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REVIEW ON PNEUMONIA DISEASE DETECTION USING DEEP LEARNING

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Abstract: Pneumonia is one of the most fatal diseases caused in the lungs. One cause the high cases of pneumonia is the lack of public understanding for early detection about this disease. In addition, the common symptoms caused by pneumonia are common things such as coughs, flu and fever so that people ignore it. Handling pneumonia is still difficult because there are many unforeseen risks resolved. One way that carried out to detect pneumonia, namely by taking X-rays chest, then the x-ray results are read by an expert. However, for getting the diagnosis results takes a long time because they have to adjust expert practice schedule. With the existence of a pneumonia classification system based on image can automatically assist medical staff in diagnosing pneumonia. Diagnosis involves chest x-ray images that are interpreted by a radiologist whereas diagnosis that assisted humans have their own limitations such as the availability of experts, costs, etc. In this review on pneumonia detection through chest x-ray images is conducted using deep learning models. However, researchers reviewed various models developed using the Deep Learning which enables researchers to understand and incept the techniques involved to detect pneumonia using deep learning for future research and practices.

Index Terms **- Pneumonia Detection, Deep Learning, Artificial Neural Networks, Convolutional Neural Networks.**

I. INTRODUCTION

Currently, pneumonia [1] is a disease that is not easy to detect in one stage early, when it is already in another phase it can generate death, this is appreciated today, the lack of specialists and hospitals in the country generates a high mortality rate due to this disease. The present research aims to develop a predictive model to be able to detect pneumonia at an early stage using Deep Learning [2] and Vision Computational [3].

Technology advancements have led to significant advancements in the identification of elements through image processing, including Deep Learning, whose concept was first introduced in 2006 at the Science magazine by computer scientist Geoffrey Hinton [4]. This has allowed pattern discovery to be able to decipher or predict with high accuracy some meaning to search for in that object [5].

This deep learning ability has received a lot of interest by the scientific communities, especially the health sector, since the implementation of this technology to make decisions about diagnoses of different diseases through the reading of medical images [6, 7], is so accurate that they are already comparable to that of medical experts and they have been gaining more and more acceptance and reliability. Likewise, deep learning, as a technique for the early diagnosis of diseases, consists of two approaches. The initial technique is aimed at the categorization of consequences, by associating the data such as a patient's past records. The second approach is devoted to the analysis of physiological data, such as radiographs, mammograms, CT scans, etc. This last approach, and from which this work of research, can be used as a pattern reading tool for accurate identification of tumors, different types of cancer and infections such as pneumonia.

That is why, through the use of predictive computational learning models such as CNN and Deep Learning [8-10], applied in medical diagnosis, have been expanding horizons in different specialties of medicine and positively impacting their results around of the world. Likewise, in an investigation in India in 2020, a system capable of analyze spectrograms to detect cough audios and be able to make a classification in relation to different respiratory diseases at the time of COVID-19 [11]. Due to the complexity of this project, only found satisfactory results in studies of acute cough versus, which was compared with other different types of cough, achieving a precision value of 98.6% and 91.7% sensitivity and specificity of correctness in the detection of diseases such as chronic pulmonary obstructive disease using SVM and MFCC [11].

In a study carried out in [12] a neural network of deep learning to classify different chest diseases, including pneumonia and COVID-19, Using a database called ChestX-ray, with this information it was possible to positive results in COVID-19 and diseases analyzed with the accuracy of 99.8%, and 99.9% of accuracy between COVID-19 and bacterial pneumoniathe disease using radiographic images.

On the other hand, a study by [13] with the use of CT scans axial, an interesting improvement was achieved in the diagnosis of lung cancer, with the use of Convolutional Neural Networks (CNN) achieved a classification accuracy of 97.2% proportional to the precision of an experienced radiologist.

Regarding the diagnosis of COVID-19 pneumonia, in [14] the 94.96% recognition accuracy has been achieved of this disease, using a specialized model called VGG16-CNN (OxfordNet Convolutional Neural Network) and pattern X-ray processing positive for the condition of COVID-19 pneumonia.

However, no specific local studies or antecedents have been found about the Use of Deep Learning to support the detection of pneumonia in India. For this reason, it is advisable that research of this technology be carried out on one of the diseases more worrying in the entire Indian population since, according to data from the Dr Randeep Guleria, Ex.Director, All India Institute of Medical Sciences, and a leading lung health expert, told News18 Cannel that, "Pollution and COVID-19 is the leading risk factor for lung disease in India, and a major contributor to pneumonia and lung cancer." In India (1,27,000) approx cases were registered in COVID-19 with the presence of pneumonia, of which 60% were fatal. On the other hand, the methods Conventional ways of detecting pneumonia in an X-ray image pose quite a challenge that requires a lot of expertise on the part of the medical specialist, so the precision and speed in giving a proper diagnosis is vital to successfully detect the disease before make the case worse.

With the use and deployment of the emerging Deep Learning technology allow the detection of pneumonia at an early stage in medical centers and hospitals in India, a precise diagnosis and treatment of the patient can be determined long before the disease enters a dangerous phase. For this reason, this research poses as a problem: To what extent to design a prognostic technique would facilitate for the early recognition of pneumonia with deep learning and computer vision?

II. LITERATURE REVIEW

By investigating various previous research and related studies for the present research found several articles based on the use of neural networks to detect pneumonia using the image data set to be able to perform the neural network training.

1. **"Research titled "Identifying Medical Diagnoses and Treatable Diseases by Image-Based Deep Learning" by [15] explores in :-**

- Summary:

His research consists of the implementation of deep learning algorithms with the objective of improving the current challenges presented in the field of medicine with regarding the reliability and interpretability of diagnoses of common diseases. On First, the authors postulate a deep learning model in order to detect the retinal diseases, which uses the technique of learning computational vision by transfer so that the neural network can train which it will use as information of input, optical coherence tomography (OCT) images. With the performance of this model, the researchers aim to use the deep learning approach for the analysis of a data set of OCT images, to demonstrate that it is possible that the precision of his model in classifying various diseases such as macular degeneration which is mainly related to age and macular edema is also mentioned diabetic, with which he can be compared to the experts in this field of medicine. Second Instead, the authors demonstrate that the application of their predictive model can also be used in other specialties, including the detection of respiratory pathologies through the analysis of X-ray images under the same transfer learning approach, with the final goal of using this to be able to have an additional tool that provides support to carry out diagnostic decision-making in different diseases to obtain better clinical results. The importance of a medical prediction system is highlighted based on Deep Learning is well trained, because it will depend on it, as well as a judgment that the patient is referred to an appropriate treatment or that a negligence.

- Methodology:

The methodology used by the authors consists of a series of processes and techniques based on other architectures used by other authors that, together, form a flow of own job. The first step in this methodology is to obtain a data set from 207130 OCT images which went through a quality and classification process, among these, qualify if the classes associated with the images were correct, discard images with resolution poor, etc. of which 108312 OCT images were used, in JPEG format, belonging to 4686 patients, required in neural network training. In addition, each OCT image went through a resizing process to minimize the computational demands of the machine vision process. Next, the process of creating the learning model by transfer was executed using the public access image database called ImageNet, under the Tensorflow platform, to obtain a pattern identification model for OCT images based on other pre-trained models with similar characteristics.

The dataset training was carried out under the Inception V3 architecture, where all the input images, resulting in 37,206 subjects classified with neovascularization choroidal (CNV), 11,349 classified with diabetic macular edema (DME), 8617 with drusen macular and 51140 in normal state. In evaluating the performance of the model, a dataset or validation dataset of 1000 digitized OCT images in images belonging to 633 patients, whose results were 250 with CNV, 250 with SMD, 250 with drusen and 250 in normal condition. Finally, for the evaluation of results, used the metrics AUC (area under the operating characteristics curve), errors and accuracy. In Figure 1, you can see the methodology used by the authors:

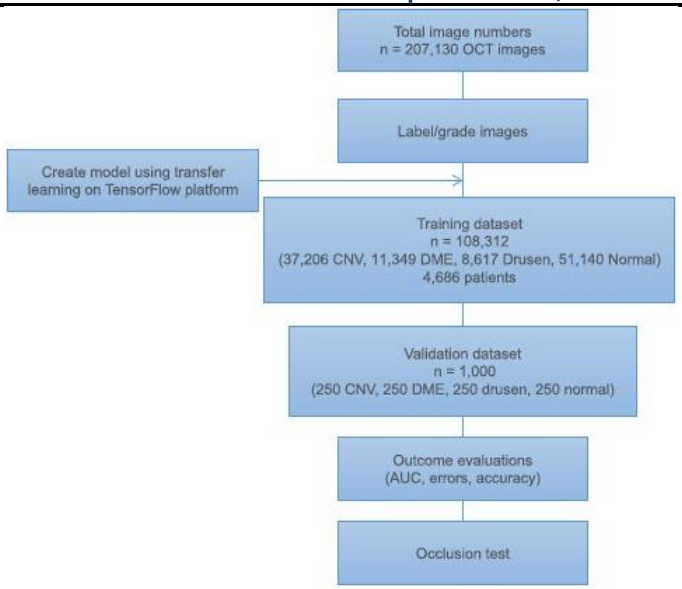

Figure 1: Methodology of a Predictive Model.

- Results

The results in the detection precision (true positives) of the model were the following: 100% for CNV, 99.87% DME and 99.96% in the case of drusen. It was shown that the neural network has outstanding classification performance.

- Conclusions

It can be drawn the conclusion that it is quite possible that in the close future, investigation for retinal diseases will only be determined by the examination of OCT imaging, rather than by conservative eye photography or clinical examination. This will increase the clinical significance of deep learning guided classification. This study also reveals that a large amount of information and resources can be dispensed with in order to obtain the expected results, however, it is necessary that the networks of deep learning learn initially from quality information (such as images well detailed) so that the process of deciphering and interpreting the results evolves each time deeper levels of accuracy.

2. "Research titled "Automated Diagnosis of Plus Disease in Retinopathy of Prematurity Using Deep Convolutional Neural Networks" by [16] explores in:-

- Summary:

In this research, it is proposed to create a diagnostic model for retinopathy of the premature (LP). This illness is characterized by appear in children who are born prematurely and with certain deficiencies in their body weight. Most cases of LP are usually mild, but 10% of these are usually serious and need to be treated in time. The authors present a system based on deep neural networks to automatically diagnose retinopathy of prematurity and other lungs associated diseases from the analysis of retinal photographs, which were previously classified by experts in the field. In order to diagnose this disease, it is necessary to identify a certain intensity in the vessels of the retina, which is very difficult to distinguish from a state without disease. Convolutions were utilised in neural networks for the model's pre-training, and the cross-validation or cross-validation technique was used to evaluate the data set to finally produce the desired results.

- Methodology:

The methodology developed by the group of researchers was supported first, with the obtaining a data set created thanks to the contribution of 8 study centers and consisting of in about 6000 retinal-posterior images created from photographic equipment called RetCam. The images went through a manual classification process called reference standard diagnosis (RSD), which served as an attribute for each image, the which are: normal (4535 images), pre-plus disease (805 images) and plus disease (172 images) being these the reference to the most serious cases. This RSD would serve as reference for the stage in which the training in the convolutional neural network was carried out which the intention of adjusting the parameters to reach the desired outputs. The model consists of 2 CNN architectures for input image pre-training, the first one deals with an architecture called U-Net, which uses a technique called retinal vessel segmentation, which generates the same image, but in pixels with intensities between 0 and 1 that represent the presence of the retinal vessel, which simplifies the ability to detect this main element of diagnosis. In the second CNN, the Inception V1 architecture was used for the stage of pre-training of images under the transfer computational vision technique learning for the creation of the predictive model specialized in the identification of these retinal patterns. This could be achieved quickly thanks to the training of the model with the ImageNet public data set which accelerated the learning process and improved the classification performance of your proposed model. For the evaluation of the results, this is divided into 5 equal parts to go through the cross-validation technique, with the intention of balance training and test results metrics. So it came to a test of 100 images, which were not included in the trainings and validations, a result of 54 normal, 31 with pre-plus disease and 15 with plus disease. In Figure 2 an approximation of the methodology used by the researchers can be seen:

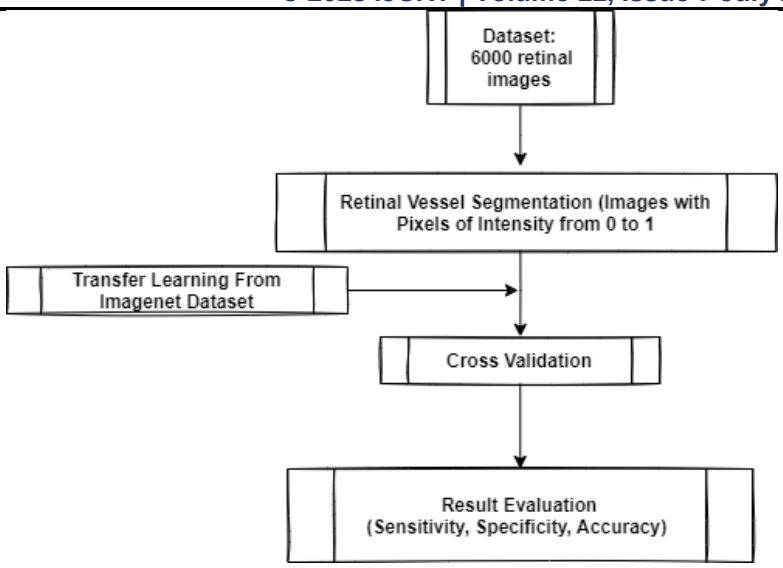

Figure 2: Retinopathy Diagnostic Methodology.

- Results:

Using the sensitivity and specificity metrics of the Deep Learning algorithm, was able to obtain a prediction result of 93% and 94% respectively. In short, from a estimated of 100 images, 91 of them could be correctly diagnosed, Figure 2.3 is shown appreciate the prediction results.

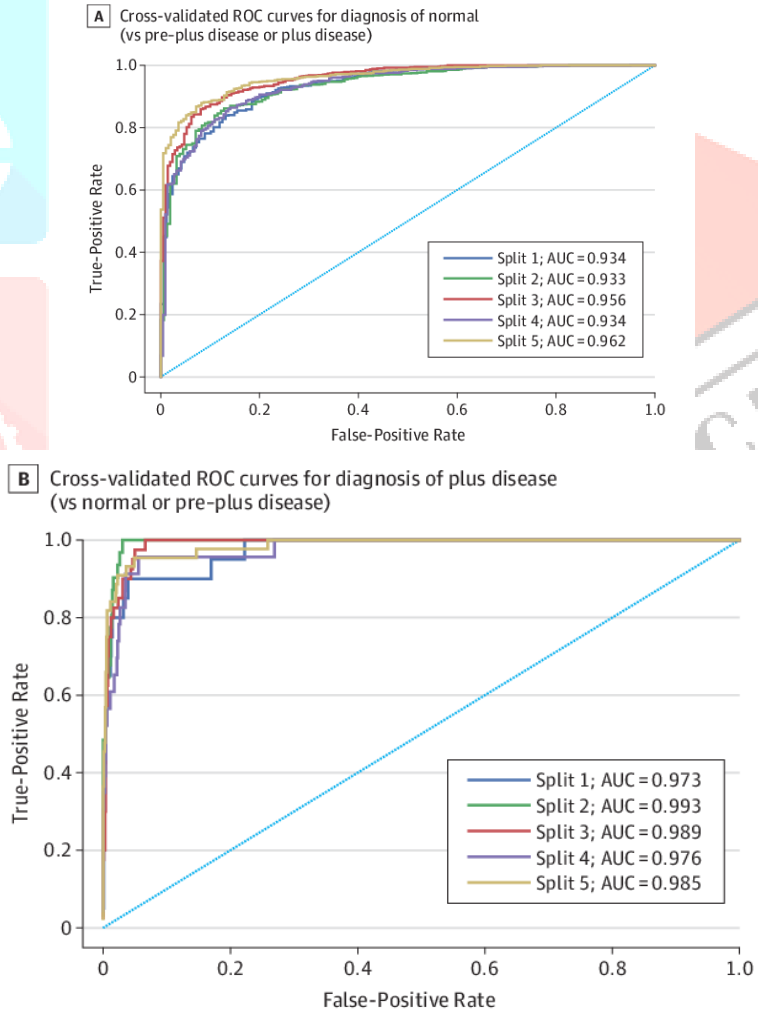

Figure 3: Prediction Results of Retinopathy of Prematurity

From the analysis of data using the cross-validation technique, as seen in the preceding image, mean area under the curve (AUC) values of 0.94 for identifying images with normal disease vs. pre-plus disease and plus disease and 0.98 for identifying images with plus vs. normal disease and pre-plus disease were obtained out of a total of 5511 retinal images..

- Conclusions:

It can be concluded that the incorporation of deep learning neural networks allows a high precision diagnosis in diseases such as retinopathy of the premature, which like pneumonia at an early stage, are difficult to diagnose. On this research shows that it is possible to use multiple neural networks convolutional based on architectures already tested and that are used for different purposes, but that, unified with other techniques such as cross-validation, work to reach a single objective, offer the best results that will serve as a great contribution to the medical field.

3. "Research titled "Pneumonia Detection Using CNN based Feature Extraction" by [17] explores in:-

- Summary:

In the present study, the authors proposed the development of a predictive model for the diagnosis of pneumonia based on convolutional neural networks for the classification of various features on chest radiographic images. They evaluated in the investigation several pre-trained convolutional neural network models, such as VGGNet, Xception, ResNet, AlexNet and DenseNet, for the classification of normal and abnormal radiographs of thorax, and thus be able to detect if there are potential cases of this pathology. The challenge of this research is how difficult it is to identify and classify respiratory pathologies such as pneumonia, especially at an early stage, as this can be misleading to radiologists because their patterns are usually very similar to those of a person with insufficiency heart disease or smoking problems, so it is crucial that several variants of pre-trained CNN models, supported by robust data sets, in order to obtain

the expected results. The objectives of this research are to offer an analytical study, comparing the different CNN pre-trained models to determine the best options in terms of extracting characteristics, presenting different models of classification of the input data and determine in this way which is the best of them and, finally, combine the best feature extractor with the best classifier to try further improve the performance of the predictive model.

- Methodology:

In obtaining the data set carried out by the researchers, a Chest X-ray14 public domain data set, which is made up of a total of 112,120 frontal radiographic images, belonging to 30,085 patients. Each image contains 14 binary attributes of different thoracic diseases. Of this total, 1431 images were labeled with the presence of pneumonia, so 573 images were randomly taken for the data training. The methodology used by the authors works under an architecture of densely connected neural network or known as DenseNet-169. Said scheme contains 3 phases of image processing. The first, as a pre-processing stage, each image that had a dimension of 1024x1024 pixels resolution, had to go through a 224x224 resizing process with the main purpose of improving the performance and thus reduce the computational complexity of your model. The second stage consists of the extraction of characteristics. At this stage the authors took as the main requirement to find a convolutional network that could be effective against the loss gradient between its layers. Said gradient loss problem is associated with the loss of information suffered by networks that have more depth of learning layers, so that your training may be paralyzed before finishing. Due to the fact that your pre-trained network has 169 layers of equal sizes that are adjacent to one another, the authors decided that DenseNet-169 is the best feature extraction architecture to handle loss of gradient. Various methods, including Support Vector Machine (SVM), Random Forest, Naive Bayes, and K-nearest, among others, were utilised in the last phase, the classification. As far as I'm aware, SVM serves as the classifier and the DenseNet-169 architecture serves as the feature extractor. Figure 4 displays the model that the researchers created:

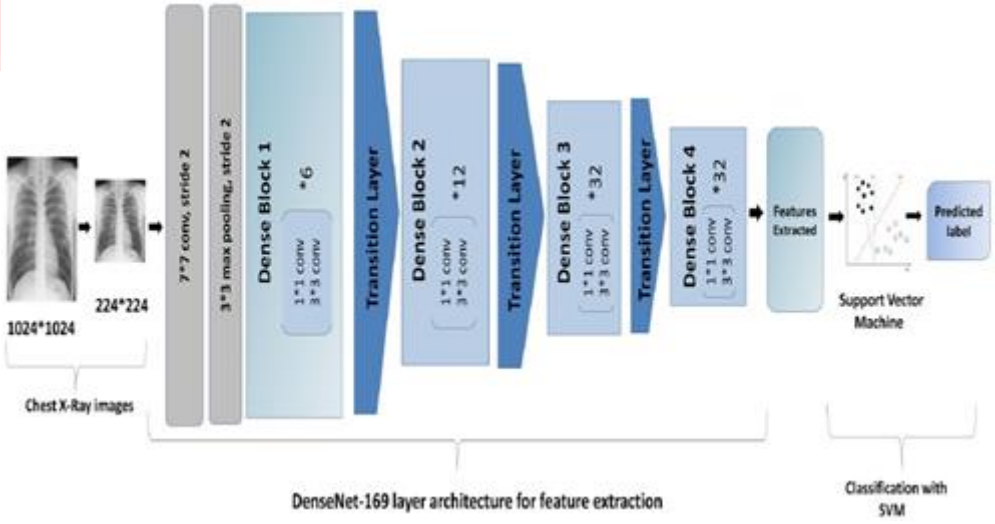

Figure 4: DenseNet-169 Convolutional Network Model

- Results:

In order to evaluate the results obtained in the investigation, the metrics were used AUC, where a precision of 0.8002 of the identification ratio was obtained with the use of the chosen architecture versus other combinations of architectures and techniques. In Figure 5, see the result of DenseNet169 architecture (0.8002) vs other DenseNet121 architecture (0.7717).

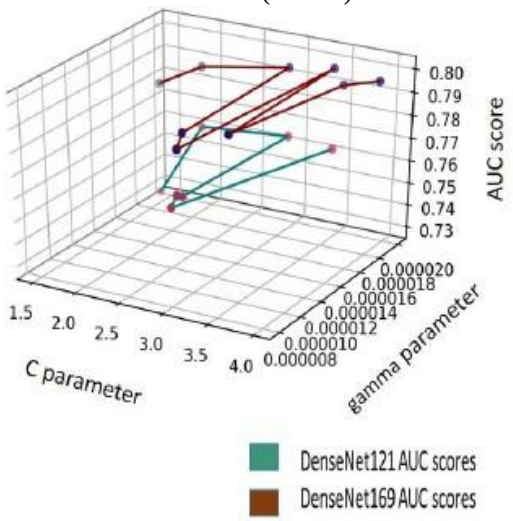

Figure 5: DenseNet-169 Convolutional Network Results versus DenseNet

- Conclusions

As a conclusion, it can be determined that the use and combination of architectures and Image classification techniques increase margins for better results in the diagnosis of diseases such as pneumonia, so it is important for the development of this research work to know and compare different types of neural networks to be able to approach the research objective.

4. **"Research titled "Prediction of Pneumonia using Deep learning"" by [18] explores in:-**

- Summary:

In this project, the authors propose the use of deep learning algorithms in the Classification of Pneumonia Disease Through Image Processing X-ray of the thorax. The researchers postulate that the use and development of neural networks convolutional, the use of architectures like Inception V3 to improve computational cost in speed performance and model accuracy, and a robust data set of thoracic imaging, are the ideal solution to be able to achieve the objective of your research, the which is to alleviate the workload of radiologists in Liberia and that this model can be used worldwide and in any type of medicinal field.

- Methodology:

One of the limitations of the team of researchers for the development of their methodology it was the lack of computational resources. To alleviate this, it was proposed to implement multiple convolutional layers with multiple grouping filters, in simple words, reduce the channels of neural network depth in exchange for faster speed and less processing computational. For this, it was decided to use 1x1 filter convolutions (64 cores of depth), instead of 3x3 (192 cores) or 5x5 (320 cores) filters. Furthermore, the use of 1x1 convolutions means that with a precise factorization the algorithms of entry and consequently even faster training. To obtain the set of data, the Kaggle repository was consulted, whose database consists of 5840 images of chest X-rays, where 624 images were used for tests and 5216 for training. This one gigabyte database is characterized by being well classified into folders for training and testing, in addition to attaching a .CSV file with all the attributes related to each image. The proposed system architecture is basically to publish a web application, where the radiographic image can be uploaded to the cloud, it goes through several processing stages fed by the convolutional network model and finally obtain as an output a prediction result "Yes" or "No", that is, if pneumonia occurs or not, where it will finally be shown to the end user. A key to this system is the use of a pre-trained model containing a convolutional layer and variable number of hidden layers. What benefits in a saving of processing of the calculation of the result a fast exit. This it will be useful for the proposed system since it is not necessary to train the predictive model each time that a new image is loaded, so the results will be delivered almost instantly. The approach used for the pre-trained model is under the vision technique computational transfer learning and the use of the ImageNet database. Thanks to this, it was possible to proceed to the analysis of the data set for the observation of patterns instead to create a model from scratch. The Keras library was used in the data processing and the ImageDataGenerator method, using convolutional neural network architecture Inception V3. This architecture, compared to others such as VGGNet, allowed to process large quantity of data at a low cost. To add, a UI platform was created under the Django framework, where you can upload the images to be analyzed and the results. In Figure 6 an approximation of the methodology used by the authors:

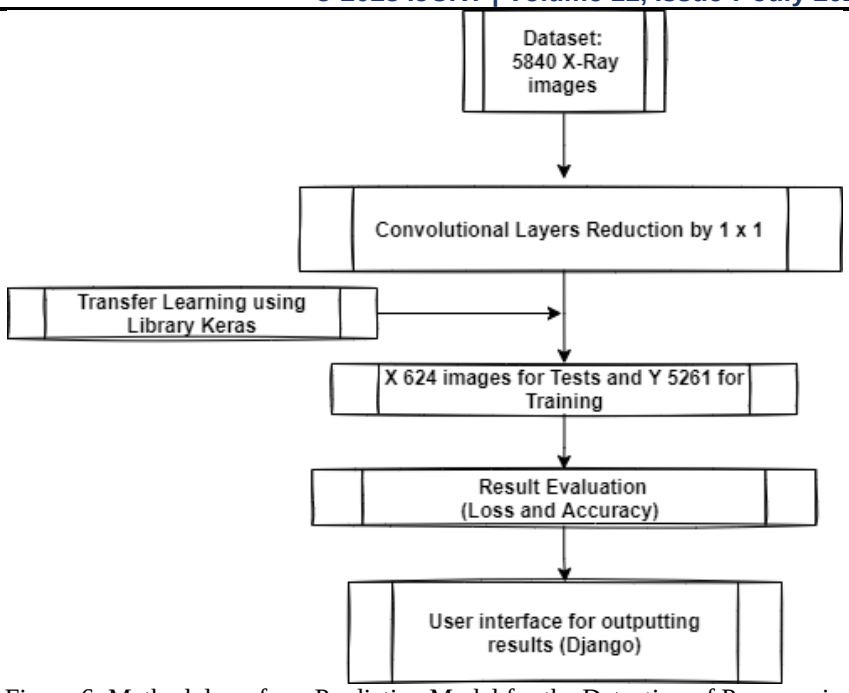

Figure 6: Methodology for a Predictive Model for the Detection of Pneumonia

- Results:

Finally, for the evaluation of results, the loss and accuracy metrics were used, where the results reached a precision level of 95%. As shown in the following figures, about the training and validation of the accuracy (Figure 7) and loss metrics (Figure 8) respectively:

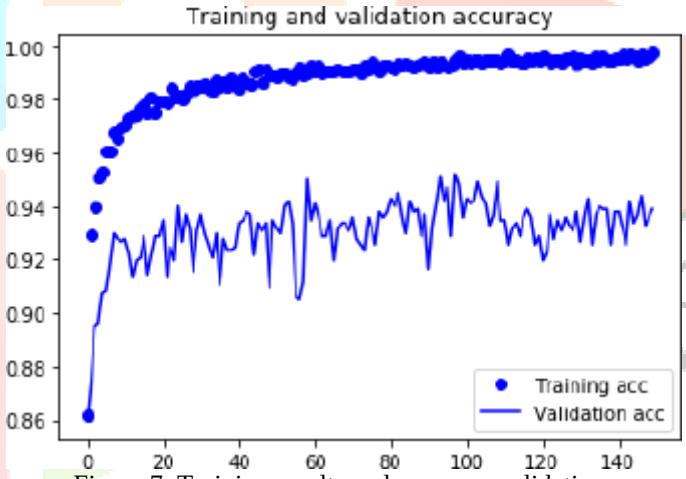

Figure.7: Training results and accuracy validation.

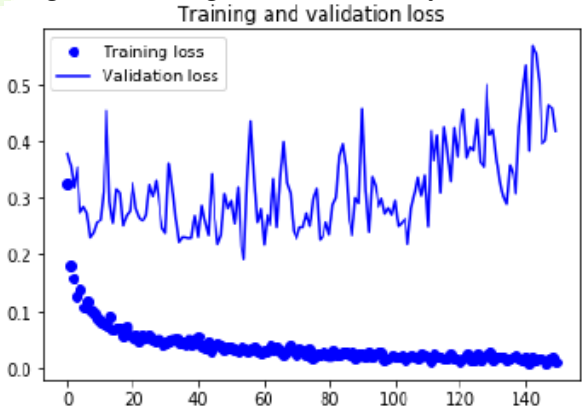

Figure 8: Loss Training and Validation Results

- Conclusions:

This study shows that the use of deep learning is very useful for discover chest diseases at the level of expert radiologists and that can be used to save many lives. The use of deep learning in the medical field can lead to an improvement in the flow efficiency of radiologists and improve the quality of the radiological diagnosis worldwide. According to the study carried out, in the field of medicine the use of deep learning is an important step that must be studied thoroughly. Must be add that to improve the results it is necessary to have high resolution images, better sampling and normalization of data, and use of variables.

5. **"Research titled "Classification of People who Suffer Schizophrenia and Healthy People by EEG Signals using Deep Learning" by [19] explores in:-**

- Summary:

In this research, a model based on deep learning techniques have been suggested for the classification of schizophrenia cases using electroencephalography (EEG) signal processing. Given that other studies using trait classifiers like Random Forest for the same type of disease revealed that the information obtained from the characteristics of EGG signals is of high dimensionality, variability, and multichannel, they proposed using the Pearson's correlation coefficient (PCC) technique to reduce this type of characteristic and bring it to a heat matrix that could serve as input for a neural network convolver. Last but not least, metrics for accuracy, specificity, and sensitivity are used to support the study's conclusions. The ultimate goal is to create a prediction model with precision using techniques like PCC.

- Methodology:

For the methodology used, a data set was obtained from a public repository called EEG of healthy adolescents and adolescents with symptoms of schizophrenia. Saying dataset consists of 122880 records (16 channels and 7680 records per channel). Then itproceeded with the stage of segmentation and ordering of the data to obtain a matrix of channels by records. Each register contains 122880 EGG signals, which were converted in matrices of 7680x16 channels. Next, the information classification was carried out when using a correlation matrix as an input to a CNN network which are values between -1 and 1 instead of variable values that an EGG signal can present, this improves considerably the performance of CNN. CNN architecture consists of 2 layers convolutional, 2 max-pooling layers, a fully-connected layer and a softmax output layer, as can be seen in Figure 9:

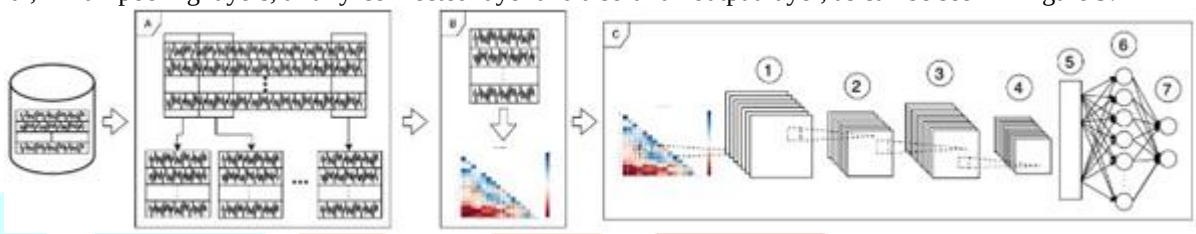

Figure 9: Predictive model for the detection of schizophrenia in children

Pearson's correlation coefficient represents the relationship between two variables, which in the project would be the captured EEG signals, which generates a channel for each signal, that is what say that one variable would be a channel and the other variable the rest of the channels, which would generate a displayed as a 16x1280 heat matrix that will serve as the input image for CNN. On Figure 10 shows the input matrix that represents EEG signals from a person with schizophrenia.

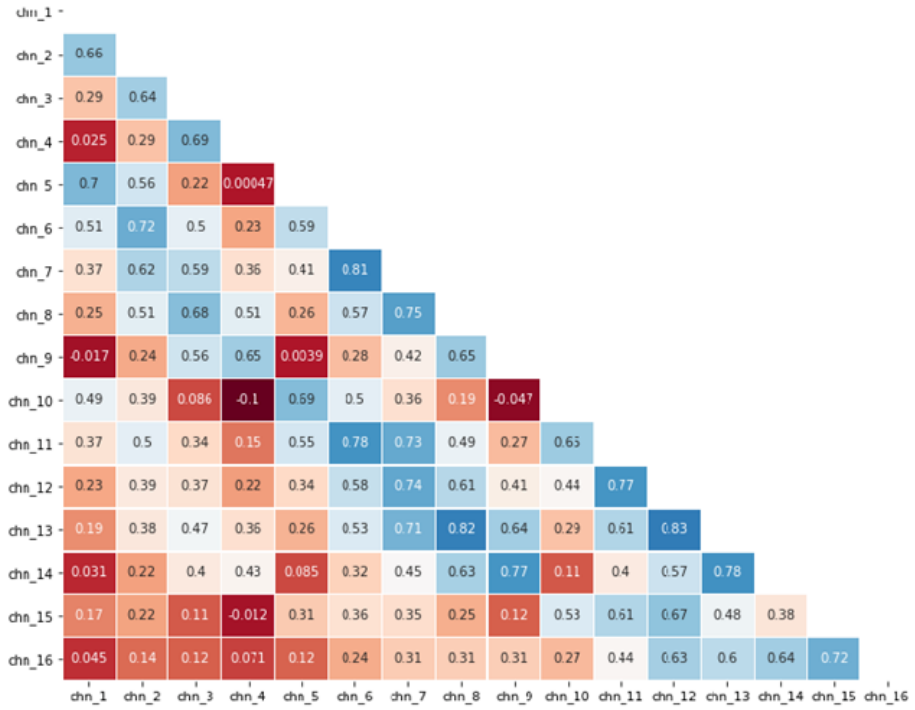

Figure 10: EEG signal correlation matrix of a schizophrenic person.

- Results:

As mentioned above, this information was partitioned to generate a heat matrix, where the intensity of color represented the level of presence of the disease. With these input data, a convolutional neural network made up of different processing layers such as Pooling Layer, Fully Connected Layer and Softmax. Finally, Using measurement metrics such as Sensitivity, Specificity, Accuracy and Loss, it was obtained a precision of 90%, with a specificity of 90% and a sensitivity of 90%, obviously superior to previous research conducted with Random Forest and Support techniques Vector Machine.

- Conclusions:

It can be determined that thanks to this type of research it can be seen that each new methodology contributes even more in the evolution of the development of solutions for the diagnosis of diseases that are difficult to detect due to the variability in their cases positive.

6. "Research titled "A Novel Transfer Learning Based Approach for Pneumonia Detection in Chest X-ray Images" by [20] explores in:-

- Summary:

Currently, pneumonia is one of the leading causes of death worldwide. This illness has a number of origins, including viruses, bacteria, and fungus. At present, it is difficult to judge pneumonia with chest x-rays. The Using transfer learning simplifies the detection of pneumonia. The use of images extracted from ImageNet where different models of neural networks were used trained, where it was then classified for prediction. The research evaluated different architectures of convolutional neural networks in order to be able to determine between all the studied which has a better performance and offers the best results in the detection of this disease. The model proposed in the research reached a precision of 96.4%, data that have not been seen in Guangzhou.

- Methodology:

The methodology proposed by the authors is shown in Figure 11, which consists of the steps mentioned below:

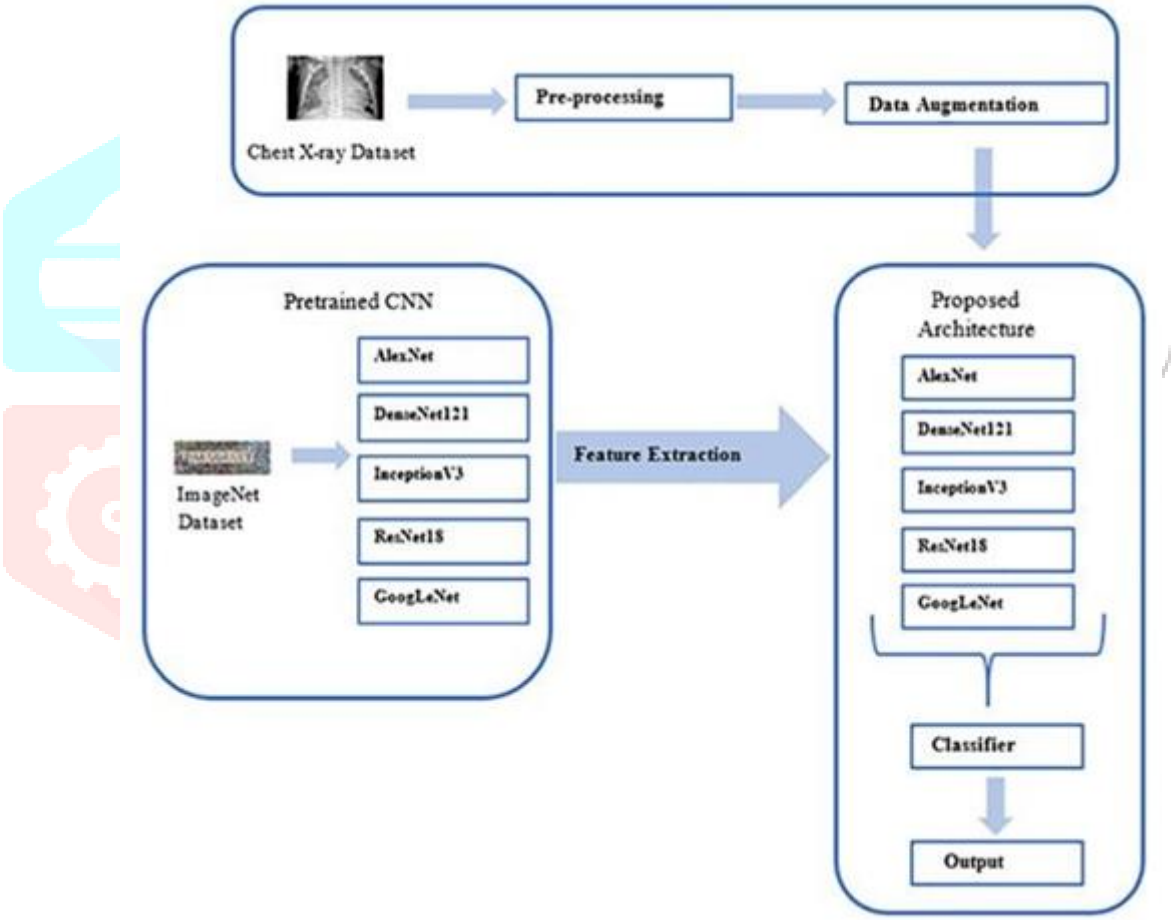

Figure 11: Methodology Scheme

- Obtain chest X-ray images to perform pre-processing of the same.
  - Data augmentation to image set with increased noise and resizing 224x224x3 images with the use of 3 magnification techniques (Random Horizontal Flip, Random Resized Crop, Image Intensity).
  - Learning transfer using AlexNet, DenseNet121, InceptionV3, Networks neural resNet18 and GoogLeNet, trained with the ImageNet dataset and the of selected chest X-ray images.
  - Extraction of characteristics and classification of sets, from a set of images provided by Guangzhou Women and Children's Medical Center. With a total of 5,232 images, of which 1,346 images were of normal patients, 3,883 patients suffering from pneumonia (2583 images of bacterial pneumonia and 1345 patients with pneumonia virus). Figure 12 shows the types of pneumonia of the dataset.

Figure 12: Types of Pneumonia

- Outcome:

For the detection of characteristics through computer vision Transfer was used Learning and 5 pre-trained convolutional neural network architectures were used as AlexNet, DenseNet121, ResNet18, InceptionV3, and GoogLeNet. After analyzing the metrics of performance such as Sensitivity, Specificity, Accuracy and Loss in all models, we proceeded to combine the results of the 5 models mentioned. This combination provided a notably better performance and achieved 96.39% accuracy and sensitivity of the 99.62%., Higher when compared to other previous research, such as the author's Kermany, cited above. Figures 13 and 14 show precision and loss graphs from tests performed, the best results of the ResNet18 network in accuracy metrics and lost.

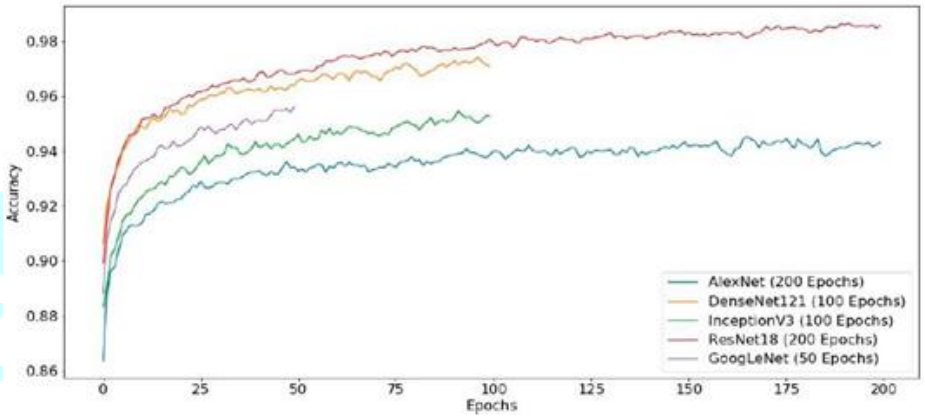

Figure 13: Neural network precision graph

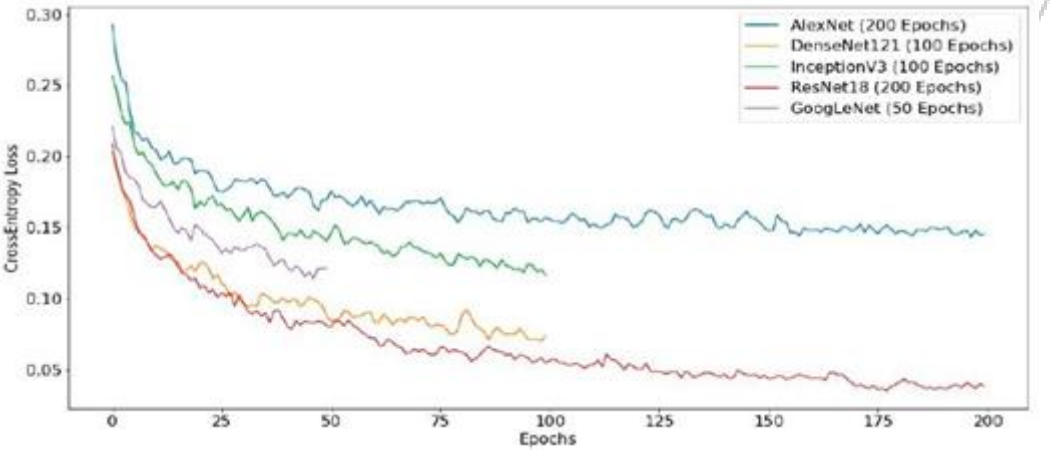

Figure 14: Neural network loss graph

- Conclusion:

One of the most interesting conclusions of this work is that this type of model predictive is not intended to replace a medical specialist, rather to become a necessary and indispensable tool to be able to determine diagnostic decisions, which It will dramatically reduce inaccurate diagnoses and save lives.

7. "Research titled "Diagnosis of Pneumonia from Chest X-Ray Images Using Deep Learning" by [21] explores in:-

- Summary:

The microorganisms that cause pneumonia are fatal, according to radiologists For a variety of reasons, including hazy images on x-rays that can even be confused with other lung ailments, experts rely on chest X-rays, despite their subjective diagnosis. Computer-assisted support is a great alternative for the detection of pneumonia. For this reason, the research in question uses the convolutional network Xception and VGG16 for the diagnosis of pneumonia.

- Methodology:

The methodology used by the authors of the research is to obtain the information from X-ray images of frontal thorax of Kermany et al., being images with Different resolutions such as 712x439 to 2338x2025 were validated between the images of normal and pneumonia patients, Figure shows an example of the images from the patients with pneumonia and normal cases (Figure 15).

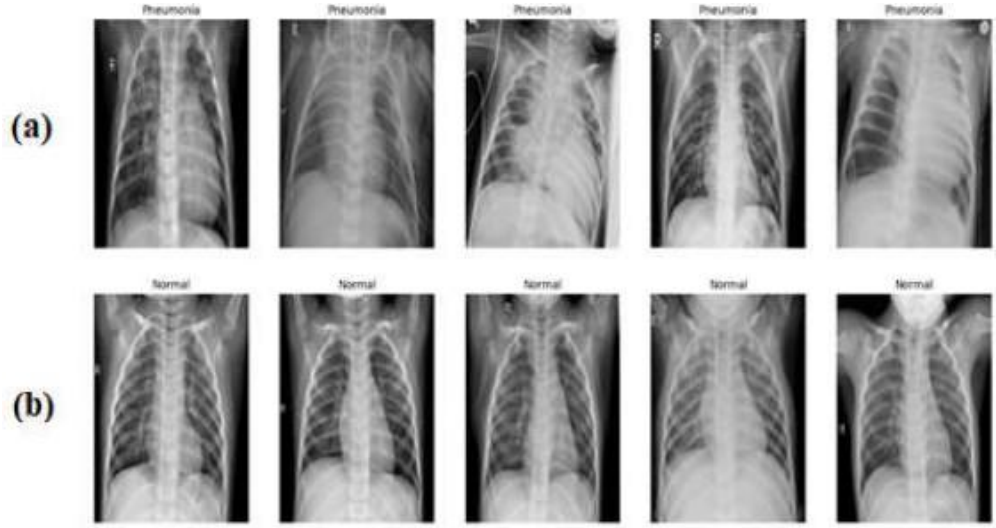

Figure 15. Example of Kermany data set images.

Argumentation and transfer learning, augmentation of images with various techniques to improve the performance of CNN networks, in which Xception and Vgg16 which is the extreme version of the Inception model.

- Outcome:

In the development of the tests it was shown that the Vgg16 network surpasses the Xception network with an accuracy of 0.87%, 0.82% but the Xception network showed a better result in the detection of pneumonia cases.

- Conclusions:

In the research work done with the tests on the same dataset, it shows that different networks show different results, the Xception network being the most successful for detect pneumonia cases and the Vgg16 network to detect normal cases. In the future combining forces can achieve better results for the detection of pneumonia.

8. "Research titled "Chexnet: Radiologist-level pneumonia detection on chest x-rays with deep learning" by [22] explores in:-

- Summary:

CheXNet is a 121-layer algorithm that has been trained on the ChestX-ray14 (X-ray dataset chest, with more than 100,000 frontal views with 14 diseases), and in tests, it outperformed four practising radiologists. It was possible to develop an algorithm that allows the detection of plaque pneumonia radiography to a higher level, compared to novice radiologists.

- Methodology:

The proposed methodology is CheXNet, an algorithm developed by the authors.

§ Data Training: In their study, they obtained a total of 112,000 images of frontal X-rays which belonged to 30,805 patients, called ChestX-ray14 (out of 14 attributes, each of them, pathologies and phases of pneumonia), of which include images diagnosed with the disease. Before normalized images is 24x224 based on the mean and standard deviation of the ImageNet trained images.

§ Test: tests performed with 4 Stanford University practicing radiologists with experience of 4,7,25 and 28 years. The mathematical model modified by the researchers (Rajpurkar et al., 2017, p. 2), called CheXNet is shown in the following equation:

$$L(x,y) = \sum_{C=1}^{14} [-y_c \log p\,(Y_c = 1|X) - (1-y_c) \log p\,(Y_c = 0|X)\,] \quad (1)$$

In Equation 1, $\sum_{C=1}^{14}$ resents the 14 pathologies or binary classes of the data set, $(Y_c = 1|X)$ is the probability that the radiographic image presents a pathology c,y $(Y_c = 0|X)$ is the probability that the image does not present the pathology c.

- Results:

The ChexNet algorithm provides better results in pneumonia accuracy if Compared with the average of practicing radiologists, Table.1 indicates the results of the study conducted.

Table 1: Deep Learning-Based Pneumonia Detection on Chest X-Rays by CheXNet Radiologist

RADIOLOGISTS	F1 Rating (95% CI)
No. 1 RADIOLOGIST	**.38**
No. 2 RADIOLOGIST	**.35**
No. 3 RADIOLOGIST	**.36**
No. 4 RADIOLOGIST	**.44**
AVERAGE RADIOLOGISTS	**.38**
CHEXNET	**.43**

- Conclusions:

The researchers devised an algorithm that, when applied to chest X-ray images taken in frontal view, can detect pneumonia at a higher level than practising radiologists. The research findings confirm this conclusion.

9. "Research titled "An Efficient Deep Learning Approach to Pneumonia Classification in Healthcare" by [23] explores in:-

- Summary:

The research work presented by Stephen implies a neural network model convolutional with the main characteristic that stands out from being trained from scratch, for this way to classify and detect pneumonia on the basis of X-ray images of the chest. Having a Working from scratch allows the extraction of various necessary characteristics from the data set of chest X-ray images, to later classify and determine if a person is infected with pneumonia. The researchers created a model from its early stage, separating it from other already created models that have a learning transfer approach, the This model allows the classification of positive and negative pneumonia data from a collection of x-ray images, allowing your early identification of this terrible disease.

- Methodology:

The methodology used by the authors is based on the following:

§ Dataset: 5856 x-ray images of patients were selected pediatric patients aged between 1 and 5 years, modifying the data category originals to be able to balance the proportion. After that, the data was reorganized to perform training and validation.

§ Preprocessing and augmentation: It was possible to generalise the model in the training phase by using a variety of data augmentation techniques to boost the size and quality of the data. The configuration that was implemented in the image magnification which can be seen in Table 2.

SETTINGS	METHOD
RESCALE	1/255
ROTATION RANGE	40
WIDTH CHANGE	0.2
HEIGHT CHANGE	0.2
CUTTING RANGE	0.2
ZOOM REACH	0.2
HORIZONTAL FLIP	TRUE

Table 2: Settings for image magnification

§ Model: As shown in Figure 16 (Proposed Predictive Model is essentially formed of 2 sections, the extraction functionality and sort functionality by function sigmoid activation), the proposed CNN model's general architecture consists of two main machines, feature extractors, and classifier.

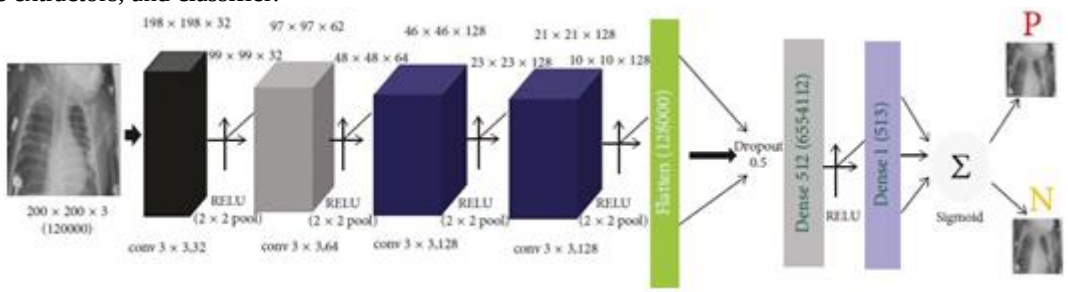

Figure16: Predictive pneumonia detection model.

- Results:

This model could help mitigate the reliability and interpretability of challenges to often at odds when it comes to medical imaging. Unlike other tasks of deep learning classification with enough image repository, hard to get a large amount of pneumonia data for this classification task; therefore, it was deployed various data augmentation algorithms to improve validation and classification accuracy of the CNN model and achieved remarkable validation precision. The results of the algorithm show a training precision of 0.9531. CNN frameworks require images of specific size, images of 100 × 100 × 3, 150 × 150 × 3, 200 × 200 × 3, 250 were trained × 250 × 3 and 300 × 300 × 3 for a period of 3 hours achieving an average performance.

- Conclusions:

The proposed model provides a tool for radiologists that provides precision in detection of pneumonia through medical imaging (chest X-ray).

III. CONCLUSION

The present research work allowed to know the reality of the various deep learning models with respect to the various investigations carried out in the medical sector with reference to the use of intelligence artificial for the detection of pneumonia disease, which served as a stimulus to deepen more on the subject and that it serves for future research in favor of people's health, reaching the objectives proposed at the beginning of the research work.

1. The importance of a robust data set has been fundamental for this type research where it is required to analyze pneumonia with other lungs diseases at an early stage, since it has allowed the optimal training of the model and the objective is reached. Pre-processing techniques, normalization and data augmentation, served as the fundamental basis for the model to be capable of to learn to recognize new cases and in turn enrich your knowledge, all due to that early-stage pneumonia can be very difficult to detect, so the more variety of training, the higher degree of detection the model will have.
2. Computer vision has played an important role in this methodology, since which has made it possible to obtain the key characteristics of x-ray images thanks to the layers convolutional values of pre-trained architectures. The use of techniques such as Transfer Learning, has made it possible to take full advantage of the power of computational vision of architectures experienced, save resources and training effort.
3. There are multiple convolutional neural network architectures, as well as the evolution of new architectures, within which the importance of being able to identify the better architecture to obtain the results, has been essential for the research performed, according to the antecedents of the authors realized the best architecture analyzed is that of CNN is having high performance architecture to detect pneumonia through medical imaging (chest X-ray) as the literature available in past researches

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