['conv1.weight']
←conv1_weight.sum(dim←1, keepdim←True) elif
inchans ←3 assert
False, "Invalid number of Grayscalepretrained weights"
model.load_state_dict(state_dict)
```

IX. MATHEMATICAL MODEL

The mathematical equations for grayscale image using machine learning algorithms such as Convolutional Neural Network, Alex Net and Kernal Convolution are as follows:

1. Convolutional Neural Network:

A Convolutional Neural Network can be employed for tasks such as object detection, image classification, and various other tasks. Additionally, it can be utilized to generate new images and extract features. CNNs have exhibited exceptional performance across a range of image recognition tasks, including but not limited to object classification, object detection and image segmentation.

$$Z=X*F+b$$

where Z is the final prediction, X is a input image and F

DOI : 10.35291/2454-9150.2024.0266

is the the filter kernel used for the convolution where b termed as bias for the image generated.

2. AlexNet:

AlexNet is a pioneer of Convolutional Neural Network primarily used for image recognition and classification. The mathematical equation for AlexNet can be represented as:

227*227*3(RGB)

where 227*227*3(RGB) are the input image sizes and dimensions of the image in the data by 3 RGB colors present in it.

3. Kernel Convolution:

Kernel convolution works as a fundamental method that is not exclusive to CNNs, but an integral part of many computer vision methods. This procedure entails utilizing a small matrix termed a kernel or filter, which is applied to the image to alter it according to the data with the filter. The resultant feature map values are determined through the formula for Kernel Convolution, which canbe expressed as:

g =f * hwhere,

$$g[m,n] = \sum i \sum j \; f[i,j] * h[m-i,n-j]$$

where g[m,n] determines the value of the pixel in the position (m,n) in the output feature map g. The summation perform on all the indices [i,j] for the input image.

In all three cases, the input features f are the inputs or attributes of the image, and the output g[m,n] is the predicted class of the image (e.g, intensity, color, etc.)

X. SYSTEM ARCHITECTURE

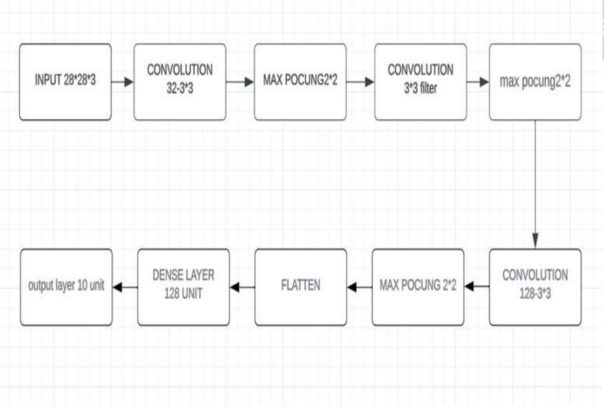


Fig.2: System Architecture

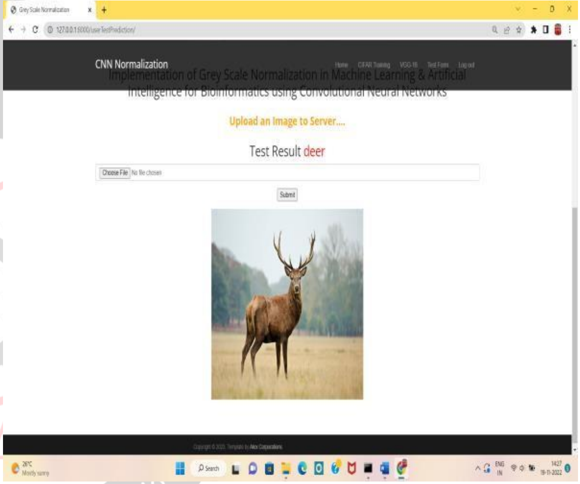
Description:

1. A user require to login for the system.
2. User can upload a image or grayscaleimage.
3. Training and Testing results of theimage that is uploaded in the system.
4. Using the vgg16 results will display.
5. Using ML algorithms, the result will beprovided and efficiency is compared.

XI. ADVANTAGES

- Automatic feature extraction.
- Highly accurate image detection andclassification.
- Comprised the image to a visible output.
- Minimizes calculations.
- Uses the same information for all imagelocations.
- Ability to process large datasets.
- Keras model for image segmentation andtraining the model for specific image data.

XII. DESIGN DETAILS



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Upload an Image to Server....

Test Result deer

Fig 3: Result

XIII. CONCLUSION

Thus we have tried to implement the paper "Implementation Of Greyscale Normalization In Machine Learning and AI For Bioinformatics Using CNN", "Divya Kothari, Mayank Patel and Ajay Kumar Sharma", IEEE 2021, and the conclusion is that although various ML techniques, including Convolutional Neural Network, AlexNet, and Kernal Convolution, can be used to analyze normal and greyscale images, not all of them yield great accuracy. According to the comparisons, CNN and kernel models plays a greater role for predicting the results for image data processing. This article provides insights into the advancements in ML and AI for bioinformatics, particularly with the relation of image processing with CNN models to increase the network performance.

DOI : 10.35291/2454-9150.2024.0266

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DOI : 10.35291/2454-9150.2024.0266