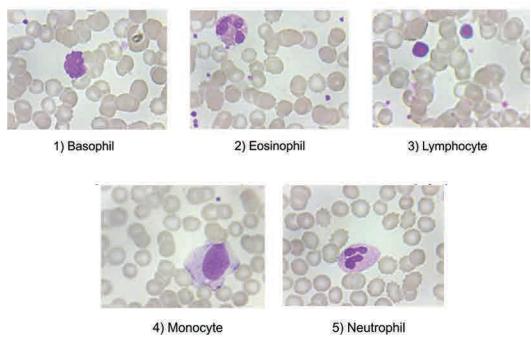


## 1. Introduction

### White Blood Cells

- 5 subtypes: Neutrophils, Lymphocytes, Monocytes, Eosinophils, Basophils.
- Differential Blood Count (DBC): Measure of the health status of the body.
- Disorders related to WBCs: HIV/AIDS, Tuberculosis, Lymphocytic Leukemia, Bacterial Infection etc.



### Current Scenario

- A pathologist manually annotates the White Blood Cells.

### Highlights of our Work

- Addition of the novel feature "number of lobes".
- Incremental learning based Naïve Bayesian classifier.

## 3. Result & Future Work

- Classification Accuracy: 92.72%.
- Development of web-based clinical tool for Differential Blood Count.
- Identify objects in the smear such as "microorganisms"

## 2. Proposed Scheme

### WBC Segmentation

#### Stain Normalization

- Reinhard's Method: For robust segmentation independent of staining in the images.

#### Nuclear Segmentation

- Generation of the seed points: HSV based thresholding (Saturation channel).
- Removal of the non-WBCs: Morphological operations and Area based Filtering.
- Precise Shape of the Nucleus: Region based Active Contours.

#### Cytoplasm Segmentation

- Generation of the seed points: HSV based thresholding (Hue channel).
- Morphological operations and Connected Component elimination using the obtained nuclei.
- Cytoplasm = WBC - Nucleus

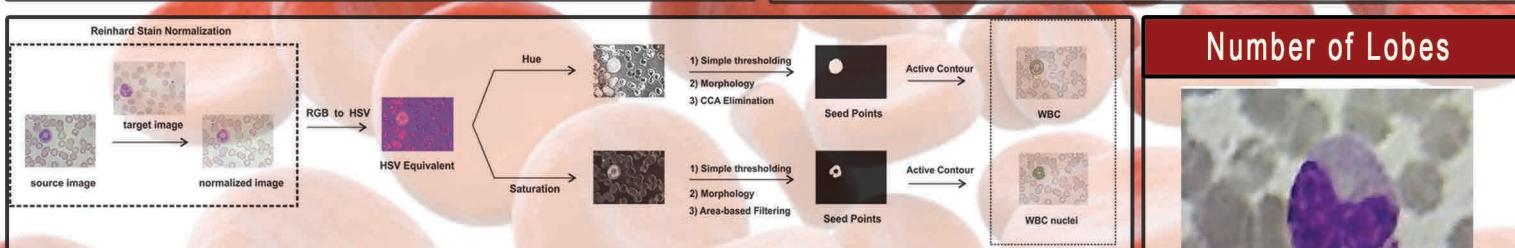
### Feature Extraction & Classification

#### Features

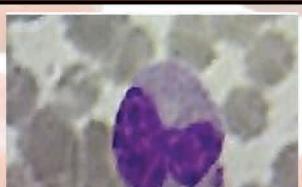
- Size of the WBC
- Compactness of the WBC
- Nuclear Cytoplasmic Ratio of the WBC
- Average Nuclear Roundness
- Number of lobes in the Nucleus
- Number of maximum curvature points in the Nucleus
- Roughness of the nucleus from the GLEM Matrix.
- Homogeneity of the cytoplasm from the Gray Level Co-occurrence Matrix.

#### Classification

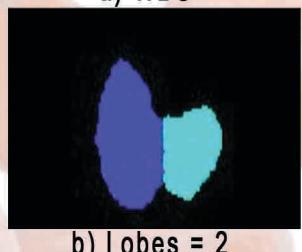
- Naïve Bayes Classifier with Laplacian correction.
- Incremental learning: Using classified data for learning.



### Number of Lobes



a) WBC



b) Lobes = 2

