e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 5, May 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.521

International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 5, May 2024 |

| DOI:10.15680/IJMRSET.2024.0705135 |

Sickle Cell Anemia Detection Using Convolutional Neural Network

Dethe Krushna[1], Mungase Nilesh[2], Shinde Tushar[3], Prof. Sapike N.S.[4]

Department of Computer Engineering, Vishwabharati Academy's College of Engineering, Ahmednagar, Maharashtra, India [1,2,3]

Professor, Department of Computer Engineering, Vishwabharati Academy's College of Engineering, Ahmednagar Maharashtra, India [4]

ABSTRACT: Sickle Cell Anemia (SCA) is a prevalent genetic blood disorder characterized by abnormal hemoglobin causing red blood cells to take on a distinct sickle shape. Early and accurate detection of SCA is essential for effective treatment and management. This study presents an innovative approach to SCA detection utilizing Convolutional Neural Networks (CNNs), a class of deep learning algorithms known for their effectiveness in image analysis tasks. The proposed method involves the use of microscopic images of blood smears from patients. These images are preprocessed to enhance contrast, normalize intensities, and remove noise. Subsequently, CNN architectures are employed to automatically extract hierarchical features from the blood smear images. The trained CNN model learns discriminative features directly from the images, effectively capturing subtle differences between normal and sickled red blood cells (RBCs).

I.INTRODUCTION

Sickle Cell Anemia (SCA) is a hereditary blood disorder caused by a genetic mutation that affects the structure of hemoglobin, the protein responsible for carrying oxygen in red blood cells. This genetic alteration leads to the distinctive sickle shape of red blood cells (RBCs) and results in various complications, including pain, anemia, organ damage, and a decreased lifespan.Traditionally, SCA diagnosis involves manual examination of blood smears under a microscope to identify the characteristic sickled RBCs. However, this process can be time-consuming, labor-intensive, and subject to inter-observer variability. As technology advances, there is a growing interest in leveraging machine learning techniques, particularly Convolutional Neural Networks (CNNs), to automate and enhance the SCA detection process.

Convolutional Neural Networks are a class of deep learning algorithms designed to process and analyze visual data, such as images and videos. They have demonstrated remarkable success in various image analysis tasks, including object recognition, image segmentation, and medical image classification.

The system is designed to develop and evaluate a Convolutional Neural Network (CNN)-based method for the automatic detection of Sickle Cell Anemia (SCA) from microscopic blood smear images. This study aims to contribute to the advancement of automated SCA detection using CNNs, potentially revolutionizing way SCA is diagnosed, increasing accessibility to diagnostics, &improving patient outcomes.

II.LITERATURE REVIEW

No.	Paper Title	Author Name	Key Points	Remark
1	Title: Automatic Sickle cell anemia detection using image processing technique	Tajkia Saima Chy, Mohammad Anisur Rahaman.	One of the important parts of the human body is red blood cells (RBCs). Disk shape is the ordinary red blood cell's shape. One type of ailment of blood is sickle cell anemia (SCA) in where red blood cells are formed in crescent shapes from their actual shapes [1]	Metric value, aspect ratio, entropy, mean, standard deviation and variance are used as features which are extracted.
2	Title:Machine learning based	Bheem Sen,Adarsh Ganesh, Anupama	In this research image processing and machine learning techniques is used to	This research describes the comparison among these

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 5, May 2024 |

| DOI:10.15680/IJMRSET.2024.0705135 |

	Diagnosis and Classification Of Sickle Cell Anemia in Human RBC	Bhan,Shubhra Dixit, Ayush Goyal.	automate the process of detection of sickle cells in microscopic images then classify the RBC into three shapes: circular, elongated (sickle cell) and other shape [2].	algorithms.
3	Title: A Review of Automated Methods for the Detection of Sickle Cell Disease	Pradeep Kumar Das, Rutuparna Panda, Ajith Abraham	Detection of sickle cell disease is a crucial job in Medical Image Analysis [3]	This review emphasizes the state-of-the-art methods and recent advances in detection, segmentation, and classification of sickle cell disease
4	Title: Automated Semantic Segmentation of Red Blood Cells for Sickle Cell Disease	Mo Zhang*, Xiang Li*, Mengjia Xu*, Quanzheng Li.	dU-Net is tested on microscopic red blood cell images from patients with sickle cell disease. [4].	Through detailed investigation of the segmentation results, we further conclude that the performance improvement is mainly caused by the deformable convolution layer.
5	Adeep convolutional neural network for classification of red blood cells in sickle cell anemia	Mengjia Xu1,2, Dimitrios P. Papageorgiou3, Sabia Z. Abidi3, Ming Dao3, Hong Zhao1,George Em Karniadakis2*	Red blood cells (RBCs) of SCD patients have diverse shapes that reveal important biomechanical and biorheological characteristics[5]	Second, we apply a mask-based RBC patch-size normalization method to normalize the variant size of segmented single RBC patches into uniform size.

III.METHODOLOGY OF PROPOSED SURVEY

The methodology for sickle cell anemia detection using convolutional neural networks (CNNs) encompasses several crucial steps. Initially, a diverse dataset of microscopic blood smear images is collected and preprocessed to enhance quality and standardize dimensions. Subsequently, the dataset is divided into training, validation, and test sets for effective model training and evaluation. The choice of a CNN architecture is a pivotal decision, with considerations for depth, pre-trained layers, and available computational resources.

Transfer learning may be employed, fine-tuning pre-trained models on a broader image dataset to leverage learned features. The CNN is then trained using appropriate loss functions and optimization algorithms, and hyperparameters are fine-tuned through validation

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 5, May 2024 |

| DOI:10.15680/IJMRSET.2024.0705135 |

A. System Architecture

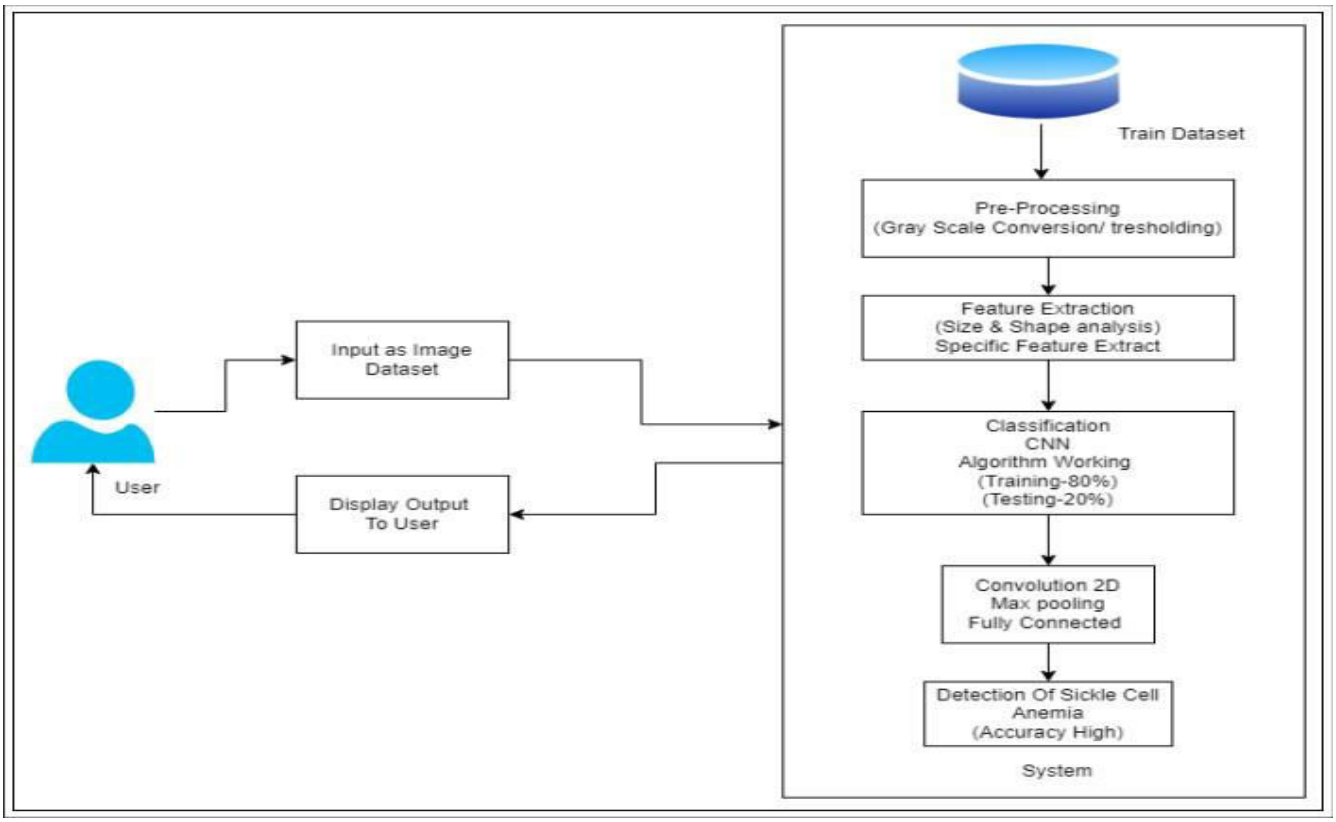


Fig :- System Architecture

B. Blood Image

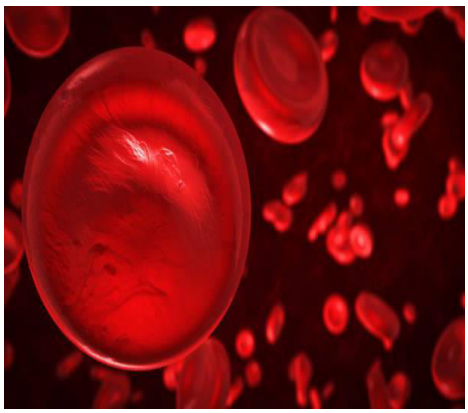


Fig :- Normal Blood Cell

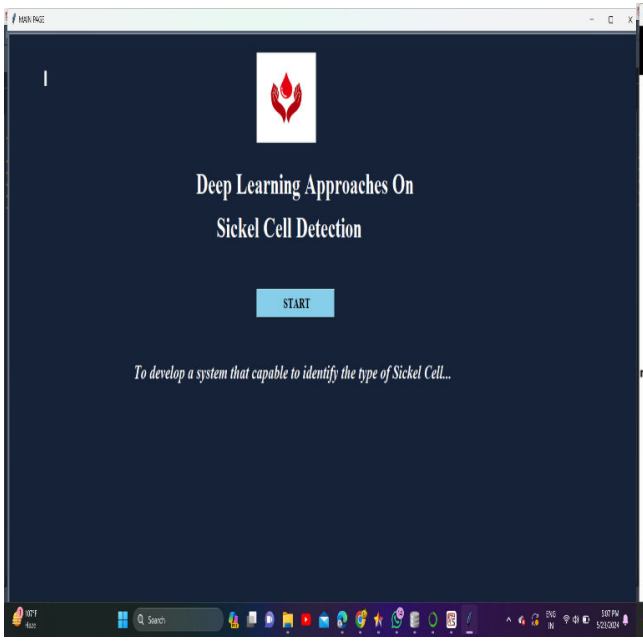
Fig :- Anemia Detected Blood Cell

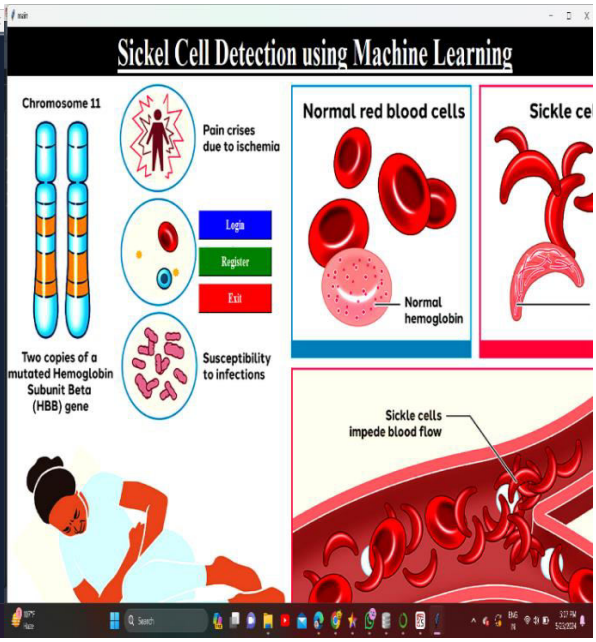
| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

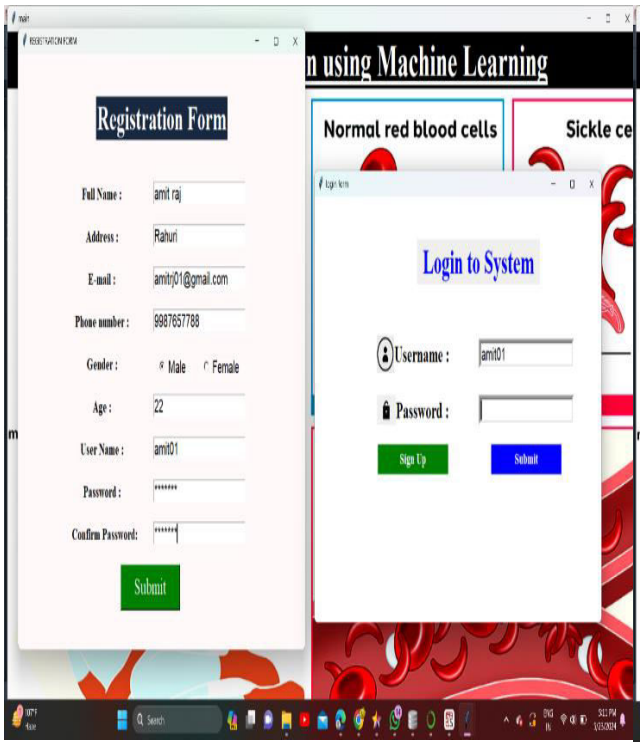
| Volume 7, Issue 5, May 2024 |

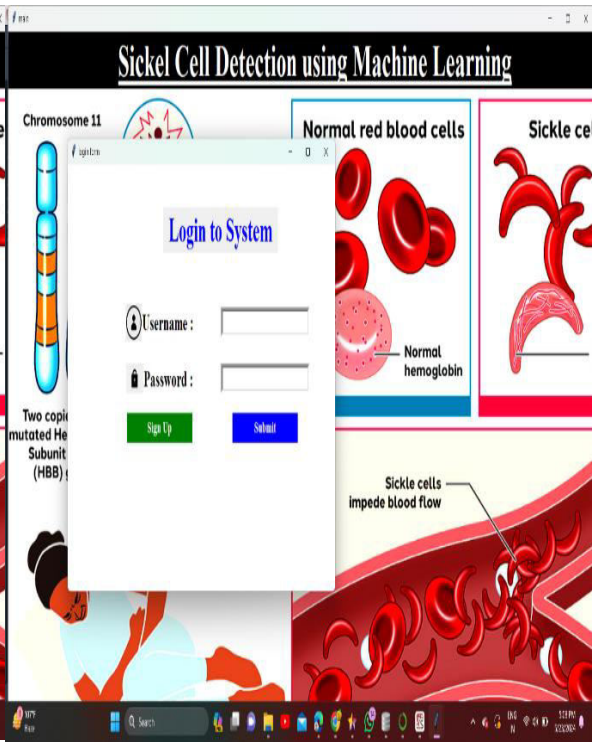
| DOI:10.15680/IJMRSET.2024.0705135 |

V. RESULTS AND DISCUSSIONS





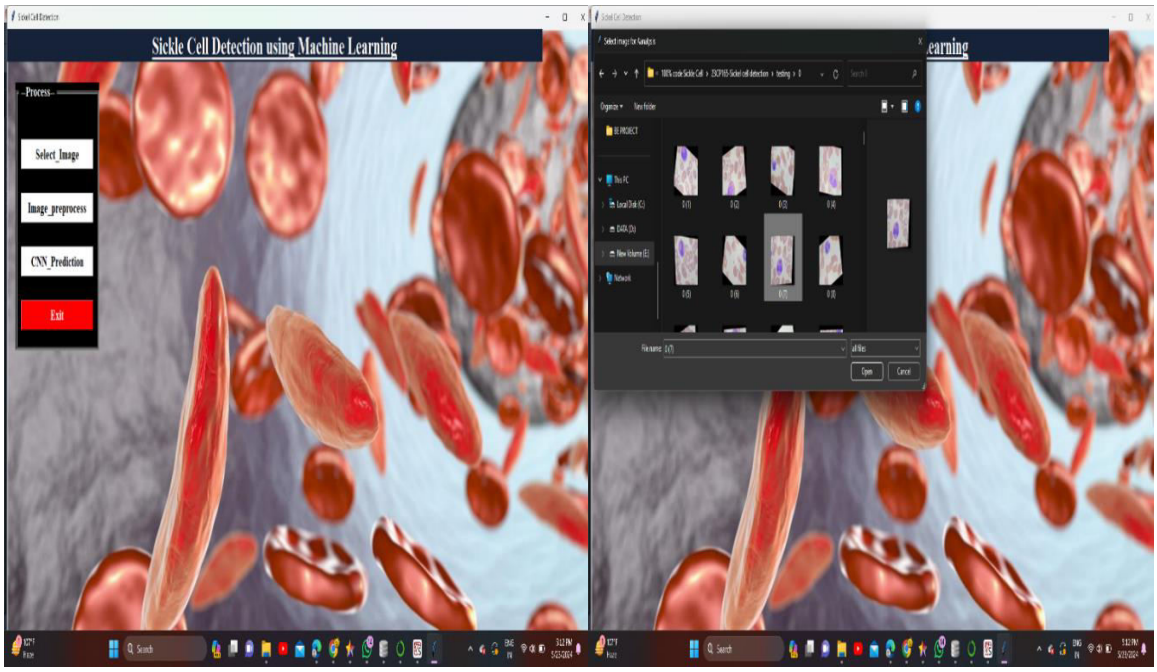


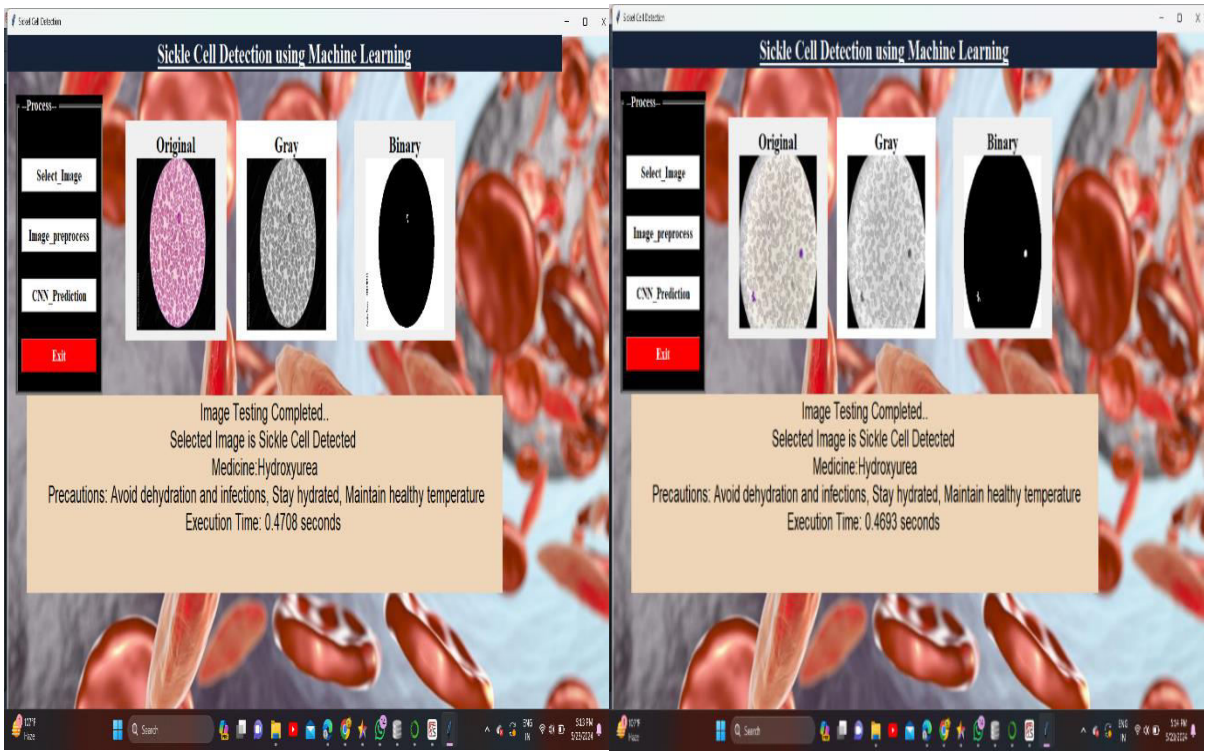


| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 5, May 2024 |

| DOI:10.15680/IJMRSET.2024.0705135 |





IV.CONCLUSION

In conclusion, the proposed deep learning model, integrating histogram equalization and gray scaling for preprocessing along with data augmentation, demonstrates a promising approach for the precise classification of blood smear images into normal, sickle shaped, and other blood components. The layered convolutional neural network effecttively addresses the challenge of dataset scarcity through transformations applied via data augmentation techniques. The incorporation of histogram equalization enhances image contrast, contributing to improved model performance.

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 5, May 2024 |

| DOI:10.15680/IJMRSET.2024.0705135 |

REFERENCES

1. L. L. Wheeless, R. D. Robinson, O. P. Lapets, C. Cox, A. Rubio, M. Weintraub, and L. J. Benjamin, "Classification of red blood cells as normal, sickle, or other abnormal, using a single image analysis feature," Cytometry, vol. 17,no. 2, pp. 159–166, 2020.
2. P. Rakshit, and K. Bhowmik, "Detection of Abnormal Finding in Human RBC in Diagnosing Sickle Cell Anaemia Using Image Processing," ScienceDirect, vol. 10, pp. 28-36, 2021.
3. M. Gonzalez-Hidalgo, F. A. Guerrero-Pena, S. Herold-Garca, A. JaumeiCapo, and P. D. Marrero-Fernandez, "Red Blood Cell Cluster Separation from Digital Images for use in Sickle Cell Disease," IEEE Journal on Biomedical and Health Informatices, pp. 2168-2194, 2020.
4. Barpanda, S.S., "Use of Image Processing Techniques to Automatically Diagnose Sickle Cell Anemia Present in Red Blood Cells Smear," 2019.
5. Sharma, V., A. Rathore, and G. Vyas, "Detection of sickle cell anaemia and thalassaemia causing abnormalities in thin smear of human blood sample using image processing," in Inventive Computation Technologies (ICICT), International Conference on.IEEE. 2020
6. Sahu, M., A.K. Biswas, and K. Uma, "Detection of Sickle Cell Anemia in Red Blood Cell: A. International Journal of Engineering and Applied Sciences (IJEAS)," 2(3), 2020.
7. Sreekumar, A. and A. Bhattacharya, "Identification of sickle cells from microscopic blood smear image using image processing," International Journal of Emerging Trends in Science and Technology, 1(05): p. 783-787, 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com