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Cervical Cancer Detection with a Tissue Smear and a Microscopic Image inside the Deep Learning Model of Squeeze Net

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Abstract: Cervical cancer is a worldwide public health problem. Cervical cancer begins in the cervical tissues, specifically at the junction where the cervix links the lower part of the uterus that connects to the vagina. Small change in the DNA cell later they might cause the multiply growth of abnormal cell, this growth is called tumours. This are most difficult to diagnose because it starts from the cervix.

It starts slowly and it risk if the infection goes long-lasting and it occurs usually people over age 30. This fungus is the type of Human Papilloma Virus (HPV), virus that passed from the one another. In past a small brush or spatula is inserted through the speculum to collect cells from the surface of the cervix. Removing abnormal cells can cause bleeding and kidney failure and microbiologist will get eye pain due to continuous work in microscope. A Pap smear test can be detected and examined in a lab. This risk can be reduced through regular screening tests and by receiving a vaccine to protect against HPV infection. If any cervical cancer found in early stage, then can be removed by the surgery, medicines, chemotherapy and radiation. Majority women are diagnosed between age 35 and 44. More than 15% occur in women over age 65. Approximately 92% of women facing cervical disease are likely to survive for nearly 5 years. Regular screening tests help reduce the occurrence of cervical disease. The output is presented as a confusion matrix. MATLAB's Squeeze Net can be utilized to classify abnormal cells by employing a deep learning model for feature extraction, training, and preprocessing the dataset through SIPaKMed. The model's performance is evaluated through training as well as testing to identify the model that is most appropriate for the given activity. This approach reduces both the time required for outcome and the value of diagnosis. With a comprehensive cervical cancer detection system, the workload of microbiologists can be significantly lessened.

I. INTRODUCTION

Cervical disease is a global public health issue. Cervical cancer develops when abnormal cells within the cervix, linking the uterus to the vagina, undergo uncontrolled growth. The disease exhibits its most common prevalence across various socio-demographic, lifestyle, dietary, age, and environmental factors, leading to a steadily rising across the globe. Roughly 6 to 29% of women are impacted by cervical cancer, with over 20% of cases occurring in women aged 65 and above. These cancers originate from abnormal cells infected with the human papillomavirus (HPV). Initially, irregular cervical cells develop and may eventually spread. However, cervical disease may not present symptoms immediately. As the cells multiply, symptoms such as back pain, bleeding during sexual activity, foul odor, and white discharge may emerge. Cervical cancer ranks as the fourth most common disease among women worldwide.

Approximately 13,820 new cases of cervical cancer are diagnosed each year, with nearly 4,360 women losing their lives to the disease. Being sexually active is a known risk factor for cervical disease. Typically, the cancer progresses slowly over time, characterized by changes in the cervix known as dysplasia.

Screening for cervical cancer poses a significant challenge due to the complex structure of the organ. Enhancing the precision of diagnoses requires the development of more efficient models. A computer-aided tool system could offer valuable support to clinicians in their diagnostic process. Recent research has explored the application of deep learning techniques in disease diagnosis. Additionally, utilizing computer vision within MATLAB enables the categorization of images and extraction of image properties. Using deep learning neural network images are been detected MATLAB software and dataset are SIPaKMed, automatically identifying the presence and absence of cervical cancer involves advanced computational techniques to analyze medical data accurately and efficiently.

II. WORKING

In our project, we developed a system using MATLAB and deep learning tools to identify abnormal, infected, tumor, benign, and normal cells. We employed a pretrained model to handle the classification tasks. A dataset, specifically named, “Kaggle using SIPaKMed”.

A dataset, referred to as “Kaggle using SIPaKMed” has been compiled, containing numerous 4049 images isolated cells and manually cropped from 966, it is divided into five distinct categories for the classification. The experimental models based on MATLAB deep learning techniques (Squeeze Net) this approach is applied to detect abnormalities and normalcy in cervical samples, and we conducted a performance analysis to present our findings.

1) Early Detection: Spotting cellular changes early improves treatment outcomes.
2) Accuracy: Detailed views aid in distinguishing between normal and abnormal cells more accurately than traditional methods.
3) Screening Advances: New imaging tech enhances sensitivity for better detection.
4) Tailored Treatment: Precise identification allows personalized treatment plans, improving outcomes.
5) Research Impact: Understanding cellular changes leads to innovative tools and therapies.
6) Public Health: It reduces the disease burden, by enabling early intervention and preventive strategies, ultimately saving lives.

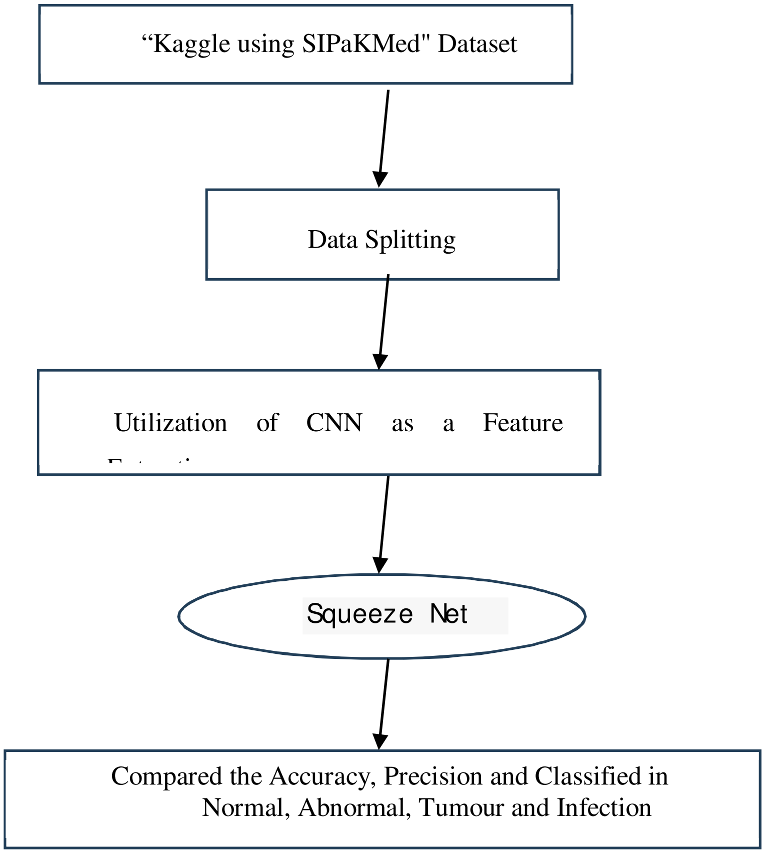
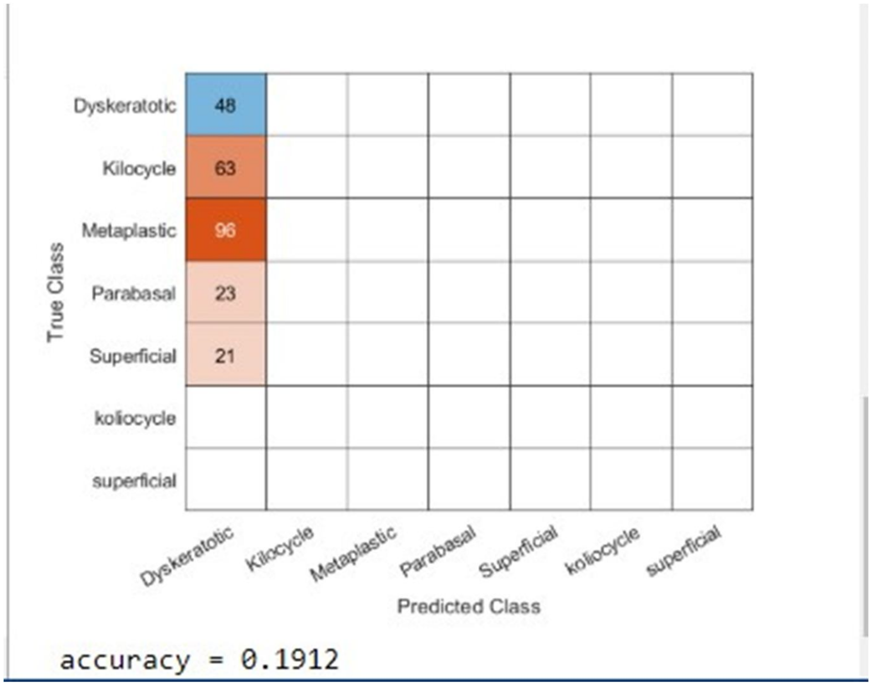


Fig: 2.1 Flow chart of working

III. RESULTS AND EVALUATION

This method is carried out using MATLAB to run and compile the program. The result obtains in the form of Confusion matrix in which distribution of cervical cancer. Squeeze Net can be used for the multiclass classification of cervical cancer, abnormal cell, tumor, and normal cases using deep learning by using the models as feature extractors, training the model on the preprocessed dataset. The performance of the models is testing set, and the results are compared and analyzed to determine which model is better suited for the given task. The goal of screening for cervical cancer is to find precancerous cervical cell changes, when treatment can prevent cervical cancer from developing. Sometimes, cancer is found during cervical screening. Cervical cancer found at an early stage is usually easier to treat.



	Dyskeratotic	Kilocycle	Metaplastic	Parabasal	Superficial	koliocycle	superficial
Dyskeratotic	48						
Kilocycle	63						
Metaplastic	96						
Parabasal	23						
Superficial	21						
koliocycle							
superficial							

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accuracy = 0.1912
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Fig: 3.1 Confusion Matrix

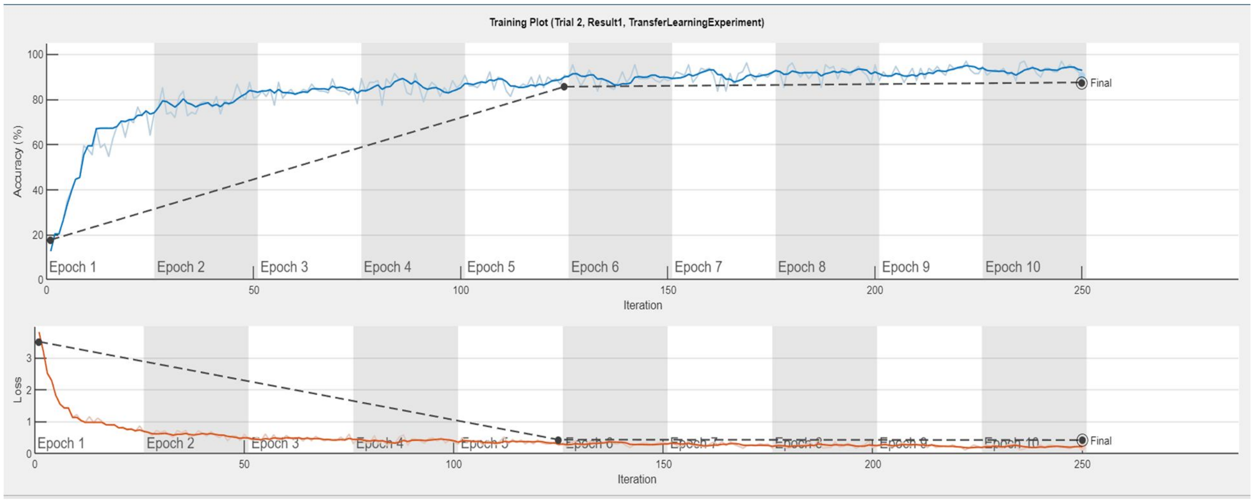

Fig: 3.2 Graph representing training and validation loss

The performance analysis for the predicted matrix have calculated based on confusion matrix. For confusion matrix, true positive, true negative, false positive and false negative, values are calculated from the prediction matrix on the validation of “Kaggle using SIPaKMed”.

The categorized report includes evaluate and recall values for each class, excluding the overall accuracy, as accuracy provides a comprehensive assessment considering all classes. For multiclass classification, accuracy scores and support values are computed by taking the weighted average across all classes.

The performance measures have calculated: -Accuracy = TP+TN / (TP+TN+FP+FN)

Precision = TP/(TP+FP)

Recall = TP/(TP+FN)

F score = 2*Precision*Recall / (Precision + Recall)

IV. CONCLUSION

The other cervical disease other than infection, abnormal, normal are been detected and classified. Moving forward, this method use to hold potential for real-time implementation and integration with scanning machines for practical application. Implementing this approach to decrease both the waiting time for results and expenses associated with diagnosis and early detection. By employing a fully developed cervical cancer detection system, the pressure of microbiologists can be alleviated.

Incorporating intelligent algorithms into Pap smear screenings has the potential to decrease cancer mortality rates, especially in areas with limited resources. However, challenges like cost-effectiveness, accuracy, and sensitivity persist in existing systems. Efforts in research and the development of computer-assisted diagnostic tools have shown advancements in image preprocessing, segmentation, and classification techniques, especially leveraging deep learning and transfer learning for improved accuracy and easier training. Although advancements, current methods still exhibit drawbacks and weaknesses. Continued research and refinement are crucial for identifying efficient algorithms that can be seamlessly integrated into routine diagnostics by healthcare professionals, offering substantial benefits in malignancy detection.

Image classifies and segment to classify and understand cervical cancer presence. In case of cervical cancer cell image and matched their segmentation refinement.

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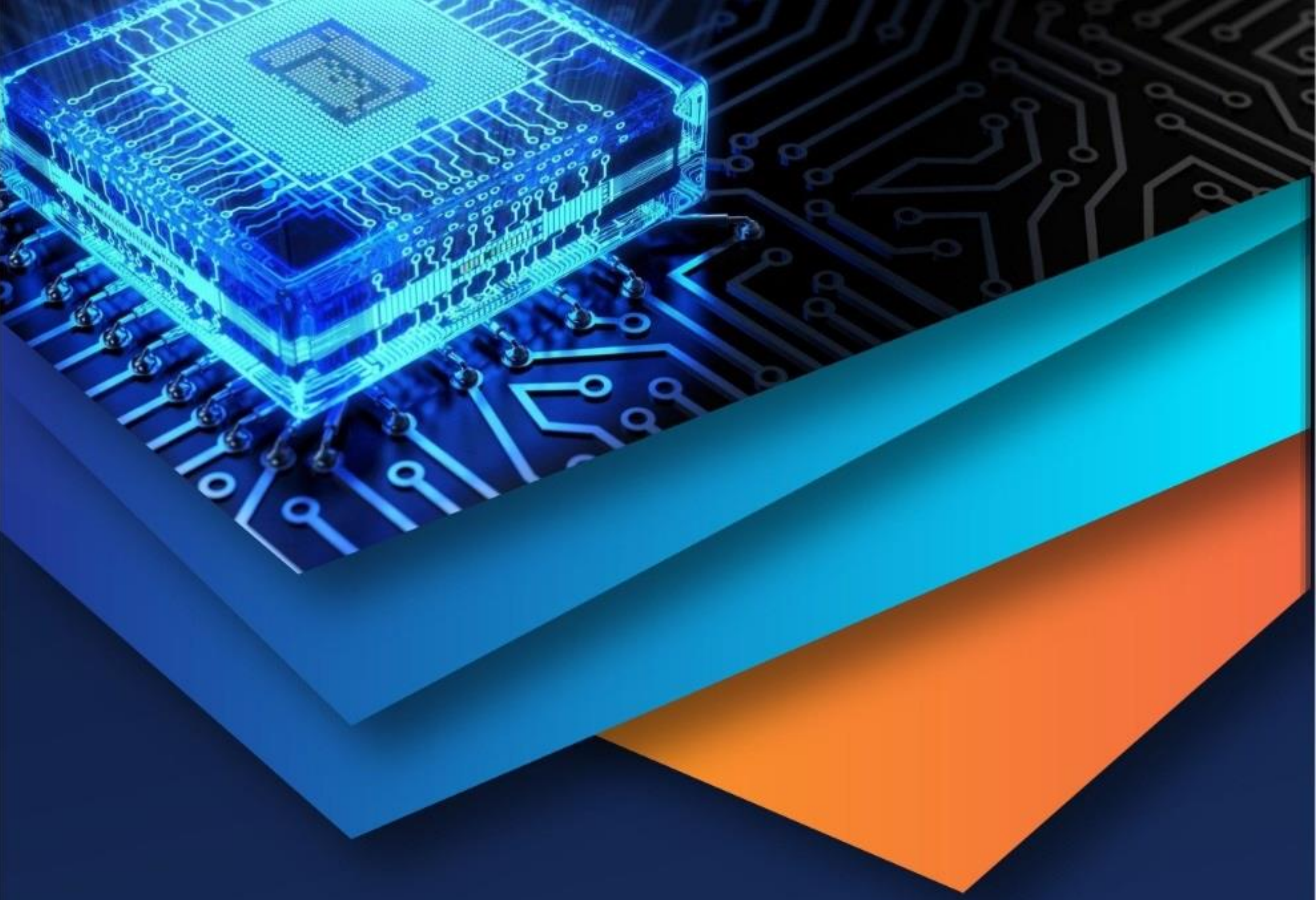

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