A Deep Learning Approach to Detect Lumpy Skin Disease in Cows

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Abstract - Disease in animals is now a common problem. There are several types of disease in animals so the identification of disease is important and diagnosis will be done at a timely pace. Lumpy skin disease in cows is caused by a virus called Neethling. By the affection of these diseases the cattles permanent damage to their skin. The disease often results in reduce milk projection, infertility, poor growth, abortion and sometimes death. We have developed an architecture using machine learning techniques to propose the disease or detect the disease. This framework developed using tools like VGG-16 , VGG-19 and Inception-v3 for extracting the features. The work is tested on our dataset and is measured with other advanced methodology kNN, SVM, NB, ANN and LR which results in considerable performance in extraction of features.

Keywords - Feature Extraction, Dataset Collection, Deep Learning , Lumpy Skin Disease, etc.

I. INTRODUCTION

Skin is an important part of an animal body. Lumpy skin disease is a viral disease in cows extent by biting insects.The disease is characterized by large skin nodules covering all parts of the body, fever ,nasal discharge, spread lymph nodes and lachrymation. Lumpy skin disease is generally found in Africa, Russia ,Egypt , Oman and India. At first it was identified in Egypt. Less commonly, the virus may be spread by direct contact to the skin lesions, saliva, nasal discharge, milk, or semen of infected animals [1].
Unfortunately, there are no specific antiviral drugs available for the treatment of Lumpy Skin Disease. The only treatment available is supportive care of cows. We can also think about treatment of skin lesions using wound care. Sprays and the use of antibiotics to prevent secondary skin infections and Pneumonia [2].

There are various parts of the paper in which Section 1 is Introduction, Section 2 is Data Collection, Section 3 is proposed approach, Section 4 is results and Section 5 is Conclusion.

Cow images infected from Lumpy Disease and Normal cow image (uninfected) are given by fig 1.

Fig 1. Images of Lumpy Skin and Normal Skin in cows

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II. DATA COLLECTION

The collection of dataset is an important phase because there is no dataset available of lumpy skin disease in cows. So we created an image dataset of cows around 300-400 images that is shown in table 1.

Since the problem with the dataset is that it can be biased due to lack of proper dimensions and resolution but in this dataset we have chosen only high resolution and proper pixel images [6].

Table. 1

Types of Cow	**Number of Images**
Infected from Lumpy Disease	132
Normal Images of Cow	199

III. PROPOSED APPROACH

In this framework we used deep convolutional Neural Networks. We take an image as input, process it and classify it in various categories. In this process it consists of many layers in which the first layer is a convolution layer that operates the feature extraction by using filter or Kernel. Since the images are non-linear so to remove the linearity of images we used

ReLU function(Rectifier Linear Unit) [3]. The result of the convolution layer passed to the next layer, the Pooling layer is responsible for reducing the images dimensionality which is used to overcome the problem of overfitting .The results of the Pooling layer are passed to the Flattening Layer formed as input layer, then we use the Artificial Neural Network [7]. The mathematical equation of CNN is given in fig 2.

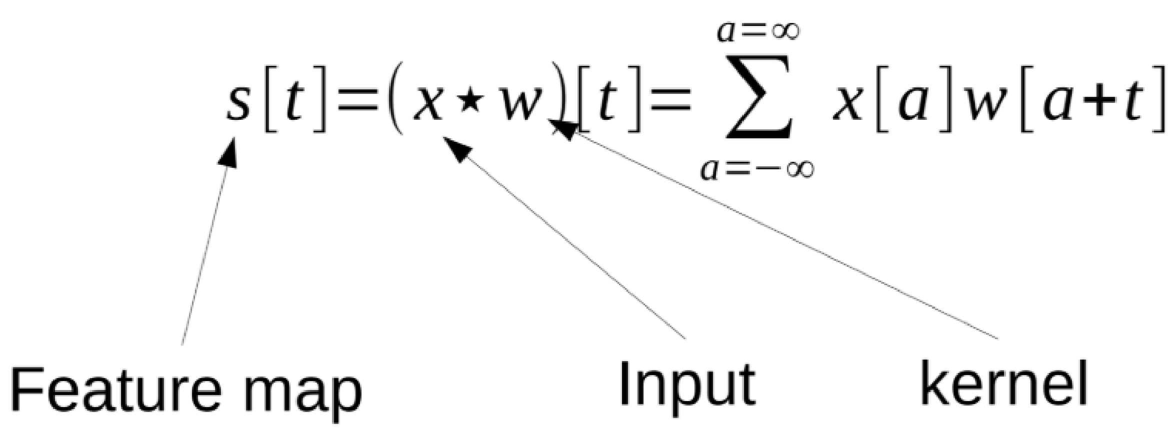

Fig 2.

The workflow of the model is given in figure 3. In the workflow Data Sampler is used to split the dataset and Image Embedder uses different models such as VGG-16, VGG-19 and Inception-V3 for feature Extraction. We split the dataset into 75% as training data and rest 25% as testing data [8].

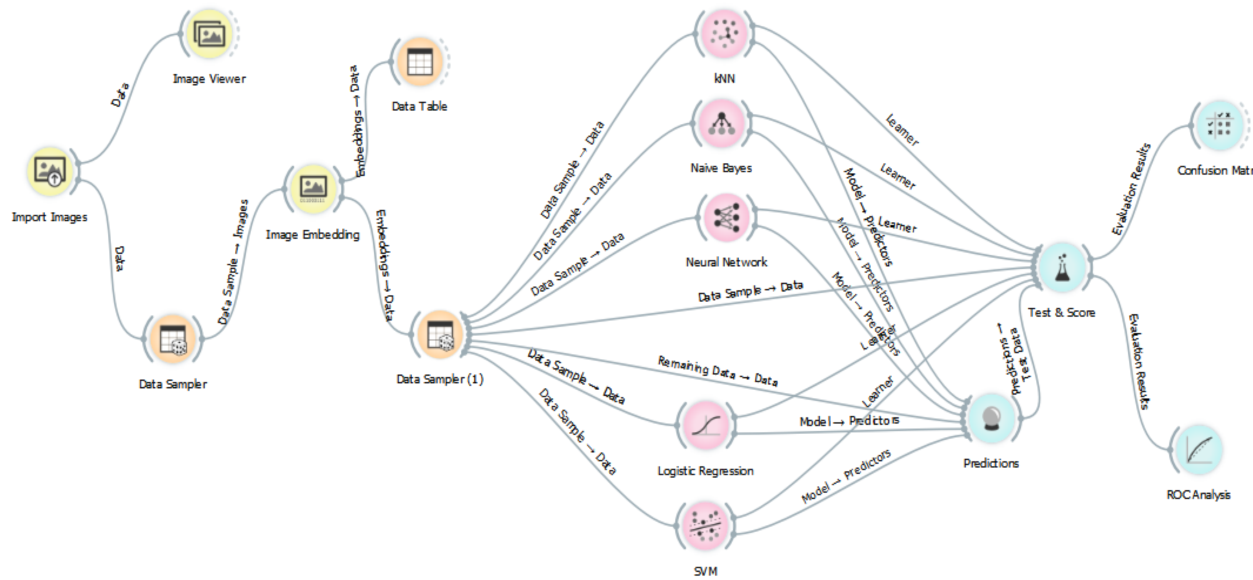

Fig 3. Workflow

We evaluate the ROC curve for the calculation of performance on our framework. On X-Axis "Specificity" is defined and on Y-Axis "Sensitivity" is mentioned. Fig 4 represents the ROC curve on Lumpy Skin Disease and Fig 5 represents the ROC curve on normal cow images [7

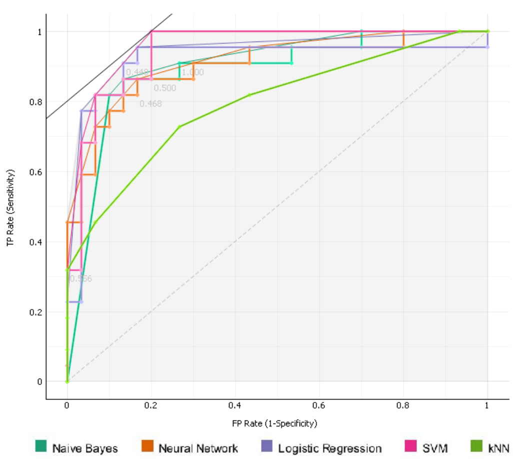

Fig 4. ROC curve on Lumpy skin disease

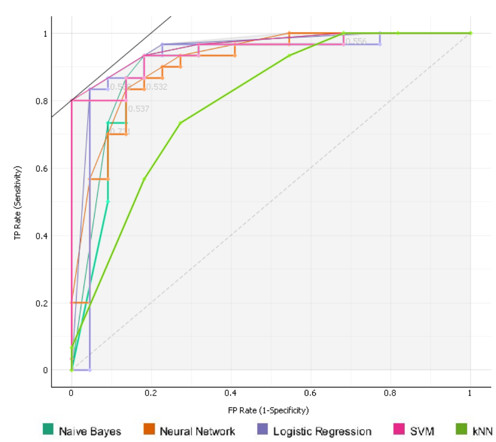

Fig 5. ROC curve on Normal cow images

IV. RESULTS

In this Section, we come up with the final result achieved by the tests done in the above section. In this project we have used three scenarios. In the first scenario Inception-v3 is used for feature extraction and applies various classification models like KNN , SVM, ANN, LR and NB , observing that we got the highest accuracy on test data of 92.5% with

Artificial Neural Network that is shown in Table 2. In the second scenario we used VGG-16 for feature extraction and got 87.9% accuracy with Logistic Regression. In the third scenario, a 19-layer convolutional Neural Network (VGG-19) is used for extracting the features and got the 88.2% accuracy with the Naive Bayes. By observing all the three scenarios we observe the best model is Inception-v3 with Artificial Neural Network with highest accuracy 92.5%. The accuracy Assessment table is given below.(Table 2)

Table 2. Accuracy Assessment

Feature Extractor	Model	Accuracy	AUC	Precision
Inception - v3	SVM	0.830	0.876	0.830
	KNN	0.698	0.848	0.738
	Neural Network	0.925	0.955	0.926
	Naïve Bayes	0.717	0.783	0.720
	Logistic Regression	0.887	0.947	0.887
VGG-16	SVM	0.848	0.889	0.857
	KNN	0.848	0.906	0.854
	Neural Network	0.864	0.859	0.862
	Naïve Bayes	0.833	0.863	0.831
	Logistic Regression	0.879	0.830	0.877
VGG-19	SVM	0.765	0842	0.807
	KNN	0.765	0.882	0.780
	Neural Network	0.838	0.870	0.838
	Naïve Bayes	0.882	0.867	0.882
	Logistic Regression	0.853	0.876	0.853

V. CONCLUSION

In our algorithms we used Deep Convolutional Neural Network to predict Lumpy skin and Normal Skin that are predicted from our given dataset which obtained result of 92.5% accuracy. Since there is no standard dataset available, there are many problems that can arise but we used the standard quality of image dataset due to which our model is working properly. This model can be used in different fields of medical science like to detect skin cancer in animals and other diseases. Moreover, it can help veterinary surgeons to figure out animal disease problems in early stages that do not require much manual work.

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