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In order to detect malnutrition, a convolutional neural network is used.

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Abstract:

Many nations have a high infant and toddler mortality rate because of malnutrition. If children are identified as being underweight, appropriate steps or therapy can be taken to lower their chance of mortality and improve their physical and mental health. The suggested system employs a Deep Learning method called a Convolutional Neural Network (CNN) to process data, evaluate pictures, and classify them. In this case, we employed Alex Net and Transfer Learning as our system of choice for training. By matching the incoming picture to the learned model, the algorithm determines whether the infant is emaciated or healthy. The system's goal is to automate the detection of childhood starvation in order to assist individuals and healthcare workers mitigate the negative outcomes associated with this condition.

Keywords — Malnutrition, Convolutional Neural Network, Alex net.

INTRODUCTION

Malnutrition can result from either an inadequate diet or an excessive one. Diabetes, cardiovascular illness, vision difficulties, and poor physical development are just some of the consequences of this. MaNy nations have a high infant and toddler mortality rate because of malnutrition. The World Health Organization (WHO) estimates that 21.3%, or 144 million, children under the age of 5 worldwide are stunted. The lives of 6.9%, or 47 million children, have been negatively impacted or are in danger because of waste. Worldwide, about 5.6%, or 38.3 million toddlers younger than 5 years old, were overweight in 2011 [1]. While there has been progress, it has been modest and uneven (as depicted in Fig. 1). Physical health problems and stunted development are the direct result of inadequate diet. One in three children worldwide is malnourished, and one in two is experiencing "hidden hunger," as stated in UNICEF's The State of the World's Children 2019 study [2].

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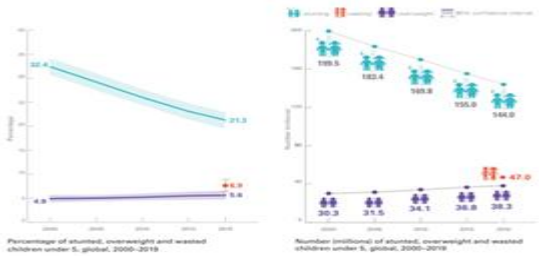

Fig. 1. Percentage and Number (millions) of stunted, wasted and overweighed under age 5 globally between the years 2000-2019. Source: UNICEF, WHO, World Bank Group joint malnutrition estimates, 2020 edition

Undernourishment is a leading cause of mortality among infants younger than five [3]. According to the National Family Health Survey 2005-2006 (NFHS-3), 48.0% of children in India under the age of 5 were undersized, 19.8% were wasted, 6.4% were seriously wasted, and 42.5% were underweight. According to the 2015–2016 National Family Health Survey (NFHS-4), 35.8% of American children were underweight, 7.5% were seriously underweight, 21.0% were wasted, and 38.4% were underdeveloped. Stunting and underweight infants decreased slightly over the decade, but squandered is still a major problem. Malnutrition has a disproportionately negative impact on children, and early diagnosis can save lives and alleviate physical or developmental problems. The effects of starvation on children can be mitigated if it is identified at an early enough age for individuals and healthcare workers to implement preventative steps. Convolutional neural networks (CNNs) are a form of artificial neural network used to identify starvation in infants. Alex Net, a convolutional neural network, was the design we used. It is a robust model that can achieve high accuracies even on difficult datasets.

RELATED WORK

The idea of using human pictures and studying data from hue to spot diseases has been laid out in depth. Some individuals may have a slender appearance despite not being hungry [6]. The dataset's many characteristics are learned using the Tensor Flow method. Semi-structured conversations yielded data that was examined with frame analysis and the Madea program. It took a long time to collect the data, and if the data wasn't perfect, the analysis would be flawed [7]. Anthropometric markers such as height, weight, and MUAC are used to describe the dietary condition of the community. The research also found that the quality of physical survey data can be enhanced by discarding data based on SMART signal cut-off marks. Instead of naming the malnourished kids, the authors explain the quality-improvement steps [8]. The function of CNS in the prevention and management of malnutrition in confined patients was described in depth in the white paper [9]. Correct labelling, financing repayment, and care of emaciated patients all depend on precise recording [10]. Using Indian Human Development statistics from two time periods (2004-2005 and 2011-2012), a decomposition analysis was performed. Measures of undernutrition included the Weight-for-Height z-score, the Height-for-Age z-score, the Weight-for-Age z-score, and the Anthropometric Failure index. Using z-scores, the study gave a current picture of the youth of India's dietary standing [11]. The malnourished monitor display device was designed to do just that. A pie chart or bar graph, containing data from the database, is generated as the end result and presented in response to the user's selection. While this information alone may not be sufficient to cure emaciated children, it can inform our efforts to reduce their numbers through preventative steps [12]. One of India's biggest problems is infant malnutrition. This analysis has uncovered the causes of hunger in children younger than five in India, as well as the measures that can be taken to reduce that number. There is an explanation of preventative steps, and [13]. To get an overall picture of the kids' diets, an algorithm was built using ID3, Random forest tree algorithm. Training data using the random forest tree method has many advantages. Predictions can be made using educated data, but the process is time consuming [14]. Children younger than five years old had comprehensive dietary statistics gathered in 2011. To aid program administrators and the government in identifying at-risk youth, a predictive model is created using PART trimmed rule induction. [15]. Children's starvation was identified using a Rule-based categorization method implemented in a Multi-Agent System. The optimality of the end choice is determined by the number of guidelines used, demonstrating a connection between the two. Time is wasted while we produce rules for complicated data or systems, and it takes a lot of human effort to do things like create rules out of facts [16]. The research found that a case-detection method based on weight and height was less effective than other methods at spotting starvation. When it comes to finding extremely emaciated kids who could benefit from community-

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based rehabilitative care initiatives, MUAC is the gold standard case-detection technique. When assessing a child's dietary state, MUAC is the gold standard [17]. The research concluded that childhood starvation is a significant health issue, affecting 21.7% of children younger than three in rural Western China in 2005. The general prevalence of malnutrition in children younger than three is illustrated in this study [18], but methods for identifying emaciated children are not included.

SCOPE OF THE STUDY

Children under the age of five are the most vulnerable to the effects of malnutrition, which include stunted physical and cognitive development and an increased risk of infection. The primary objective of the initiative is to identify malnourished toddlers using pictures and basic metrics. (Gender, age, weight, and height).

METHODOLOGY

Dataset

Images of toddlers with starvation and healthy children are separated into starvation and Normal files, respectively. B. A Visually Oriented User Interface (GUI) MATLAB's graphical user interface (GUI) is used to collect data from the user, as in Fig. 2, and then to process that data and present the findings.

Fig. 2. Graphical User Interface for Malnutrition Detection

Image of a child, gender, and your input . Months of age, 4. Weight in kilograms, 5. (in cm). Alex net and transfer learning are used in this processing training. Image analysis and parametric conditions for classifying body mass index, height-for-age, and weight-for-age ratios. Results textbox is updated with the outputted phrase. The hunger FAQs that appear when you click the Questions icon.

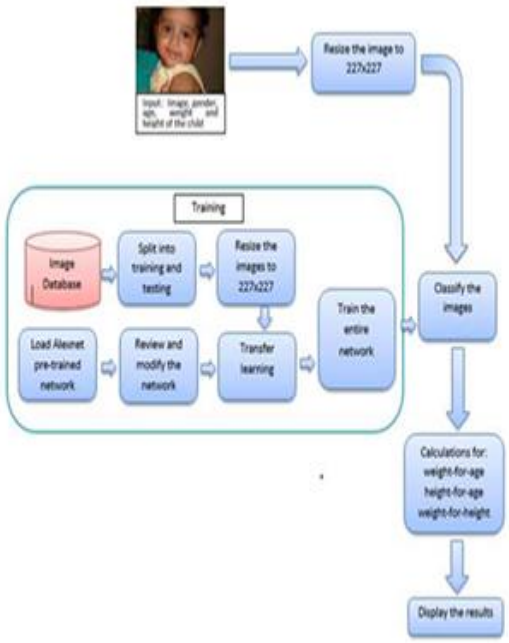

Fig. 3. Architecture for Malnutrition Detection

Children who are malnourished and those who are robust are included in the file, which you can load. Data files and subfolders loading is the first stage in this lesson. Cut the data collection in half: The collection arbitrarily divides the pictures into training and testing sets, creating two separate data warehouses. Pre-trained network loading and tweaking: Alex Net is a convolutional neural network that can categorize pictures into 1000 item types, including a computer, mouse, stylus, and many creatures, thanks to its training on more than one million images from the ImageNet collection. Therefore, the model has learned to depict a broad variety of pictures with a wealth of features. The Alex Net design is a multi-layered structure. There are a total of five convolutional layers, three of which are completely linked, and two others that are succeeded by max-pooling layers. Training results can beenhanced by employing a non-saturating Rectified Linear Unit (REL) activation function. It is an effective algorithm that can perform well even on difficult data sets. The Alex net neural network is loaded after it has already been taught. After the new dataset is loaded, the Alex net architecture's learning rate, epochs, and mini-batch values are adjusted and the end layers are tweaked (Fig. 4). (Malnutrition and normal). The neural network is used to learn the job of picture classification, and then the final layers are swapped out for a fresh, smaller collection of images. Transfer learning can be used to fine-tune a network much more quickly and easily than starting from zero with random weight initialization would allow. What this procedure does Learning by transferring with the tweaked pre-trained network and the specified settings. Next, the complete network is trained to identify pictures; in this case,

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training images must have a measure of 227 by 227, so the resize function is used to adjust all the images to this size.

1	'data'	Image Input	227x227x3 images with 'zerocenter' normalization
2	'conv1'	Convolution	96 11x11x3 convolutions with stride [4 4] and padding [0 0 0 0]
3	'relu1'	ReLU	ReLU
4	'norm1'	Cross Channel Normalization	cross channel normalization with 5 channels per element
5	'pool1'	Max Pooling	3x3 max pooling with stride [2 2] and padding [0 0 0 0]
6	'conv2'	Convolution	256 5x5x48 convolutions with stride [1 1] and padding [2 2 2 2]
7	'relu2'	ReLU	ReLU
8	'norm2'	Cross Channel Normalization	cross channel normalization with 5 channels per element
9	'pool2'	Max Pooling	3x3 max pooling with stride [2 2] and padding [0 0 0 0]
10	'conv3'	Convolution	384 3x3x256 convolutions with stride [1 1] and padding [1 1 1 1]
11	'relu3'	ReLU	ReLU
12	'conv4'	Convolution	384 3x3x192 convolutions with stride [1 1] and padding [1 1 1 1]
13	'relu4'	ReLU	ReLU
14	'conv5'	Convolution	256 3x3x192 convolutions with stride [1 1] and padding [1 1 1 1]
15	'relu5'	ReLU	ReLU
16	'pool5'	Max Pooling	3x3 max pooling with stride [2 2] and padding [0 0 0 0]
17	'fc6'	Fully Connected	4096 fully connected layer
18	'relu6'	ReLU	ReLU
19	'drop6'	Dropout	50% dropout
20	'fc7'	Fully Connected	4096 fully connected layer
21	'relu7'	ReLU	ReLU
22	'drop7'	Dropout	50% dropout
23	''	Fully Connected	2 fully connected layer
24	'prob'	Softmax	softmax
25	''	Classification Output	crossentropyex

Fig. 4. Modified Alex netnetwork.

Classification

This component determines whether or not a picture shows starvation. It scans the input picture, scales it to 227 by 227 so that it matches the input dimensions of the network, and then applies the pre-trained Alex net model to it for labelling. Children with z-scores of less than -2 standard deviations (SD) from the middle of the WHO Child Growth Standards for weight-for-age, height-for-age, and weight-for-height are considered malnourished. The algorithm uses these criteria along with the user's input of the child's age, weight, and height to place them into one of three categories: 1. malnutrition; 2. danger of malnutrition; 3. normal.

EXPERIMENTAL RESULTS

The suggested method used five hundred pictures of kids under five, 250 of them emaciated and 250 of them robust. Training uses 90% of the info and assessment uses 10%. All of the pictures in the collection, including the initial image for categorization, were scaled down to 227 by 227 by 3 for the training and assessment phases.

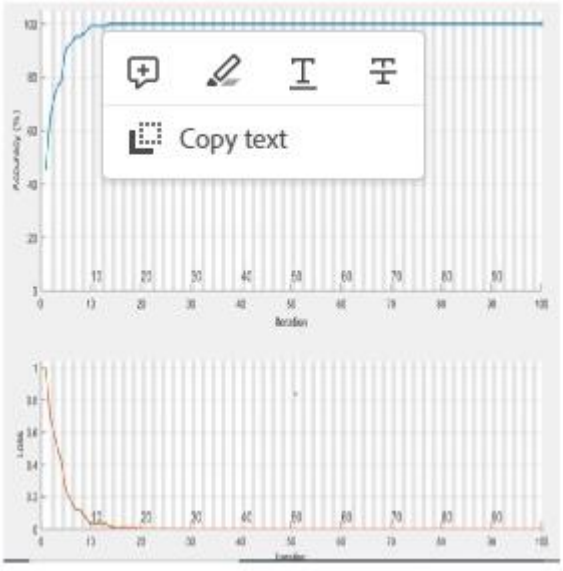

Fig. 5. Training progress of the network

Layer transfers and newly added network levels are shown in Fig. 5 to illustrate the training process so far. Precision is used to measure efficiency. It's proportional to the amount of accurate forecasts. Every version brings a new level of precision. Each iteration's worth of precision is graphed over time. There is a decrease in waste and an increase in precision, as shown by the shape of the curve. The greater the precision of the algorithm, the lower the loss should be. If the algorithm accurately forecasts the future, then the loss will be minimal or null. The worth of the loss increases if the model's forecast is incorrect or not as anticipated.

Fig. 6. Performance evaluation for different learning rates

Fig. 6 displays the results of our testing of the trained version of the suggested model, which shows an accuracy of 96% at a learning rate of 0.001. WAZ,

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WHZ, and HAZ z-scores were used to categorize the end findings into three groups: (I) Malnutrition - if the picture and z-scores categories were forecasted as malnutrition, the end outcome indicates that the infant is emaciated, as displayed in Fig. 7.(a), (ii) Risk of nutrition - if either the image or z-scores classification is predicted as malnutrition, the final result shows that the child is at risk of malnutrition, as shown in Fig 7(b); (iii) Normal - if both the image and z-scores classification were predicted as normal, the final result shows that the child is not malnourished or normal, as shown in Fig 7(a).(c).

Fig 7 (a)

Fig 7 (b)

Fig 7 (c)

Fig. 7. The child is detected as (a) malnutrition (b) risk of malnutrition and (c) normal using image and simple inputs

CONCLUSION AND FUTURE WORK

The prevalence of malnutrition in many parts of the globe is shockingly high. Preventative steps can be taken by the government or health agencies if hunger is detected or predicted. A CNN or Convent method is used to identify kids under the age of five who are malnourished. As feedback, we use pictures of kids. Alex net is a convolutional neural network (CNN) for picture pattern recognition and categorization. Predicting whether or not a kid is malnourished is achieved through the use of parametric conditions, Alex net design, and the aid of the derived characteristics. The infants at danger of starvation are also classified. The next step of the research would involve using the CNN algorithm to determine the specific form of starvation the kids were experiencing. It would be useful for parents and doctors to have this information as the therapy varies depending on the variety.

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