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Deep Learning based Face Recognition of NewbornBabies

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Abstract: Infant combining, kidnapping, and unlawful adoption are critical issues that have received little attention. Traditional fingerprint-based and non-biometric procedures are flawed, because they do not provide enough safety for babies. In recent history, face recognition for adults has become a hot topic, while automatic face recognition for babies has received less attention in the literature. As a result, its vital to get started on analysis so that forthcoming facial recognition algorithms can deal with the difficult task of newborn identification. On the new born face image with neutral expression, the suggested matching algorithms have an accuracy of 87.04 percent, demonstrating that no two newborns are alike.

Keywords: Deep learning, Convolution Neural Network,Face recognition

I. INTRODUCTION

The practice of swapping, mixing, and abducting infants is abig concern, and hospitals have implemented a number of policies and procedures to prevent it.ID wristbands, which areput on a newborn's wrists or legs shortly after birth, are one of the most used methods for identifying newborns, although they haven't been resulted to prevent baby mixing. Traditional methods of authentication, which are routinely hacked. Biometrics are expected to replace disregarded and repeated data. Biometrics may provide parents with peace of mind by allowing them to prove that the kid they are returningafter childbirth is their own. Apart from this, it's astonishing how few studies on newborns identification have been published.Year after year, 80-90 million newborns are brought into existence, estimated to reach 400-500 million babies and young children aged 0 to 5. Biometric researchers cannot ignore this group in the face of such a vast population;otherwise, the entire design of biometric technologies will beincorrect. In healthcare institutions, maternity wards, and other places where many births occur, recognizing babies after delivery is a critical issue. Gray et al discovered in a research conducted in the United States that among 34 infantsadmitted to a newborn intensive care unit on any given day, there is a 50% risk of erroneous recognition. Switchingand abduction of newborn babies is a worldwide issue that hospitals are dealing with. In the United States, it is estimated that between 100000 and 500000 newborns are exchanged bymistake every year. There have been allegations of baby kidnapping and illicit adoption, in addition to unintended switching. Such situations may be eliminated or much minimized if quick and accurate techniques of newborn identification have been given access and employed in maternity wards, hospitals, and bus stops. Other biometric elements of individual recognition systems are more convenient, straightforward and quick than face detection. The lack of a face dataset of infants is one of the main reasonsfor the absence of face recognition research.

II. GOAL OF THE PROJECT

The project's major goal is to create a faster and more effective facial recognition system for newborns. To create a system that can correctly recognize the face inorder to reduce problems such as mixing, swapping and abduction. This project would be very useful for maternity wards and intensive care unit in hospitals where facial recognition of child identities is required.

III. PROBLEM STATEMENT

Face recognition is tough because it involves the identification or classification of an input images quickly and reliably. Some difficulties in face recognition are identifying similar faces, illumination condition, facial expression and aging effect.

If accurate and speedy means of infant recognition were available, abductions of babies and illegal adoptions might be avoided.As a result, it's vital to get started on analysis as soon as possible so that eventual face identification and classification algorithm can tackle the complex situation of newborn perception. The performance of a recognition systems should be able to produce results in a fair period of time.

1V. PROPOSED SYSTEM

The existence of pattern in infant images, as the pattern ofbaby the image fluctuates with uttarance fluctuation and the spark in image, motivates the suggested methodology for newborns.

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A. DEEP LEARNING

It is like a machine language that directs a computer to behave as if it were a person. As a result, deep learning has been chosen to use it in this paper. Neural networks can, in general, accomplish the same tasks as machine learning approaches (but old algorithms cannot perform the sameoperations as neural networks).

Artificial neural networks uses massive data to develop efficient models, permitting modern versions to achieve tasks. Reinforcement learning reduces the amount of data pre- processing required by machine learning. These algorithms can consume and analyze unprocessed text files andphotographs, as well as automate extraction of features, whichreduces the need for human expertise. We can organize or classify training dataset using neural networks based on similarities between instances in the data.

B. SYSTEM ARCHITECTURE

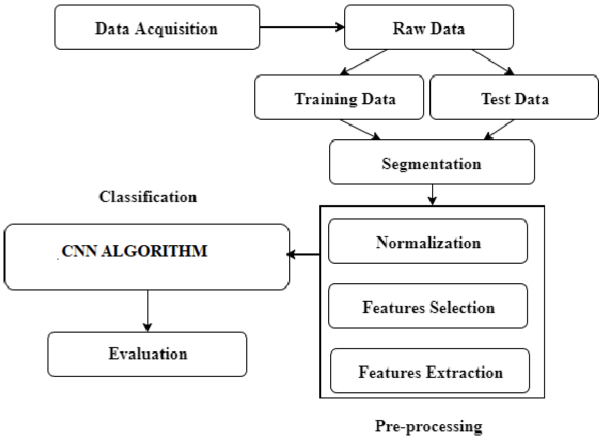

FIGURE1.SYSTEM ARCHITECTURE

- The data set is collected from the source and be used for training/testing purposes only if it matches the requirement.
- Pre-processing involves converting the image from theRGB format to grey scale to ease processing, the use of an averaging filter to filter out the noise, global basicthreshold to remove the background and consider onlythe image.

C. DATA ACQUISITION

The flowchart for collecting data is as depicted in the fig.The data set is collected from a source and a complete analysisis carried out. The image is selected to be used for training andtesting purpose only if it matches our requirements and is not repeated.

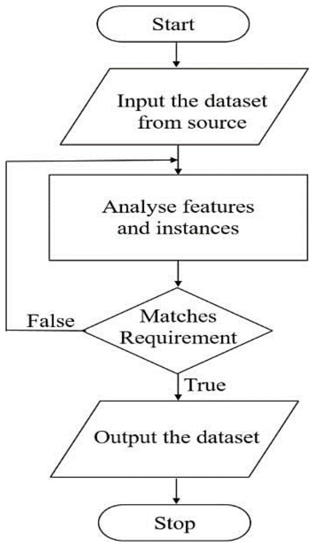

FIGURE2.FLOW CHARTOFDATA ACQUISITION

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D. PRE-PROCESSING

For pre-processing, the image acquired from the previousstep's output is used. This involves converting the image from the RGB format to grayscale to ease processing. The use of anaverage filter to filter out the noise, global basic threshold toremove the background and consider only the image and a high pass filter to sharpen the image by amplifying the finer details.

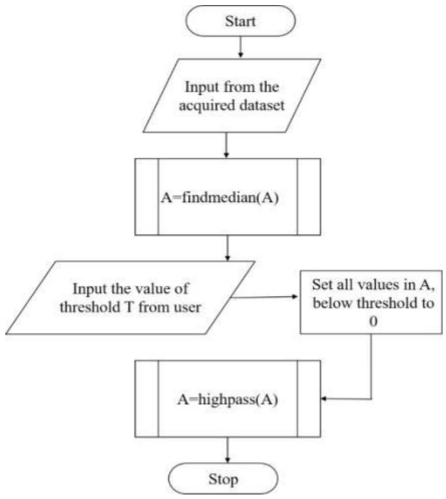

FIGURE3.FLOW CHART OF PRE-PROCESSING

CONVERSIONFROMRGBTOGREYSCALE

Transforming the picture from RGB to Gray scale imagewill be the first step in pre-processing. It can be computed by adding the RGB image to use the equation below. The transition from RGB to grayscale can be seen in the diagram below.

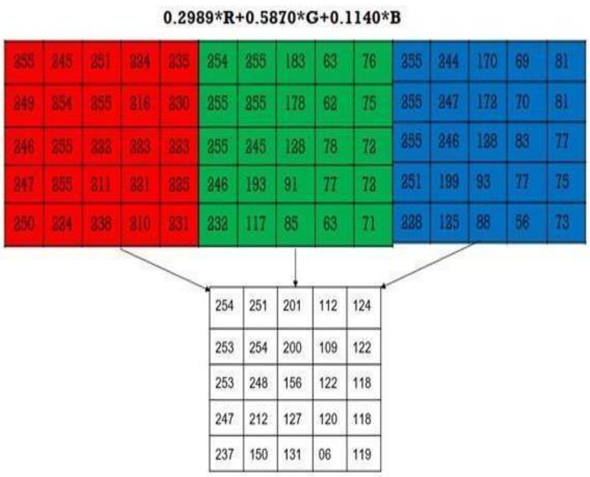

FIGURE4.RGBTOGREY SCALECONVERSION

MEDIAN FILTERING

It is a form of digital filter. More likely to minimize the amount of noise in a picture or transmission.

Here Os are appended at the edges and corners to the matrix which is the representation of the grey scale image. Then, for each 3*3 matrix, arrange the elements in ascending order, find the average factor of those 9 factors, and assign that median value to that pixel position.

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The Original matrix:

244	250	246	249	237
251	253	248	211	149
202	202	153	127	132
112	110	123	120	105
124	121	117	116	119

Append 0s at edges and corners:

0	0	0	0	0	0	0
0	244	250	246	249	237	0
0	251	253	248	211	149	0
0	202	202	153	127	132	0
0	112	110	123	120	105	0
0	124	121	117	116	119	0
0	0	0	0	0	0	0

The enhanced matrix:

0	246	246	237	0
202	246	246	211	132
202	202	153	132	120
112	123	121	120	116
0	112	116	116	0

FIGURE5.NOISEFILTER USINGMEDIANFILTER

BASIC GLOBAL THRESHOLDING

A(i,j) is higher than or equal to the threshold T, retain it.
Else, replace the value by 0.

Here, the value of T can be manipulated in the frontend, tosuit the varying needs of different images. We use trial and error method here to obtain threshold value which may be bestsuited for us.

0	246	246	237	0
202	246	246	211	132
202	202	153	132	120
112	123	121	120	116
0	112	116	116	0

Suppose, T=150

⟺

0	246	246	237	0
202	246	246	211	0
202	202	153	0	0
0	0	0	0	0
0	0	0	0	0

The leaf, minus the background

FIGURE6.GLOBALTHRESHOLDING

HIGH - PASS FILTERING

Here the output from the threshold is given as input. Here, we are making use of a filter, first we append the nearest values to pixels at the boundary pixels.

Boundary extension at edges and corners:

0	0	246	246	237	0	0
0	0	246	246	237	0	0
202	202	246	246	211	0	0
202	202	202	153	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

X 1/9

-1	-1	-1
-1	8	-1
-1	-1	-1

The filtered matrix:

-127	60	6	79	-76
35	52	47	90	-76
62	63	35	-68	-23
-67	-62	-39	-17	0
0	0	0	0	0

After rejecting negatives:

0	60	6	79	0
35	52	47	90	0
62	63	35	0	0
0	0	0	0	0
0	0	0	0	0

FIGURE7.HIGH-PASSFILTERING

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FEATURE – EXTRACTION TECHNIQUE

The feature extraction method utilizes the image as input.The feature extraction signal is used by the neural network to partition the input.

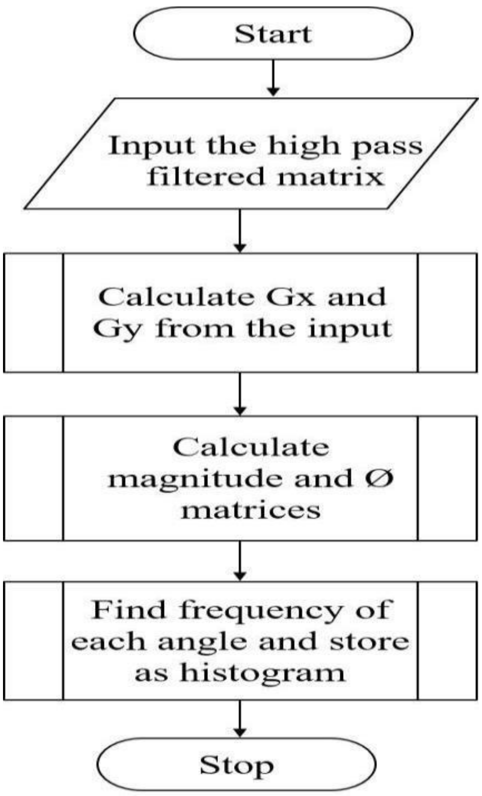

FIGURE8. FLOW DIAGRAM OF FEATUREEXTRACTION

HISTOGRAM ORIENTATION GRADIENT

Here 0's are appended at the edges and corners to the matrix. Then Gx and Gy are calculated. Gx is calculated as Gx = value on right –value on left and Gy is calculated as Gy =value on top-values on left.

The input:

0	0	0	0	0	0	0
0	0	60	6	79	0	0
0	35	52	47	90	0	0
0	62	63	35	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Gx:

60	6	19	-6	79
52	12	38	-47	-90
63	-27	-63	-35	0
0	0	0	0	0
0	0	0	0	0

Gy:

-35	-52	-47	-90	0
-62	-3	-29	79	0
35	52	47	90	0
62	63	35	0	0
0	0	0	0	0

FIGURE9.Gx and Gy in HOG

E. CLASSIFICATION USING CNN

Performance By considering all the features in the output layer which gives the result with some predictive values. The soft max activation function is used to evaluate these values.Based on the predictive values the final result will be identified.

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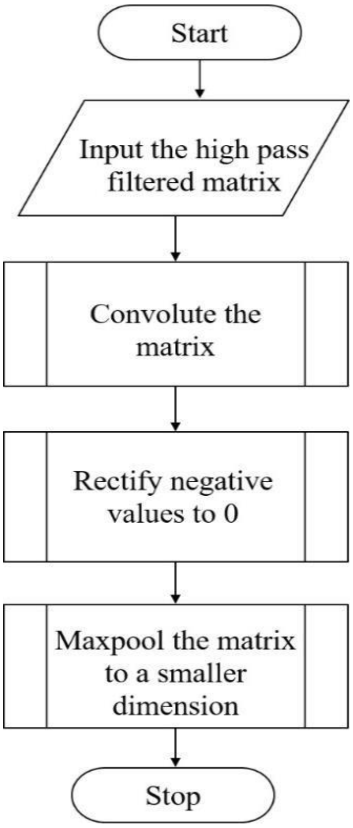

FIGURE10.FLOW DIAGRAM OF CLASSIFICATION USING CNN

TYPICAL CNN ARCHITECTURE

The visible cortex's structure and capability stimulated CNN structure, which became advanced to emulate the sample of neuron interconnection within side the human brain.Each organization of neurons in a CNN is partitioned right into a 3D framework, analyzing a particular component or thing of the picture.

To positioned it every other way, every set of neurons is devoted to figuring out the unique issue of the image. The very last output of CNNs is a vector of cgance rankings that showsthe possibility that a positive characteristics belongs to a selected class. The positioning and adequacy of the visible cortex stimulated CNN architecture, that became installed to mirror the connectedness of neurons community with inside the human brain.

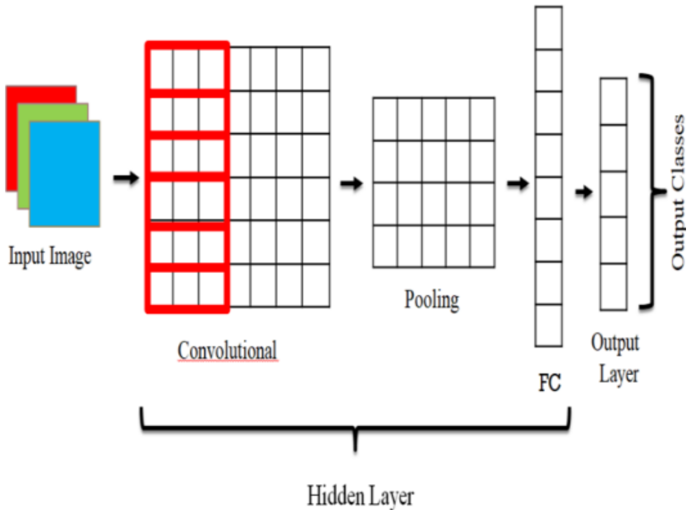

FIGURE11.TYPICAL CNN ARCHITECTURE

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LAYERS OF CNN

Convolutional layer-It is the first step in CNN. Here 3*3 part of the given matrix which was obtained from high-pass filter is given as input. The sum of that 3*3 matrix and the filter matrix for the corresponding location is printed in the specific position. This output is given to pooling layer where the matrix is further reduced.

Pooling layer- - In pooling layer 3*3 matrix is minimized to 2D matrix, this is done by choosing the maximum of the particular 2*2 matrix for the particular position.

Fully connected layer and output layer- The pooling layer's output is flattened, and the fully connected layer takes this flattened matrix. The image that is subsequently transmitted to the decoder, which categorises it using the soft max activation function in this example.

V. RESULT ANALYSIS

The suggested deep learning algorithm's result is evaluated to that of existing manual and learning-based methods. Facial detection is the first stage in recognising a face image. Detecting face regions from acquired photos of infants, on the other hand, is an error-prone operation considering the aforementioned challenges. Despite explicit training, existing approaches have failed to reliably differentiate facial areas. The proposed matching of the new-borns database has an accuracy of 87.04 percent, confirming that no two babies are alike.popular newborn detection methods. Various methods such as RFID wristbands, foot prints, and palm prints, among others, can be used to identify newborns. Various difficulties arose as a result of these tactics, and it took a lot longer to recognize them. The design of a convolutional neural network for automatic newborn facial identification outperformed previous methods and improved recognition accuracy. In addition, compared to previous feature extraction techniques, the convolutional neural network provides better accuracy.

V1. CONCLUSION

The use and challenges of newborn recognition are briefly discussed in this paper. We often go into some of the more

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