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Jaundice Detection

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ABSTRACT-

Hyperbilirubinemia is emerging as an increasingly common problem in newborns due to a decreasing hospital length of stay after birth. Jaundice is the most common disease of the newborn and although being benign in most cases it can lead to severe neurological consequences if poorly evaluated. Early detection of clinically relevant hyperbilirubinemia can be enhanced by the application of deep learning. We are using CNN (Convolutional Neural Network) algorithm in deep learning on the dataset for classification of image. The generated system is connected with a user-friendly website where user will upload photo for identification purpose and it gives the desired output., on preterm and term born neonates with serial measurements of total serum bilirubin in the first two weeks of life to predict jaundice.

Keywords-Hyperbilirubinemia Jaundice,Neurological consequences.

I. INTRODUCTION

1. About jaundice-Jaundice can be caused by a problem in any of the three phases in bilirubin production.Before the production of bilirubin, you may have what is called unconjugated jaundice due to increased levels of bilirubin. In this project, deep learning is applied to enhance the early detection of clinically relevant hyperbilirubinemia in advance with the help of CNN algorithm.

Jaundice or icterus describes the yellow coloration of the skin and sclerae caused by the hyperbilirubinemia. Based on the levels of the bilirubin, the color of the skin and sclerae will vary. The infant Jaundice is common during the first day of postnatal life and affects almost two thirds of human newborns. Mild jaundice is natural in newborn babies, which normally disappears within few days as the enzymes are formed in the body.

1.Types of jaundice:

A. Physiological jaundice
B. Pathological jaundice
C. Hemolytic jaundice.

2. Causes of infant jaundice- The primary reason for the infant jaundice is increase in the level of bilirubin. The bilirubin is a waste product that is produced after the breakdown of the red blood cells. It comprises of an open chain of four pyrrole-like rings (tetrapyrrole). As the hemoglobin of Red Blood Cells (RBC) in womb is different than the hemoglobin after birth, the rate at which the new RBC produced is faster. Further, the underdeveloped liver of the

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infants increases the level of bilirubin as fast as possible and results in the hyperbilirubinemia. In certain cases, the presence of bilirubin results in the following disorders, such as, Liver disease, Viral infections, Deficiency in enzymes, Abnormality in RBC, Hypothyroidism, Liver inflammation.

To improve the early detection of clinically relevant hyperbilirubinemia we applied both conventional as well as state-of-the-art ML-methods—algorithms that can "learn" from data to improve their performance with respect to a particular task, which in this case is the prediction for the need of a phototherapy treatment. All analyses were implemented in the Python3 programming language using models from the scikit-learn library. The runtime for the models is very fast: for the whole time series of measurements, training time lies in the range of a few seconds, and new predictions take only a few milliseconds to compute.

II. RELATED WORK

Hyperbilirubinemia is the most common condition requiring evaluation and treatment in neonates. Identifying among all newborns those few at risk to develop marked hyperbilirubinemia is a clinical challenge

The prevention, detection and management of jaundice in term and late preterm newborn infants remains a challenge [1-3]. Sixty per cent of term newborns develop jaundice, and 2% exceed

a Total serum bilirubin (TSB) concentration of 340 μmol/L [4]. The incidence of acute encephalopathy is much lower, recent data [4] suggesting an incidence of approximately one per 10,000 live births; the incidence of chronic encephalopathy has been estimated to be between one per 50,000 live births and one per 100,000 live births [5]. Acute encephalopathy does not occur in full-term infants whose peak TSB concentration remains below 340 μmol/L and is very rare unless the peak TSB concentration exceeds 425 μmol/L; above this level, the risk for toxicity progressively increases [6]. Two-thirds of patients with chronic encephalopathy had a recorded peak TSB concentration that exceeded 600 μmol/L[7].

HDFN can cause fetal hydrops during pregnancy or neonatal jaundice after birth.Direct Antiglobulin Test (DAT) detects antibodies bound to red cells and is a valuable test aiding in the diagnosis of HDFN.

Zone	**Greater than 37 weeks gestation and DAT negative**	**35 to 37 6/7 weeks gestation or DAT-positive**	**35 to 37 6/7 weeks gestation and DAT**
High	Further testing or treatment requried	Further testing or treatment requried	Phototherphy requried
High intermediate	Routine care	Follow-up within 24hr to 48hr	Further testing or treatment requried
Low intermediate	Routine care	Routine care	Further testing or treatment requried
Low	Routine care	Routine care	Routine care

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Response to results bilirubin screening

III. PROPOSED METHODOLOGY

The aim of AI is to improve computer functions which are related to human knowledge, for example, reasoning, learning, and problem-solving. Machine learning is a branch of artificial intelligence that aims at solving real life engineering problems. It provides the opportunity to learn without being explicitly programmed and it is based on the concept of learning from data.

The application of machine learning models on human disease diagnosis aids medical experts based on the symptoms at an early stage, even though some diseases exhibit similar symptoms. One of the important problems in multivariate techniques is to select relevant features from the available set of attributes. The common feature selection techniques include wrapper subset evaluation, filtering and embedded models. Embedded models use classifiers to construct ensembles, the wrapper subset evaluation method provides ranks to features based on their importance and filter methods rank the features based on statistical measurements.

To implement our project, we are using one of the deep learning algorithms called CNN. So in deep learning, a convolution neural network is a class of deep neural networks, most commonly applied to analyzing visual imagery. CNNs use relatively little pre-processing compared to other image classification algorithms.

Convolution Neural Network (CNN) algorithm consists of 4 steps

They are:

1. convolution
2. pooling
3. flattening
4. full connection

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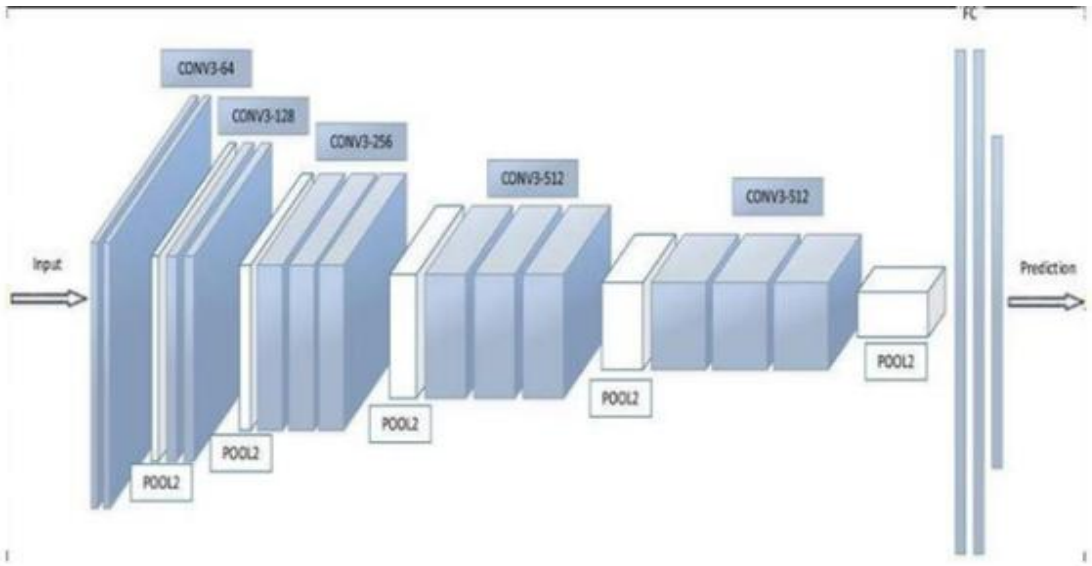

Convolution:

When programming a convolution layer, each convolution layer within a neural network should have the following attributes:

- Input is a tensor with shape (number of images) x (image width) x (image height) x (image depth).
- Number of convolution kernels.
- Width and height of kernels are hyper-parameters.
- Depth of kernels must be equal to the image depth. Convolution layers apply a convolution operation to the input, passing the result to the next layer.

The convolution emulates the response of an individual neuron to visual stimuli. Each convolution neuron processes data only for its receptive field. Although fully connected feed forward neural networks can be used to learn features as well as classify data, it is not practical to apply this architecture to images. A very high number of neurons would be necessary, even in a shallow (opposite of deep) architecture, due to the very large input sizes associated with images, where each pixel is a relevant variable. For instance, a fully connected layer for a (small) image of size 100 x 100 has 10000 weights for each neuron in the second layer. The convolution operation brings a solution to this problem as it reduces the number of free parameters, allowing the network to be deeper with fewer parameters. For instance, regardless of image size, tiling regions of size 5 x 5, each with the same shared weights, requires only 25 learnable parameters. In this way, it resolves the vanishing or exploding gradients problem in training traditional multi-layer neural networks with many layers by using back propagation

Pooling:

Convolution networks may include local or global pooling layers. Pooling layers reduce the dimensions of the data by combining the outputs of neuron clusters at one layer into a single neuron in the next layer. Local pooling combines small clusters, typically 2 x 2. Global pooling acts on all the neurons of the convolution layer. In addition, pooling may compute a

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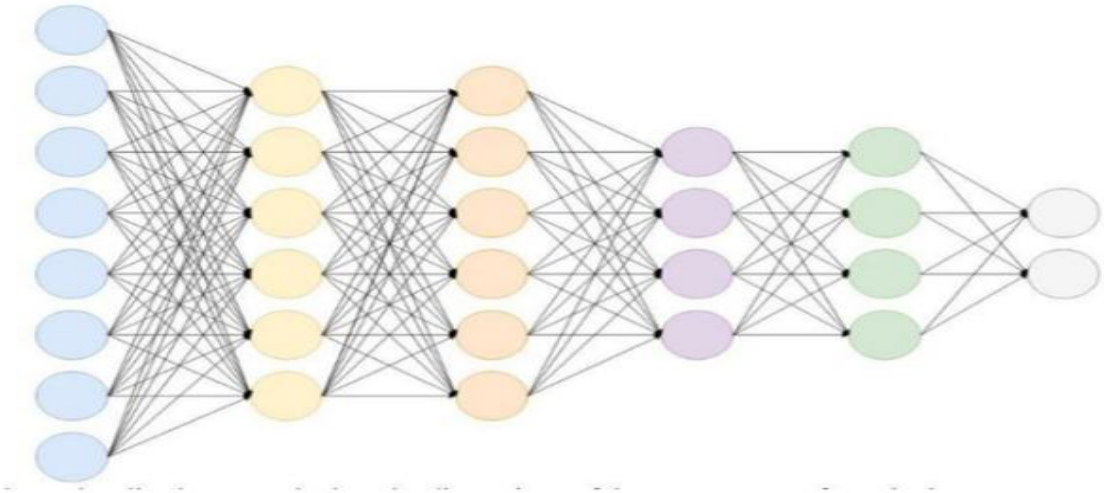
max or an average. Max pooling uses the maximum value from each of a cluster of neurons at the prior layer. Average pooling uses the average value from each of a cluster of neurons at the prior layer.

Flattening:

This step is for converting the multidimensional array to single dimensional array.

Fully connected:

Fully connected layers connect every neuron in one layer to every neuron in another layer. It is in principle the same as the traditional multi-layer perceptron neural network (MLP). The flattened matrix goes through a fully connected layer to classify the images. It is one of the ways of machine learning where the model is trained by input data and expected output data.



To create such model, it is necessary to go through the following phases:

1. model construction
2. model training
3. model testing
4. model evaluation

Model construction depends on machine learning algorithms. In this projects case, it was neural networks. CNN feature vector to implement jaundice recognition. Firstl collect the images with two conditions with and without jaundice from the patients inorder to construct over model.

Model training is achieved only when we collected the required inputs from the patients suffering from jaundice.Now we should train this model based on the inputs we have gathered.We have to train for both with and without jaundice.The construction of the model based on this training is about 80%.

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Model Testing is achieved only after the model training completed.In this We also train the model

with both conditions with a small sample of images when compared with the above phrase.The remaining model construction of about 20%done here.

Model Evaluation is to check the accuracy of the model.The more images added the more accuracy generated.For evaluation we have created an user interfaces to check wheather the evaluate image belongs to which condition.The result of the model will generate here.

V. RESULTS

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VI. CONCLUSION

The present study investigated a method to identify the whether the person having jaundice or not using Deep learning algorithm on the dataset for classification of image. The generated system is connected with a user-friendly website where user will upload photo for identification purpose and it gives the desired output. The proposed system works on the principle based on detection of a part and extracting CNN features from multiple convolutional layers. These features are aggregated and then given to the classifier for classification purpose. On basis of the results which has been produced, the system has provided the 96% accuracy in prediction of finding whether the person is having jaundice or not

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