IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DETECTCTION LEUKEMIA AND MULTI MYLOMA USING CNN

K. MAHADEVAN[1], B. GOKUL[2]
1 ASSISTANT PROFESSOR 2 PG STUDENT
COMPUTER SCIENCE AND ENGINEERING
CARE COLLEGE OF ENGINEERING, TIRUCHIRAPALLI, TAMILNADU, INDIA

ABSTRACT

Microscopic image analysis plays a significant role in initial leukemia screening and its efficient diagnostics. Since the present conventional methodologies partly rely on manual examination, which is time consuming and depends greatly on the experience of domain experts, automated leukemia detection opens up new possibilities to minimize human intervention and provide more accurate clinical information. This paper proposes a novel approach based on conventional digital image processing techniques and machine learning algorithms and deep learning algorithms to automatically identify acute lymphoblastic leukemia from peripheral blood smear images. The proposed model eradicates the probability of errors in the manual process by employing deep learning techniques, namely convolutional neural networks. The model, trained on cells' images, first pre-processes the images and extracts the best features. This is followed by training the model with the optimized Convolutional neural network framework (termed CNN here) and finally predicting the type of cancer present in the cells. The model was able to reproduce all the measurements correctly while it recollected the samples exactly 94 times out of 100. The overall accuracy was recorded to be 97.2%, which is better than the conventional machine learning methods like Support Vector Machine (SVMs), Decision Trees, Random Forests, Naive Bayes, etc. This study indicates that the CNN model's performance is close to that of the established CNN architectures with far fewer parameters and computation time tested on the retrieved dataset. Thus, the model can be used effectively as a tool for determining the type of cancer in the bone marrow. To overcome the greatest challenges in the segmentation phase, we implemented extensive pre-processing and introduced a three phase filtration algorithm to achieve the best segmentation results.

Keywords: CNN architectures, leukemia, CNN model's and hematologists

1. INTRODUCTION

Leukemia is a hematological disorder and type of cancer that weakens the human immune system by generating malignant White Blood Cells (WBC). Leukemia is considered as one of the fatal cancers with a high death rate. Leukemia is usually classified based on myelogenous or lymphoblastic disorders of the WBCs. If the affected cells are lymphoblastic, then the leukemia is called Acute Lymphoblastic Leukemia (ALL). If the affected WBCs are monocytes and granulocytes, then the leukemia will be called Acute Myeloid Leukemia (AML). Leukemia is a blood cancer resulting from an abundance of abnormal white blood cells in humans. Usually, a hematology analyzer is used to diagnose leukemia through manual counting. Cell classification usually depends on the morphological characteristics of the cells and requires a skilled medical operator. This procedure can be time-consuming, tedious, and costly. Moreover, the manual analyzer may sometimes lead to the incorrect counting and classification of leukocytes. Undoubtedly, this manual examination mechanism can be replaced by machine-learning-based automated techniques that can save precious time and significantly reduce human effort and error. Deep learning algorithms are powerful and versatile algorithms used efficiently in significant research areas such as medical image processing,

supercomputing, investment modelling, and fraud detections. Convolutional Neural Network (CNN) is a popular subcategory of deep learning algorithms, specially designed for visual pattern recognition among all types of blood cancers, leukemia is the most common form of malignancy in different age groups, especially in children. Abnormal Phenomenon is caused by excessive proliferation and immature growth of blood kidneys, and then Metastasize to important tissues of the body. There are different types of leukemia that haematologists in cell transplant aboratories can differentiate diagnose based on microscopic images. If the slide is correctly stained, some types of leukemia can be more easily identified and distinguished than others, but more equipment is needed to determine underlying leukemia. Shows the stained slides of the most common different types of Leukemia. An early diagnosis of leukemia has always been a challenge to researchers, doctors, and hematologists. Enlargement of lymph nodes, pallor, fever, and weight loss are the symptoms of leukemia, but they can also be associated with other diseases. Leukemia diagnosis is difficult in its early stages due to the mild nature of the symptoms. Most common leukemia diagnosis method is the microscopic evaluation of PBS, but the golden standard for leukemia diagnosis only involves taking and analyzing bone marrow samples. In the last two decades, various studies have adopted machine learning (ML) and computer-aided diagnostic methods for laboratory image analysis, hoping to overcome the limitations of a late leukemia diagnosis and determine its sub groups. These studies have analyzed blood smears images for diagnosing, differentiating, and counting the cells in various types of leukemia. ML is a well-known branch of artificial intelligence, comprising algorithms and mathematical relations, which was quickly introduced to the domain of clinical research. ML enables computers to be programmed without explicit experience and learns from that experience. The outcome of using these methods in medical data processing has been extraordinary, and they have made remarkable success in disease diagnosis. Research indicates that, in medical image processing, ML methods greatly aid complex medical decision-making processes by extracting and then analysing the features of these images. As the number of medical diagnosis tools increased and a large volume of high-quality data was produced, there was an urgent need for more advanced data analysis methods. Traditional methods could not analyse such a large volume of data or find data patterns.

2. LITREATURE SURVEY

AUTOMATIC DETECTION OF WHITE BLOOD CANCER FROM BONE MARROW MICROSCOPIC IMAGES USING CONVOLUTIONAL NEURAL NETWORKS DEEPIKA KUMARI, NIKITA JAIN1, AAYUSH KHURANA1, SWETA MITTAL1, SURESH CHANDRA SATAPATHY.

Leukocytes, produced in the bone marrow, make up around one percent of all blood cells. Uncontrolled growth of these white blood cells leads to the birth of blood cancer. Out of the three different types of cancers, the proposed study provides a robust mechanism for the classification of Acute Lymphoblastic Leukemia (ALL) and Multiple Myeloma (MM) using the SN-AM dataset. Acute lymphoblastic leukemia (ALL) is a type of cancer where the bone marrow forms too many lymphocytes. On the other hand, Multiple myeloma (MM), a different kind of cancer, causes cancer cells to accumulate in the bone marrow rather than releasing them into the bloodstream. Therefore, they crowd out and prevent the production of healthy blood cells. Conventionally, the process was carried out manually by a skilled professional in a considerable amount of time. The proposed model eradicates the probability of errors in the manual process by employing deep learning techniques, namely convolutional neural networks. The model, trained on cells' images, first pre-processes the images and extracts the best features. This is followed by training the model with the optimized Dense Convolutional neural network framework (termed DCNN here) and finally predicting the type of cancer present in the cells. The model was able to reproduce all the measurements correctly while it recollected the samples exactly 94 times out of 100. The overall accuracy was recorded to be 97.2%, which is better than the conventional machine learning methods like Support Vector Machine (SVMs), Decision Trees, Random Forests, Naive Bayes, etc. This study indicates that the DCNN model's performance is close to that of the established CNN architectures with far fewer parameters and computation time tested on the retrieved dataset. Thus, the model can be used effectively as a tool for determining the type of cancer in the bone marrow

LEUKEMIA DIAGNOSIS BASED ON MACHINE LEARNING ALGORITHMS. PATIL BABASO S, S.K. MISHRA, APARNA JUNNARKAR.

Leukemia is brought about by the quick generation of unusual white platelets. The high no of strange white platelets is not ready to battle contamination, and they impede the capacity of the bone marrow to create red platelets and platelets. Machine Learning techniques are widely used in the diagnosis and classification of different leukemia types in the patients. In this paper, we have described the different machine learning algorithms like Support Vector Machines, k-Nearest Neighbour, Neural Networks, Naïve Bayes and Deep Learning algorithms which are used to classify leukemia into its sub-types and presented a comparative study of these algorithms.

MACHINE LEARNING BASED SYSTEM FOR AUTOMATIC DETECTION OF LEUKEMIA CANCER CELL. SUPRIYA MANDAL, VANI DAIVAJNA, RAJAGOPALAN V.

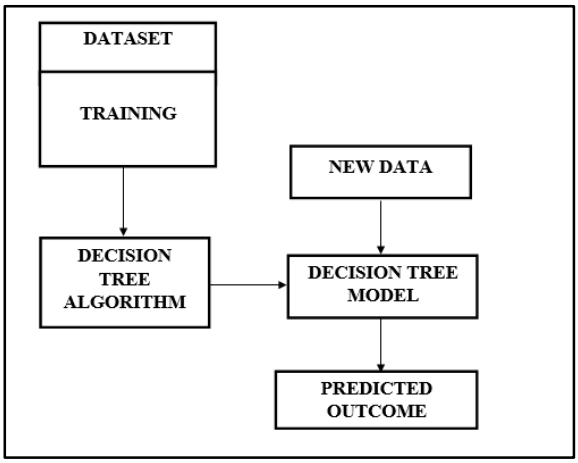
In recent years, blood cell classification with the help of image processing techniques has attracted many researchers to build an automated system that assists doctors for diagnosis of cancer. Also, it's very challenging to differentiate cancer cell from normal cell as they look similar in initial stages. In this manuscript, we have presented an approach for cancer cell detection by extracting important features from the blood cell images and learning multiple classifiers. We have observed that Gradient Boosting Decision Tree classification algorithms give better result than Support Vector Machine. We have also derived few important features like presence of adjacent nuclei and measure of irregularity in the shape of a nucleus, which has significant impact on cancer cell detection. Our techniques can be used in a limited computing environment without a Graphics Processing Unit. We have achieved 85.6% of F1 score on validation data. This approach also identified an important feature for the images that can help doctors or technicians for better understanding of stained images to aid diagnosis of leukemia patients.

3. EXISTING SYSTEM

This existing study provides a robust mechanism for the classification of Acute Lymphoblastic Leukemia (ALL) and Multiple Myeloma (MM) using the SN-AM dataset. Acute lymphoblastic leukemia (ALL) is a type of cancer where the bone marrow forms too many lymphocytes. On the other hand, Multiple myeloma (MM), a different kind of cancer, causes cancer cells to accumulate in the bone marrow rather than releasing them into the bloodstream. Therefore, they crowd out and prevent the production of healthy blood cells. The model eradicates the probability of errors in the manual process by employing machine learning techniques, namely k-beast algorithm. The model, trained on cells' images, first pre-processes the images and extracts the best features. This existing study indicates that the model's performance is close to that of the established K-beast algorithms architectures with far fewer parameters and computation time tested on the retrieved dataset.

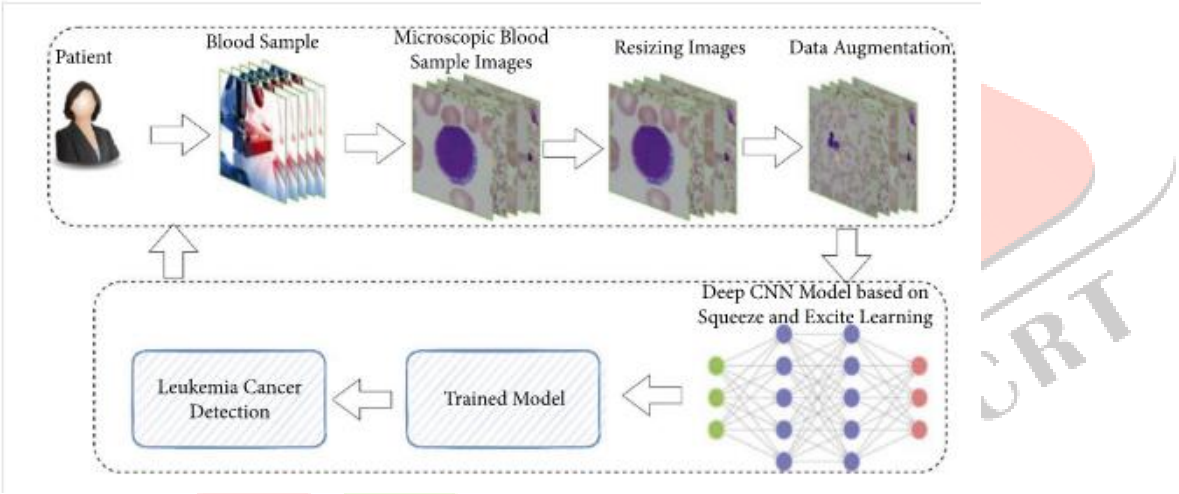
4. PROPOSED SYSTEM

In the proposed methodology, the image of blood smear goes through different stages. First the input image Undergo segmentation. Then the image cleaning operation is performed. After that features are extracted from the image. Finally, these features are classified by a classifier. The objectives of proposed method are developing automated and accurate method to find whether the blood image is leukaemia affected or not. if leukaemia is affected then it is classified the leukaemia is Acute Lymphoblastic Luekmia (ALL) or Multiple Myloma (MM). It includes identification and classification of leukocytes. Also find the best method which classifies the leucocytes among three classification methods. The proposed method also aims in analysing performance of Decision Tree and CNN. Convolutional neural network (CNN) is a type of artificial neural network that is most commonly used in all application of image processing widely. It is a multilayer neural network, and it is based on supervised learning method. It is a complex feed forward neural network. It is used for image classification and recognition because of its high accuracy and small error rates. The following is the steps involved in the CNN method to produce a classified output. The model, containing three types of layers, namely convolution layer, max pool, and fully connected layer, is trained on the training set, and then it is used for prediction on the testing set.



4.1 IMPLEMENTATION

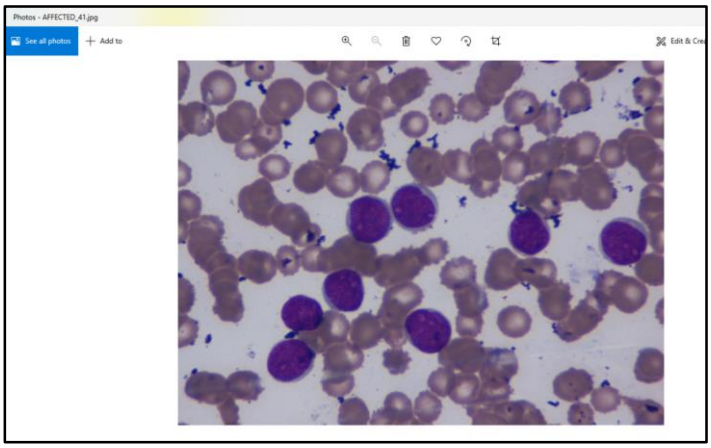
The design overview of the proposed methodology is depicted in below images. The proposed framework begins with the acquisition of microscopic images of blood samples. Later on, the data augmentation techniques are employed to overcome the problem of fewer data since in deep neural networks more data are required for their training and superior performance. Lastly, a deep CNN architecture-based squeeze and excitation learning is proposed to diagnose leukemia from the inputted microscopic images of blood samples. Each step is explained in-depth in the following subsections of methodology:



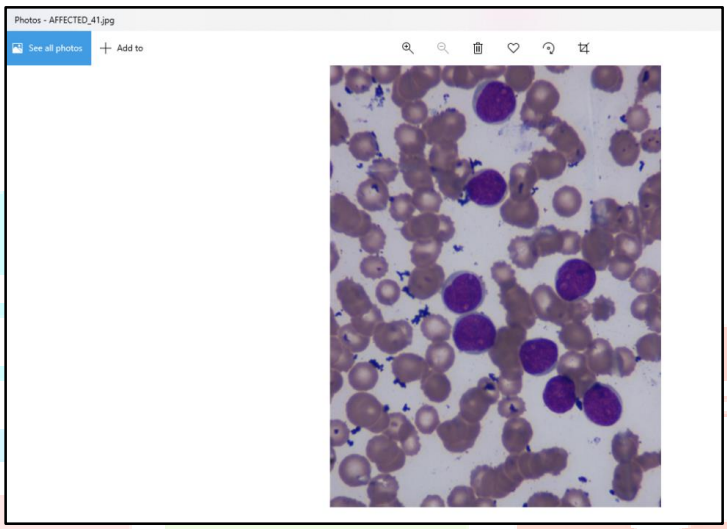
5. SOFTWARE DESCRIPTION

Python 3.7.3
Keras
Tensorflow
Numpy
Pillow

ACTUAL IMAGE



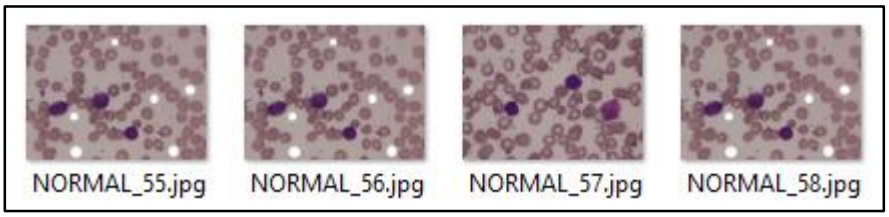
ROTATED IMAGE



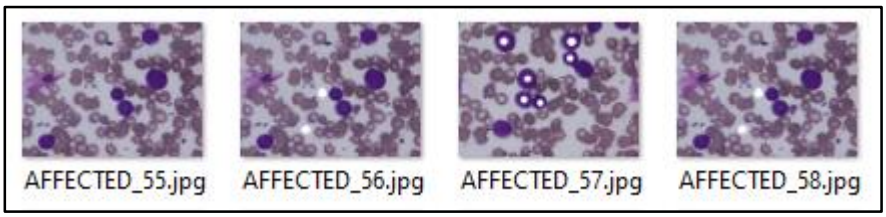
6. CONCLUSIONS

Acute Lymbhoplastic Leukemia (ALL) and Multimyloma (MM) is a hematological disorder and type of cancer that weakens the human immune system by generating malignant WBCs. In this work, we have proposed the CNN-based model to identify ALL and MM in microscopic blood images and compared its performance with the CNN based model in Precision, Recall, Accuracy, and Quadratic Loss. CNN model is composed of two convolutional, two maximum pooling, and three FC layers. In contrast, the CNN model has five convolutional, three maximum pooling, and three FC layers. Based on results, it is concluded that CNN performed well with high accuracy compared to LeNet-5-based model. CNN was able to classify 88.9% images correctly with 87.4% precision and 98.58% accuracy, whereas LeNet-5 correctly identified 85.3% images with 83.6% precision and 96.25% accuracy. CNN algorithm is a competent and well-known deep learning algorithm that can be used efficiently in significant research areas, especially medical image processing. CNN can analyze and detect important features from different medical images such as CT scans, X-rays, MRI, PET, ultrasound, and hematological images. In the future, we are planning to apply the CNN architecture for other types of leukemia cell detection, such as Acute Lymphatic Leukemia (ALL), to get high accuracy.

NORMAL IMAGES

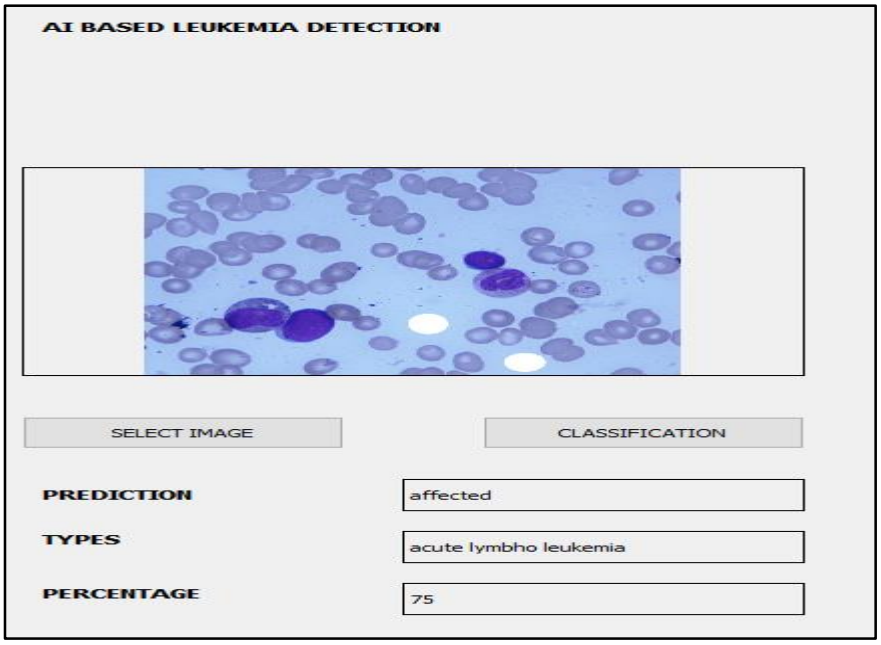


AFFECTED IMAGES



7. RESULTS AND DISCUSSION

This paper is mainly focused on classify the cancer called leukemia. The leukemia is a most dangerous cancer for humans to affect the bones and bone morrows. this project we use machine learning to detect leukemia using image classification techniques called decision tree. in case the person is affected by leukemia cancer, we use deep convolutional nueral network for classify the leukemia types. lukeamea is classify by his severity. first level of leukemia is called Acute Limbo Plastic Leukemia and the second one is Multiple Myeloma. this project we use Deep Convolutional Neural Network to classify the leukemia cancer types.



8. REFERENCES

[1] Vos, Theo, C. Allen, M. Arora, R.M. Barber, Z. M. Brown, A. Carter, A. Casey et al. "Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015." The Lancet 388, no. 10053.2016, pp. 1545-1602.

[2] Wang, Haidong, M. Naghavi, A. Carter, R. M. Barber, Z. M. Brown, A. Casey et al. "Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015." The lancet 388, no. 10053. 2016, pp. 1459-1544.

[3] C. H. Pui, L. S. Frankel, A. J. Carroll, S. C. Raimondi, J. J. Shuster, D. R. Head, et al. "Clinical characteristics and treatment outcome of childhood acute lymphoblastic leukemia with the t (4; 11) (q21; q23): a collaborative study of 40 cases [see comments]". Blood, vol. 77(3). 1991, pp. 440-447.

[4] S. Mandal, V. Daivajna, S. Kalsangra, Rajagopalan V, A. Kuchlous, “Computer aided system for automatic detection and marking instance of nuclei”, Proceedings in IEEE ICECCT. 2019, in press.

[5] M. M. Amin, S. Kermani, A. Talebi, M. G. Oghli. "Recognition of acute lymphoblastic leukemia cells in microscopic images using kmeans clustering and support vector machine classifier". Journal of medical signals and sensors.2015, vol. 5(1), p.49.

[6] A. Chaddad, C. A. Tanougast, A. Dandache, A. H. Bouridane “Extracted haralick’s texture features and morphological parameters from segmented multispectrale texture bio-images for classification of colon cancer cells”. WSEAS Trans Biol Biomed. 2011, vol. 8(2), pp. 39-50 .

[7] M. Madhukar, S. Agaian, A. T. Chronopoulos "New decision support tool for acute lymphoblastic leukemia classification". InImage Processing: Algorithms and Systems X and Parallel Processing for Imaging Applications II, International Society for Optics and Photonics.2012, Vol. 8295, p. 829518.
[8] J. Rawat, A. Singh, H. S. Bhadauria, J. Virmani, "Computer aided diagnostic system for detection of leukemia using microscopic images". Procedia Computer Science. 2015, 70, pp. 748-756.
[9] S. Kumar, S. Mishra, P. Asthana, "Automated Detection of Acute Leukemia Using K-mean Clustering Algorithm". In Advances in Computer and Computational Sciences. 2018, pp. 655-670.
[10] T. Markiewicz, S. Osowski, B. Marianska, L. Moszczynski, "Automatic recognition of the blood cells of myelogenous leukemia using SVM". InProceedings. IEEE International Joint Conference on Neural Networks. 2005 ,4, pp. 2496-2501.