# A new computerized method of detecting leukemia

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## Abstract

Currently, blood problems are diagnosed by looking at tiny images of blood cells. The classification of certain blood-related ailments can be aided by identifying blood abnormalities. This report describes a preliminary investigation into the development of a method for detecting leukaemia kinds using microscopic images of blood samples. Image analysis is crucial because diseases may be recognised and diagnosed more quickly. Other disease control, surveillance, and prevention methods can then be implemented.

## Keyword

## I. INTRODUCTION

White blood cells come in a variety of shapes and sizes. Leukemia is a blood cell malignancy in which the number of immature white cells increases and these immature cells destroy other cells. Experts examine microscopic images of blood in the manual method of Leukemia identification; this is a lengthy and time-consuming process that requires specialist abilities. As a result, the correctness isn't guaranteed. The ratio of white blood cells to red blood cells in human bodies is 1000:1. It signifies that there is one white blood cell for every 1000 red blood cells. As a result, if the quantity of white blood cells in the body increases dramatically, the person will get leukaemia. There are two types of leukaemia: acute and chronic.

## II. OPERATION

The automated leukemia detection system is built for experts and students to learn about how the leukemia cells are in a blood cancer sample. This system is built using python and opencv with image processing techniques. A total of 350 images were collected in order to train the machine learning model where it will classify when a test sample given is cancerous or not cancerous. The graphical user interface built will help the experts in order to visualize the cells better by segmenting the given image where the final image only consists of the cancer cells if they are present. The graphical user interface consists of operations such as selecting image to be segmented and classified, image processing tools such as enhancement of the image, grayscale conversion,

smoothing the image, thresholding the image after gray scale conversion and finally classifying the image. When the user presses the classify button, a new window pops up where the segmentation process results can be seen and a message telling the user that the model has detected cancer or not. The fundamental steps taken in the implementation of this model were image acquisition, image preprocessing, image segmentation, feature extraction and classification.

### A. Image Acquisition.

The images were obtained from kaggle, UCI referential and cancer image archives. A total of 370 images were obtained
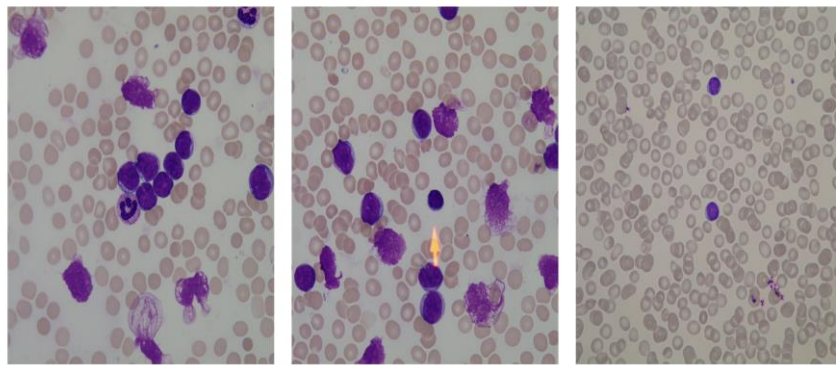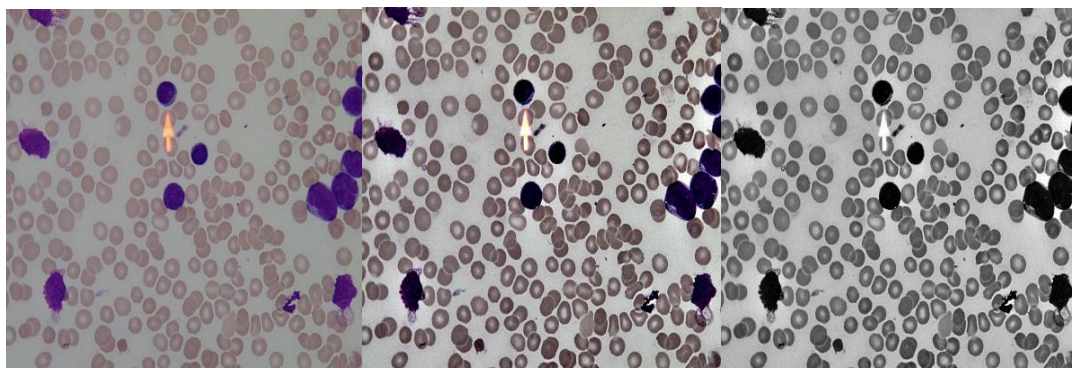


*Fig 1 Sample Image*



*Fig 2a Normal Image*       *Fig 2b Enhanced Image*                      *Fig 2c Grayscale Image*



Fig 2d Histogram Equalization  Fig 2e Negative and Median Blur   Fig 2f Canny Edge detection

| Threshold Standard Deviation |
| :---: |
| Canny Mean |
| Canny Standard Deviation |
| Gaussian Mean |
| Gaussian Standard Deviation |
| Sobel Mean |
| Sobel Standard Deviation |
| White Pixel Count |

*Table 1 Features Extracted*

## B. Classification

In machine learning, classification refers to a predictive modeling problem where a class label is predicted for a given input data. Our model is a binary classification model in which the given image may be classified as cancerous or non-cancerous. A total of 3 machine learning models were used to validate the efficacy of our model a)KNN classifier, b)Support vector machine and, c)Random forest classifier. Out of three machine learning models, Random forest Classifier gave the highest accuracy.

| Machine Learning Algorithm | Precision (%) | f1-Score | Accuracy |
| :--- | :--- | :--- | ---: |
| KNN Classifier | TP - 84 TN - 64 | TP - 84 TN - 64 | 71 |
| SVM | TP - 92 TN - 60 | TP - 68 TN - 73 | 71 |
| Random Forest Classifier n = 300 | TP - 82 TN - 88 | TP - 85 TN - 84 | 85 |

*Fig 3 Different Machine learning models implemented*

## F. Validation

Initially, the data was split 80% as training and 20% as testing, for which our machine learning model gave an accuracy of 87%. Next, fifteen unseen images from another dataset were fed to the machine learning model and got 95% as our accuracy.

## G. Graphical User interface

The final phase of the project involved building a front-end application so that users could use our model to easily classify leukemia. With the help of libraries like Tkinter, we built a GUI to make it user-friendly.
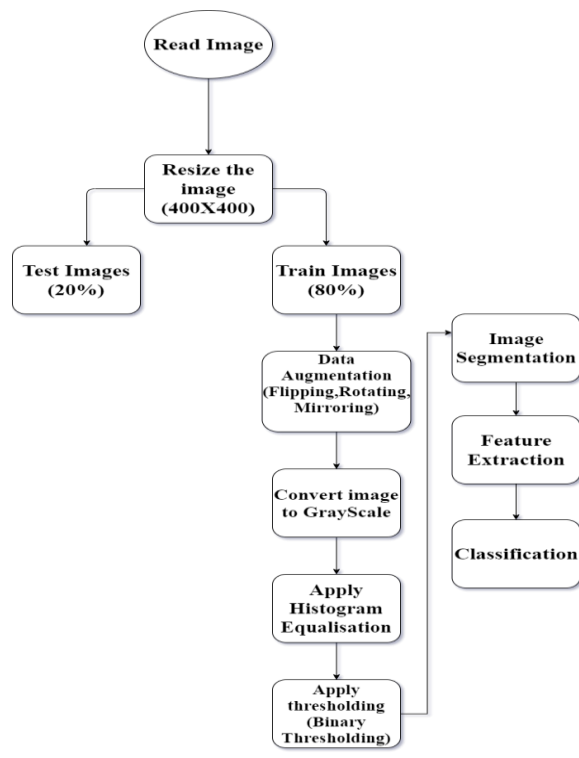
## III. FLOWCHART OF THE BACKEND CODE.



*Fig 4 Flowchart*
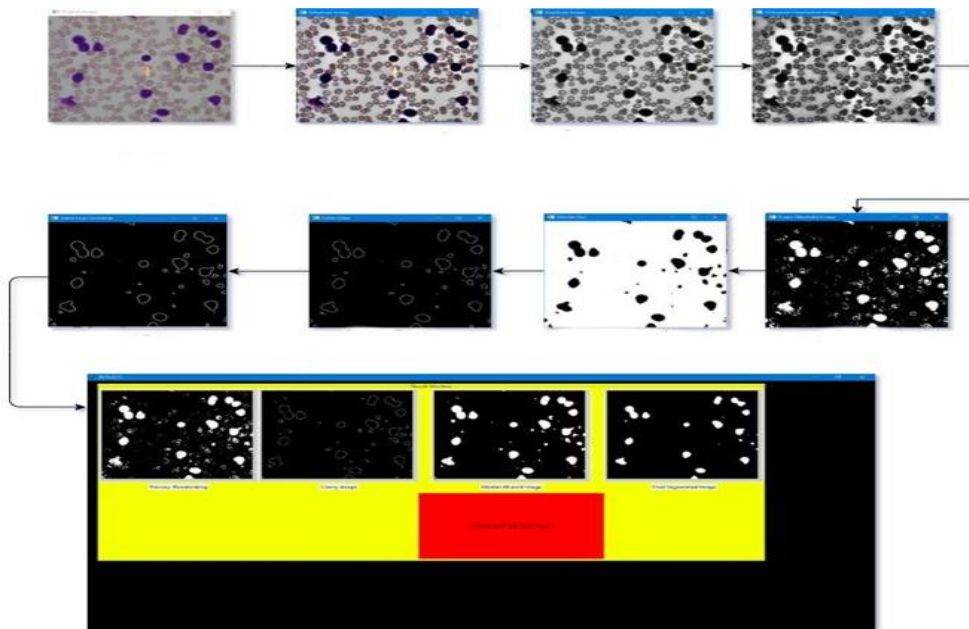
## IV. THE FLOW OF WORKING.



*Fig 5 The flow of working*

An input image that is to be tested is added to the GUI (Graphical user interface) by the user. Once the image is fed to the model a series of outputs are displayed along with the classification result.

## V. RESULT

With a 92% average accuracy, 90% selectivity, and 88% sensitivity our model works perfectly when classifying test images. The graphical user interface is user-friendly and it eventually performs all the pre-processing, segmentation, and feature extraction and Classifies the image.
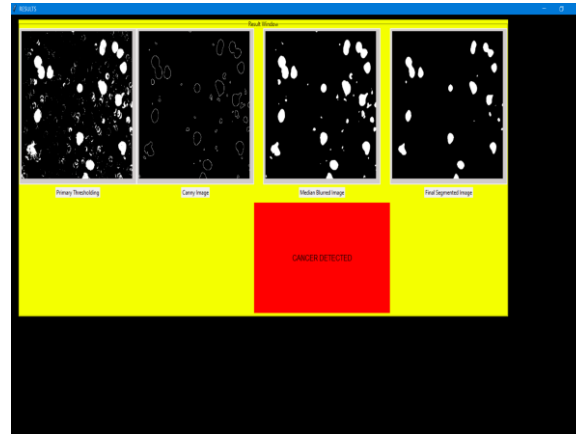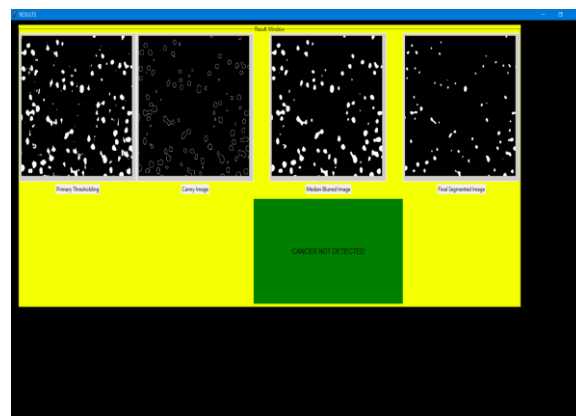


*Fig 6a Cancer Detected*



*Fig 6b Cancer not Detected*

## VI. CONCLUSION

Leukemia is dangerous cancer that affects white blood cells and bone marrow and affects the immune system of the human organism. One of the most commonly used diagnostics is a microscopic analysis of blood cells (blood swabs). In this study, we presented a new approach to diagnosing leukemia from microscopic blood images using random forest classifiers capable of identifying cancerous or non-cancerous cells. Our model has demonstrated the capability to process a small number of image samples. As a result, 91% accuracy, 90% specificity, and 88% sensitivity for binary classification of acute lymphoblastic leukemia were achieved. We also used cross-validation in all experiments and achieved good results.

## VII. APPLICATION

- User-friendly application.

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- Computationally efficient software.

- Rapid results have made it possible to diagnose acute lymphoblastic leukemia.

- High-quality enhanced results.

## VIII. ADVANTAGES

a)Overcomes the disadvantages of traditional diagnosis of leukemia that include CBC, bone marrow aspiration whose results take a long time to get results.

b)Our method may be one of the diagnostic methods where the doctor may consider diagnosing leukemia. c)In this method, we separate blastic and normal cells.

## IX. FUTURE SCOPE

Going forward, we plan to expand our experiments using a hybrid deep learning approach using convolutional neural networks with recurrent neural networks to enhance performance. In addition, we plan to expand our dataset by adding new samples and using new data-raising techniques. We also plan to implement equipment with the aid of a microscope with a raspberry pi camera module.

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## XI. REFERENCE

1. Mohapatra, Subrajeet, Sushanta Shekhar Samanta, Dipti Patra, and Sanghamitra Satpathi. "Fuzzy-based blood image segmentation for automated leukemia detection." In Devices and Communications (ICDeCom), 2011 International Conference on, pp. 1-5. IEEE, 2011.
2. Lim, Huey Nee, Mohd Yusoff Mashor, and Rosline Hassan. "White blood cell segmentation for acute leukemia bone marrow images." In Biomedical Engineering (ICoBE), 2012 International Conference on, pp. 357-361. IEEE, 2012.
3. Fatma, Mashiach, and Jaibir Sharma. "Identification and classification of acute leukemia using neural networks." In Medical Imaging, m-Health and Emerging Communication Systems (MedCom), 2014 International Conference on, pp. 142-145. IEEE, 2014.
4. Abdul Nasir, A. S., M. Y. Mashor, and H. Roseline. "Unsupervised color segmentation of white blood cells for acute leukemia images." In Imaging Systems and Techniques (IST), 2011 IEEE International Conference on, pp. 142-145. IEEE, 2011.
5. Ge, Jia, Z. Gong, Jiann-Jong Chen, Jiangchuan Liu, John Nguyen, Z. Y. Yang, Chingyue Wang, and Yue Sun. "A system for automated counting of fetal and maternal red blood cells in clinical KB tests." In Robotics and Automation (ICRA), 2014 IEEE International Conference on, pp. 1706-1711. IEEE, 2014.
6. Supardi, N. Z., M. Y. Mashor, N. H. Harun, F. A. Bakri, and R. Hassan. "Classification of blasts in acute leukemia blood samples using a k-nearest neighbor." In Signal Processing and its Applications (CSPA), 2012 IEEE 8th International Colloquium on, pp. 461-465. IEEE, 2017.

7.   Mohammed, Emad, Mostaja MA Mohamed, Christopher Naugler, and Behrouz H. Far. "Chronic lymphocytic leukemia cell segmentation from microscopic blood images using watershed algorithm and optimal thresholding." In Electrical and Computer Engineering (CCECE), 2013 26th Annual IEEE Canadian Conference on, pp. 1-5. IEEE, 2013.

8.   Abdul Nasir, A. S., M. Y. Mashor, and H. Rosline. "Unsupervised colour segmentation of white blood cell for acute leukaemia images." In Imaging Systems and Techniques (IST), 2011 IEEE International Conference on, pp. 142-145. IEEE, 2011.

9.   Akrimi, Jameela Ali, Azizah Suliman, Loay E. George, and Abdul Rahim Ahmad. "Classification red blood cells using support vector machine." In Information Technology and Multimedia (ICIMU), 2014 International Conference on, pp. 265-269. IEEE, 2014.

10.  Madhloom, Hayan T., Sameem Abdul Kareem, and Hany Ariffin. "A Robust Feature Extraction and Selection Method for the Recognition of Lymphocytes versus Acute Lymphoblastic Leukemia." In Advanced Computer Science Applications and Technologies (ACSAT), 2012 International Conference on, pp. 330-335. IEEE, 2012.

11.  Aimi Salihah, A. N., Mohd Yusoff Mashor, Nor Hazlyna Harun, and H. Rosline. "Colour image enhancement techniques for acute leukaemia blood cell morphological features." In Systems Man and Cybernetics (SMC), 2010 IEEE International Conference on, pp. 3677-3682. IEEE, 2010.

12.  Raje, Chaitali, and Jyoti Rangole. "Detection of Leukemia in microscopic images using image processing." In Communications and Signal Processing (ICCSP), 2014 International Conference on, pp. 255-259. IEEE, 2014.