|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Class ID | Name | A | P | D | SGF | DV | CP | TF | Image | Notes |
| 1 | Normal RBC  **Pink** |  |  | >6.0  And  <8.0 | <1.2 |  | 1 |  |  | Normal may CP  -**Micocyte** pag ang diameter less than 6.5micro ( <6.5 micro)  -**Macrocyte** pag greather than 7.8micro ung diameter naman.  -**Normocyte**  6.5-7.8 micro diameter |
| 2 | Echinocytes (Burr Cell)  **Yellow** |  |  | <6 | <1.2 |  | 1 |  |  | Thorny projections may CP |
| 3 | Elliptocytes (Elongated)  **Red** |  |  |  | >1.8 |  | 1 |  |  | Elongated may CP |
| 4 | Dacrocytes (Tear Drop cell) **Blue** |  |  |  | <1.8  And  >1.2 |  | 1 |  |  | May point-edge lagi sa dulo may CP |
| 5 | Spherocytes  **Green** |  |  | 6.1-7 micro | <1.2 |  | 0 |  |  | Bilog na bilong WALANG CP |
| 6 | Schisotcytes  **Violet**  **NEW** |  |  |  |  |  | 0 |  |  | Fragmented portion of a red blood cell WALANG CP |
| 7 | Target Cells  **Orange**  **NEW** |  |  | >6.0  And  <8.0 | <1.2 |  |  | 1 |  | May CP tas may tuldok pa sa gitna |
| 8 | Stomatocytes  **Brown**  **NEW** |  |  | >6.0  And  <8.0 | <1.2 |  |  | 1 |  | May CP, parang lips. Or parang coffee beans |
| 9 | Hypochromic  **Black**  **NEW** |  |  |  |  |  |  | 1 |  | Cells possess a greater central pallor than normal (greater than one-third) |

- Lalabas parameters Area, Perimeter, Diameter, SGF, CP, TF, DV

- Elliptocytes lang ang may Deviation value

- Sasabihin anong type ng cell

- Pag wala madetect mag “Unknown” siya

- Pag normal sasabihin kung microcyte, macrocyte, or normocyte

- Sasabihin din kung ano associated condition pag clinick ang specific button

Table 2

|  |  |  |
| --- | --- | --- |
| ID | Features | Description |
| 1 | Area (A) | * Sum of pixels enclosed by cell boundary |
| 2 | Perimeter (P) | * Sum of perimeter pixels |
| 3 | Diameter (D) | * Ratio between area and perimeter * Area/(4\*perimeter) |
| 4 | Shape Geometric Factor (SGF) | * Proportion of peripheral oval’s diameter * SGF = Large\_diameter/small\_diameter |
| 5 | Deviation Value (DV) | * ratio between the shape geometric factor and area of the cell * SGF/A * For elongated and oval shape |
| 6 | Central Pallor (CP) | * 1 if central pallor is present * 0 if there is no central pallor |
| 7 | Target Flag (TF) **NEW** | * 1 has a central pallor and has another dot in the middle * 0 has no Target Flag |

Table 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Class ID | Name | | Description | Associated Conditions |
| 1 | Normal RBC | Normocyte | Normal, mature red blood cell with a mean cell volume within the reference  interval. |  |
| Microcyte | Smaller than a normal cell (<6.5micro); mean corpuscular volume usually <80 fL; has a central  pallor; normochromic or hypochromic | ◗ Iron deficiency anemia  ◗ Thalassemias  ◗ Lead poisoning  ◗ Anemia of chronic disease  ◗ Sideroblastic anemia |
| Macrocyte | Large cell (>7.8micro), mean corpuscular volume usually >100 fL; usually normochromic; may  be round or oval; cytoplasm is pink-red | ◗ Liver disease (round macrocytes seen)  ◗ Megaloblastic anemias (oval macrocytes seen)  ◗ Myelodysplastic syndrome  ◗ Acute blood loss  ◗ Chemotherapy |
| 2 | Echinocytes (Burr Cell) | | Cell with evenly distributed, short spicules; the spicules have a blunt end;  retains central pallor | ◗ Slow drying in high humidity  ◗ Renal insufficiency  ◗ Pyruvate kinase deficiency  ◗ Stored blood  ◗ Severe dehydration  ◗ Burns  ◗Uremia  ◗microangiopathic hemolytic anemia  ◗neonates |
| 3 | Elliptocytes (Elongated) | | Oval-shaped cell (may be slightly egg, rod, or pencil shaped); hemoglobin is  concentrated at two ends; normal central pallor | ◗ Hereditary elliptocytosis  ◗ Iron deficiency anemia  ◗ Myelophthisic anemia  ◗ Megaloblastic anemia  ◗ Thalassemia  ◗ Sideroblastic anemia  ◗ Congenital dyserythropoietic anemia |
| 4 | Dacrocytes (Tear Drop cell) | | Pear-shaped cell with a blunt pointed projection | ◗ Extramedullary hematopoiesis (myelofibrosis, myelophthisic anemia)  ◗ Megaloblastic anemia  ◗ Thalassemia  ◗ Hypersplenism |
| 5 | Spherocytes | | Round cells; increased staining intensity with no central pallor; smaller volume  than a normal cell (decreased surface:volume ratio) | ◗ Hereditary spherocytosis  ◗ Immunohemolytic anemias  ◗ Heinz body hemolytic anemia  ◗ Severe burns (microspherocytes seen); microspherocytes are 4.0   ◗ Hypersplenism |
| 6 | Schistocytes | | Irregular shape or fragment of cell; results from damaged membrane | ◗ Microangiopathic hemolytic anemias  ◗ Traumatic hemolytic anemias  ◗ Waring Blender syndrome |
| 7 | Target Cell | | Bell shaped, with a thin wall having a greater-than-normal surface membrane:volume  ratio; central area of hemoglobin, a clear ring, and a peripheral ring of hemoglobin,  giving an appearance of a bull’s eye | ◗ Hemoglobinopathies  ◗ Thalassemia  ◗ Obstructive liver disease  ◗ Iron deficiency anemia |
| 8 | Stomatocytes | | Cell having a slitlike area of central pallor | ◗ Hereditary stomatocytosis  ◗ Alcoholism  ◗ Obstructive liver disease  ◗ Cirrhosis  ◗ Rh-null disease |
| 9 | Hypochromic | | Cells possess a greater central pallor than normal (greater than one-third);  may lack hemoglobin and have a decreased mean corpuscular hemoglobin  concentration or may be abnormally thin | ◗ Iron deficiency anemia  ◗ Thalassemia  ◗ Anemia of chronic disease  ◗ Sideroblastic anemia  ◗ Myelodysplastic syndromes |

- Itong table na ito pandagdag info lang talaga siya.

- Title Namin: **Identification of Abnormal Red Blood Cells and Diagnosing Specific Types of Anemia Using Image Processing and Support Vector Machine**

- Support Vector Machine – Paano namin mabanggit sa defense na ginamit ito?

- Watershed Segmentation – Paano namin mabanggit sa defense na ginamit ito?

- Sobel Edge Detection – Paano namin mabanggit sa defense na ginamit ito?

Capture

Exit

**Red Blood Cell Classification**

Description

Associated

Conditions

About

Status of RBC (Normal or Abnormal)

Highlight all abnormal RBC and View Parameters of each RBC

**-** Ito naman, yung UI. iHighlight kung ano yung mga abnormal RBC tas papakita rin parameters.

- Naglagay ako description and associated condition kung kaya sanang pag na detect na RBC may lalabas info.

- Pag hindi kaya okay lang naman. Yung dinesign ko naman dati pag nagClick ng button lalabas info about sa mga RBCs na parang Manual.

- About info lang sa proto and amin hahaha.

- Ito naman mga testing table naming

- Accuracy lang kinukuha naming rito

**Testing Tables**

**Training Procedure**

**Table 3.5** Training of SVM for Class 1 RBC

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| RBC Sample # | Area | Perimeter | Diameter | Shape Geometric Factor | Deviation Value | Central Pallor |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| . |  |  |  |  |  |  |
| . |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |

**Table 3.6** Training of SVM for Class 2 RBC

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| RBC Sample # | Area | Perimeter | Diameter | Shape Geometric Factor | Deviation Value | Central Pallor |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| . |  |  |  |  |  |  |
| . |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |

For Table 3.5 and 3.6, it will train the SVM by inputting diagnosed blood smear images of different classes in separate trainings and teach the machine to understand normal and abnormal RBC. As well, determine the 7 features to successfully classify a RBC. The desired data for each feature is shown in Table 2.2 and 2.3. Same training process will be done for the remaining classes 3-6.

**Table 3.7** Testing and Classifying of RBC in the Constructed Machine

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RBC Sample # | A | P | D | SGF | DV | CP | Class | Anemia Condition |
| 1 |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |
| . |  |  |  |  |  |  |  |  |
| . |  |  |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |  |  |

Table 3.7 shows the Table of testing and classifying RBC in the constructed machine; 20 samples will be used for different classes. It will then identify its features, classify its class and diagnose an Anemia condition base on the morphology and features of RBC. The features and Anemia diagnosis is based on Table 2.3 and 2.4 respectively.

**Statistical Analysis**

**Table 3.8** Confusion Matrix for the Blood Sample Classification

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Predicted Classification of Blood Sample** | | | | | | | |
|  | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Class 6 | Class 7 | Unknown |
| **Actual Classification**  **of Blood Sample** | Class 1 |  |  |  |  |  |  |  |  |
| Class 2 |  |  |  |  |  |  |  |  |
| Class 3 |  |  |  |  |  |  |  |  |
| Class 4 |  |  |  |  |  |  |  |  |
| Class 5 |  |  |  |  |  |  |  |  |
| Class 6 |  |  |  |  |  |  |  |  |
| Class 7 |  |  |  |  |  |  |  |  |
| Unknown |  |  |  |  |  |  |  |  |

Table 3.8 shows the confusion matrix for the blood classification. This table will be used to evaluate the ability of the system to successfully classify the RBC samples. For each class, 20 samples will be tested, and the result will be tabulated. The cases True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN) are used to interpret the values in a confusion matrix. In this study these cases mean the following: a.) True positive (TP), the system correctly identified the RBC sample class; b.) True negative (TN), the system correctly identified that the sample does not belong to a certain class; c.) False positive (FP), the system identified that the RBC sample belongs to certain class but it belongs to another class; d.) False negative (FN), the system identified that the RBC sample does not belong to a certain class but it actually does. The total for each case are required in getting the accuracy of the system.

Accuracy is the measure of how often the system is correct in classifying. The formula of the accuracy of the system:

**Accuracy of the System = (3.1)**