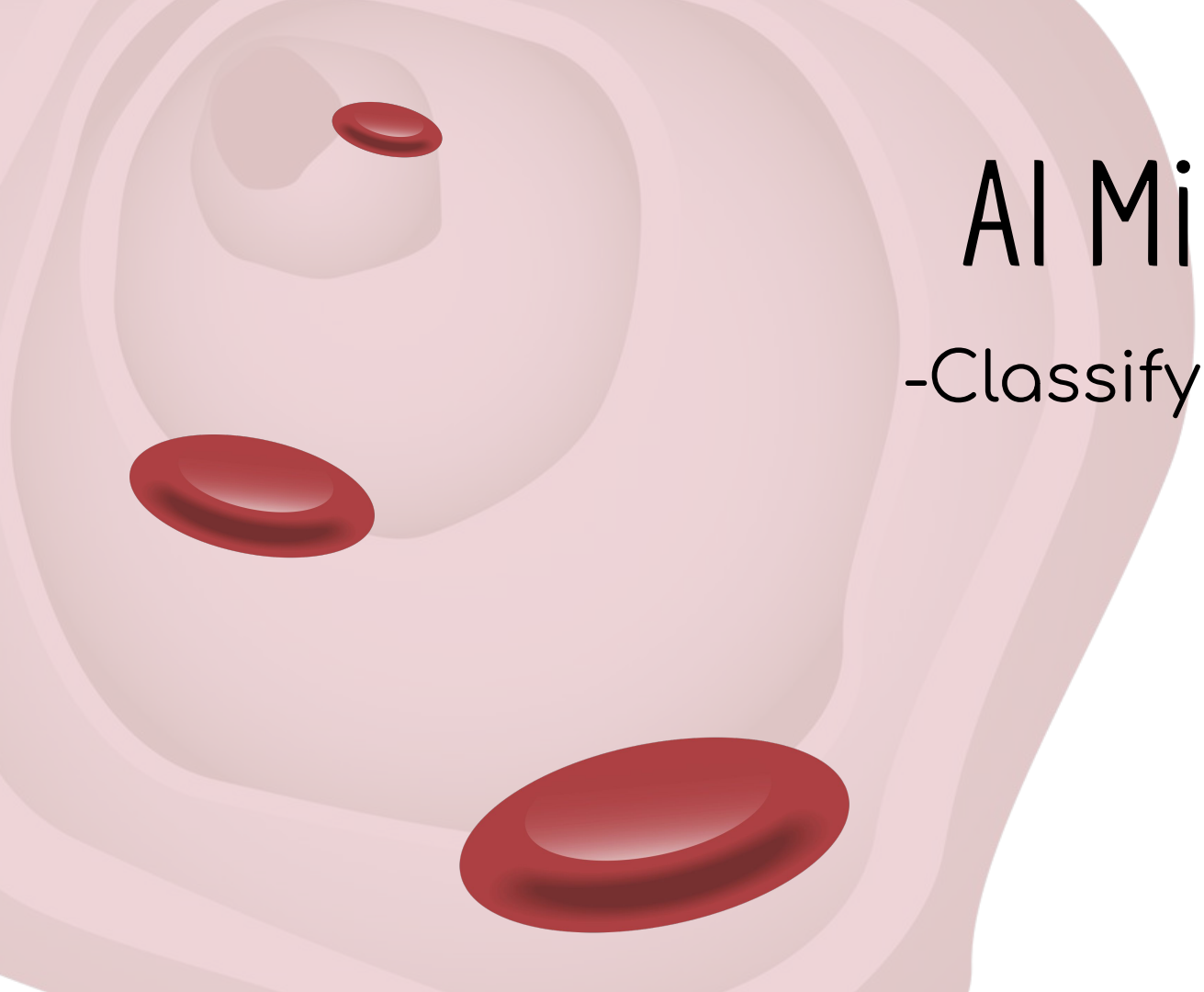
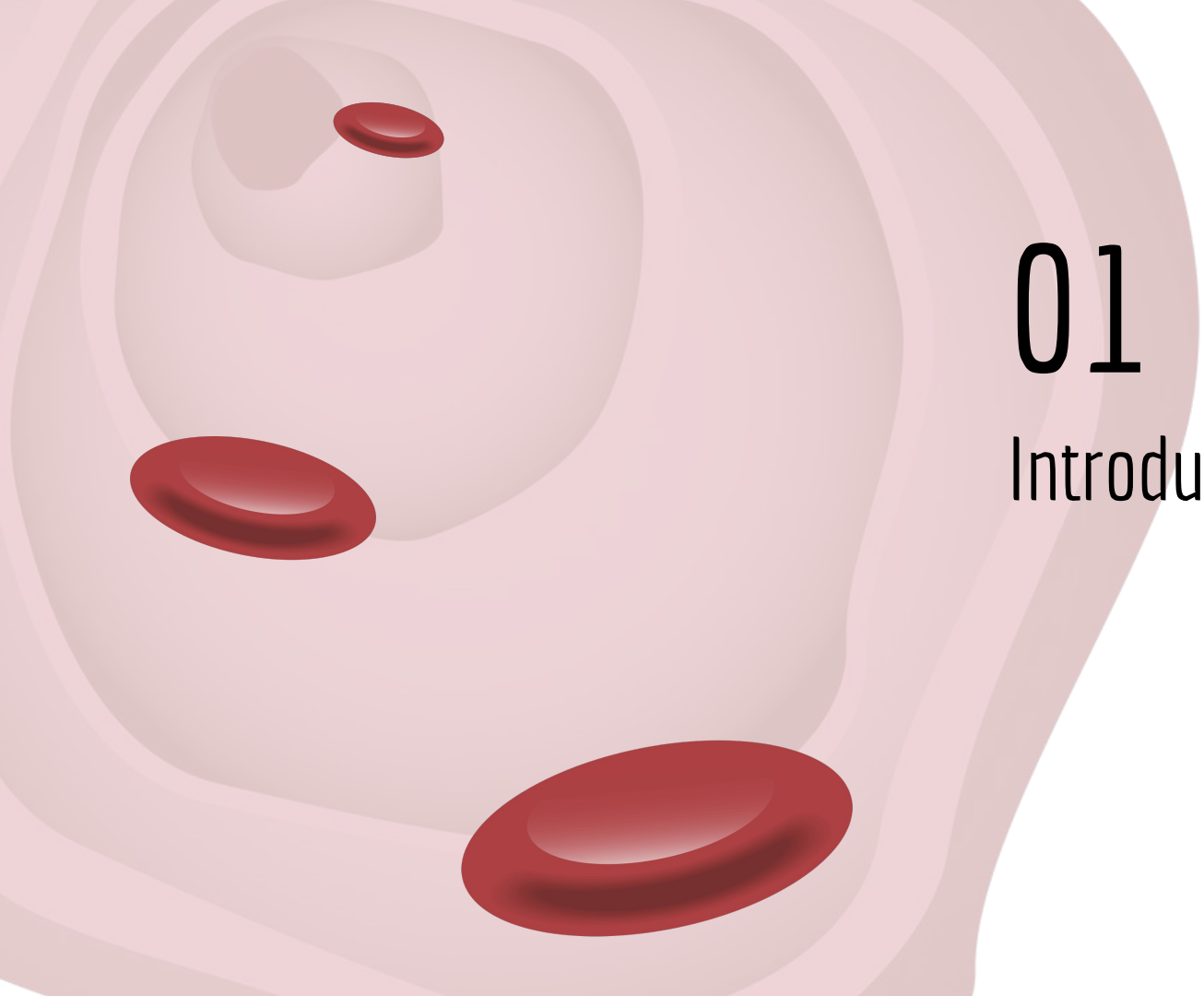


AI Microscope

-Classify Blood Cells-

Frauke Albrecht

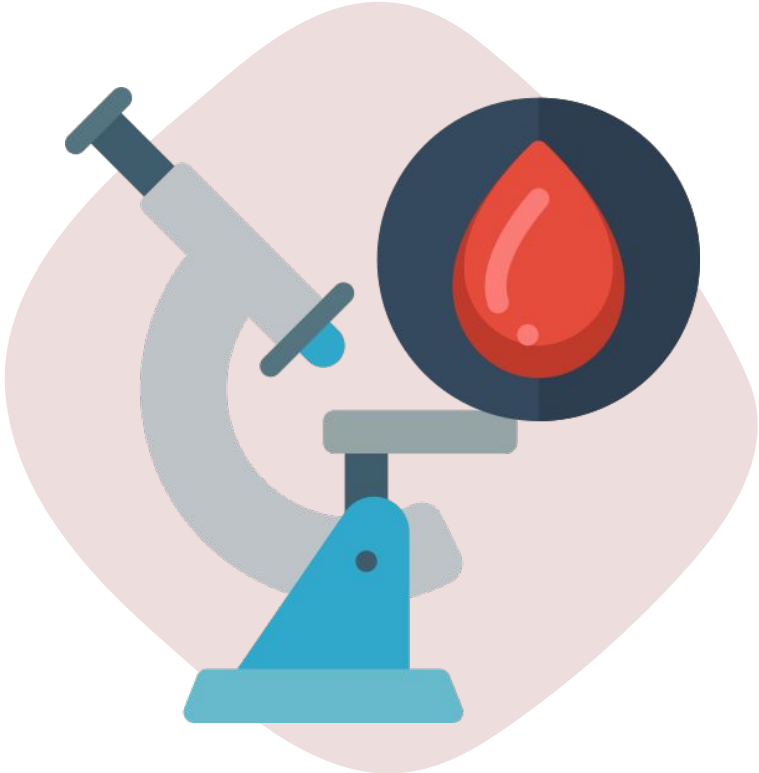


01

Introduction

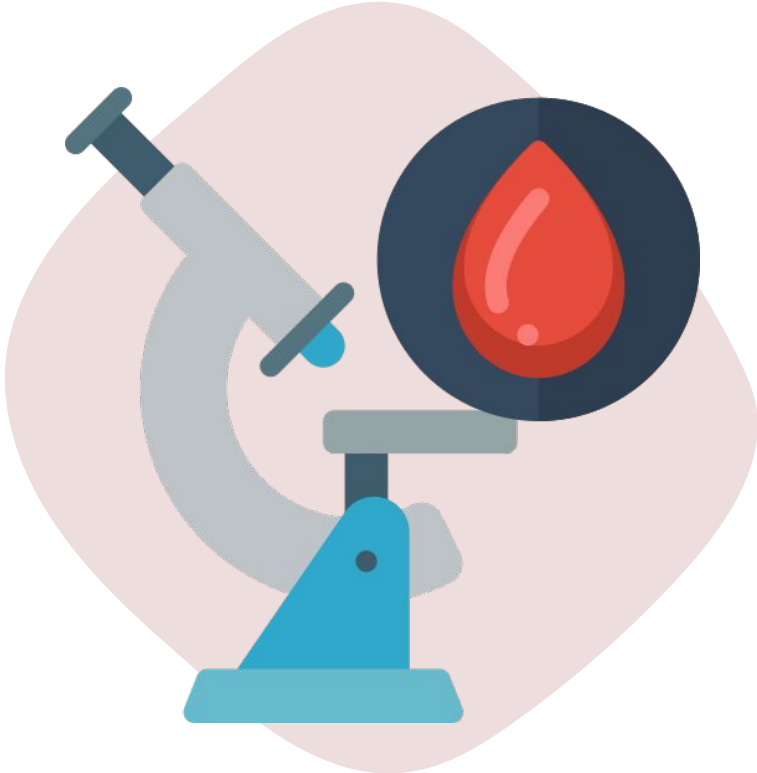
Background

- White blood cells important for the **immune system** and defend the body **against infectious disease** and foreign materials
- **5 main types** of white blood cells
- Share commonalities but are **distinct in form and function**



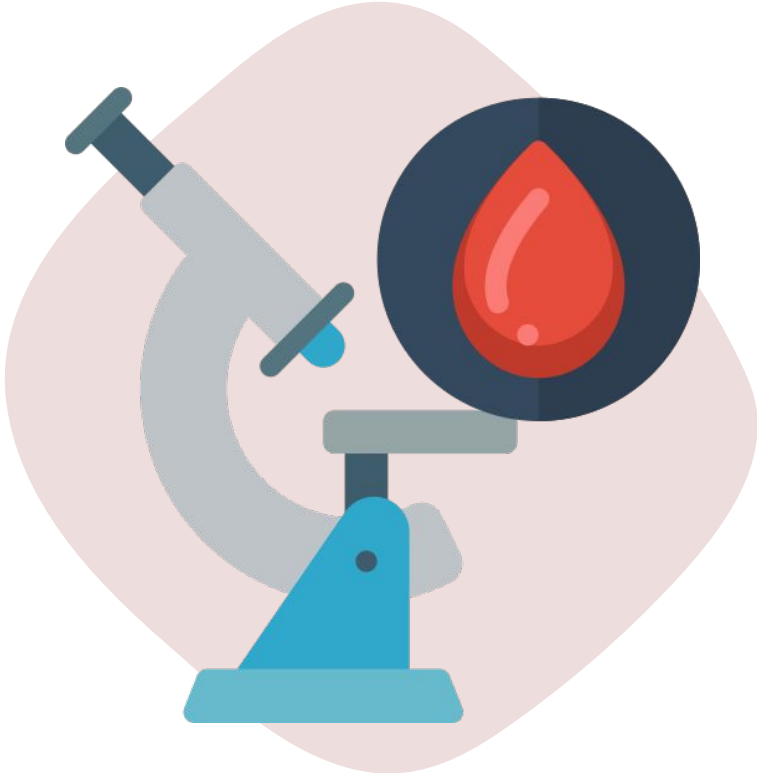
Objective

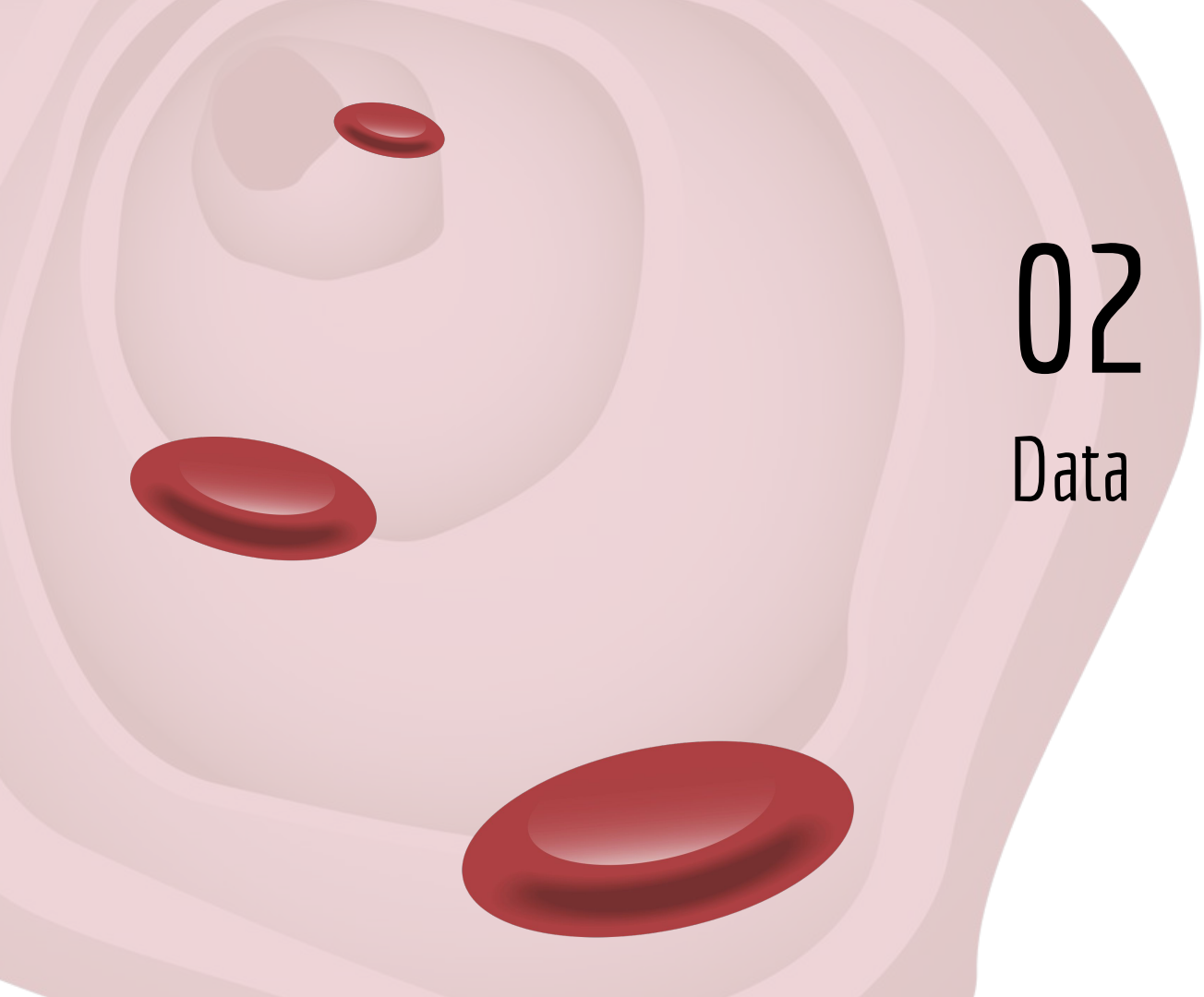
Automize **Classification** of different types of **white blood cells** in microscope images



Motivation

- **Support medical experts** with visual diagnosis
- **Increase** diagnostic **accuracy**

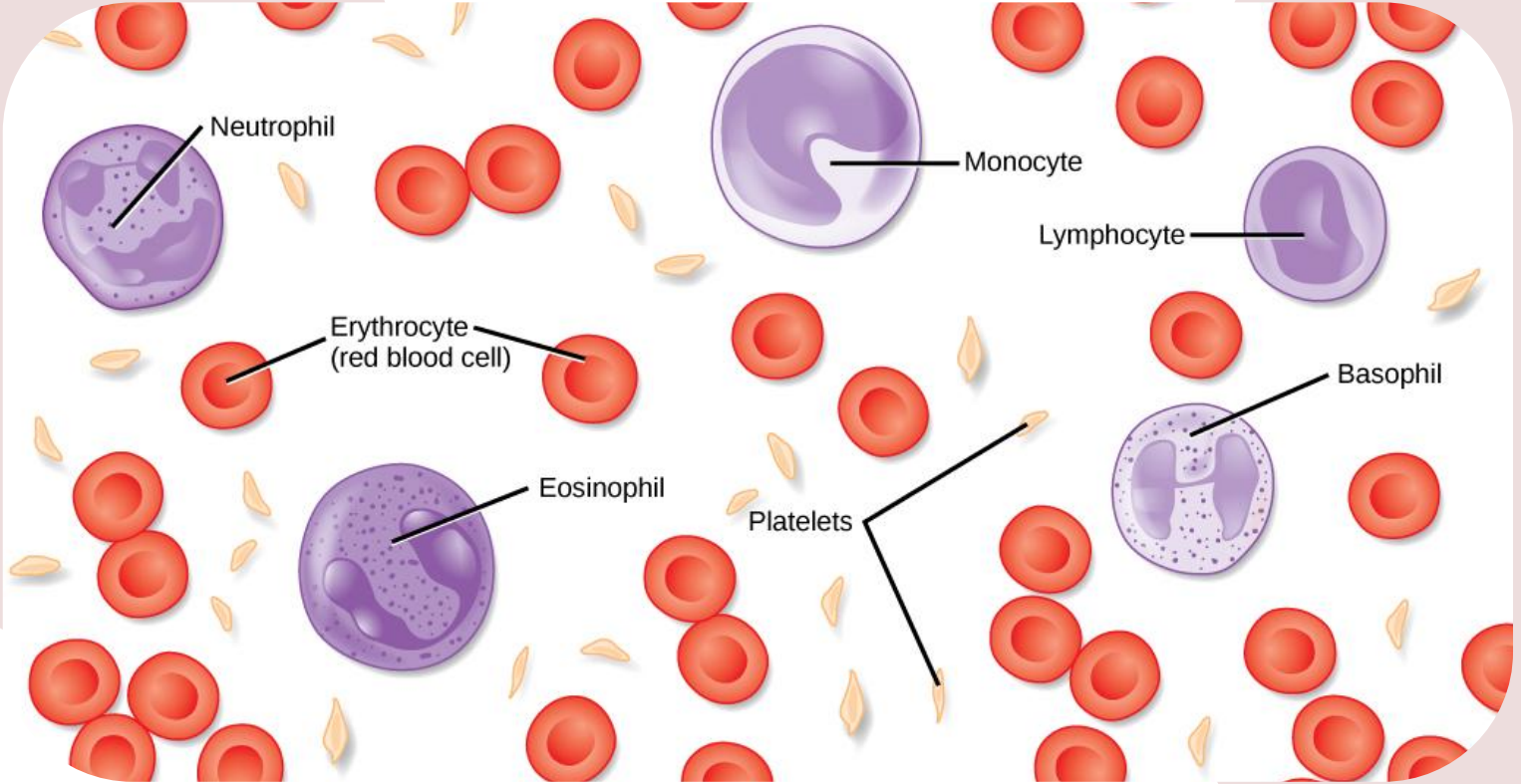




02

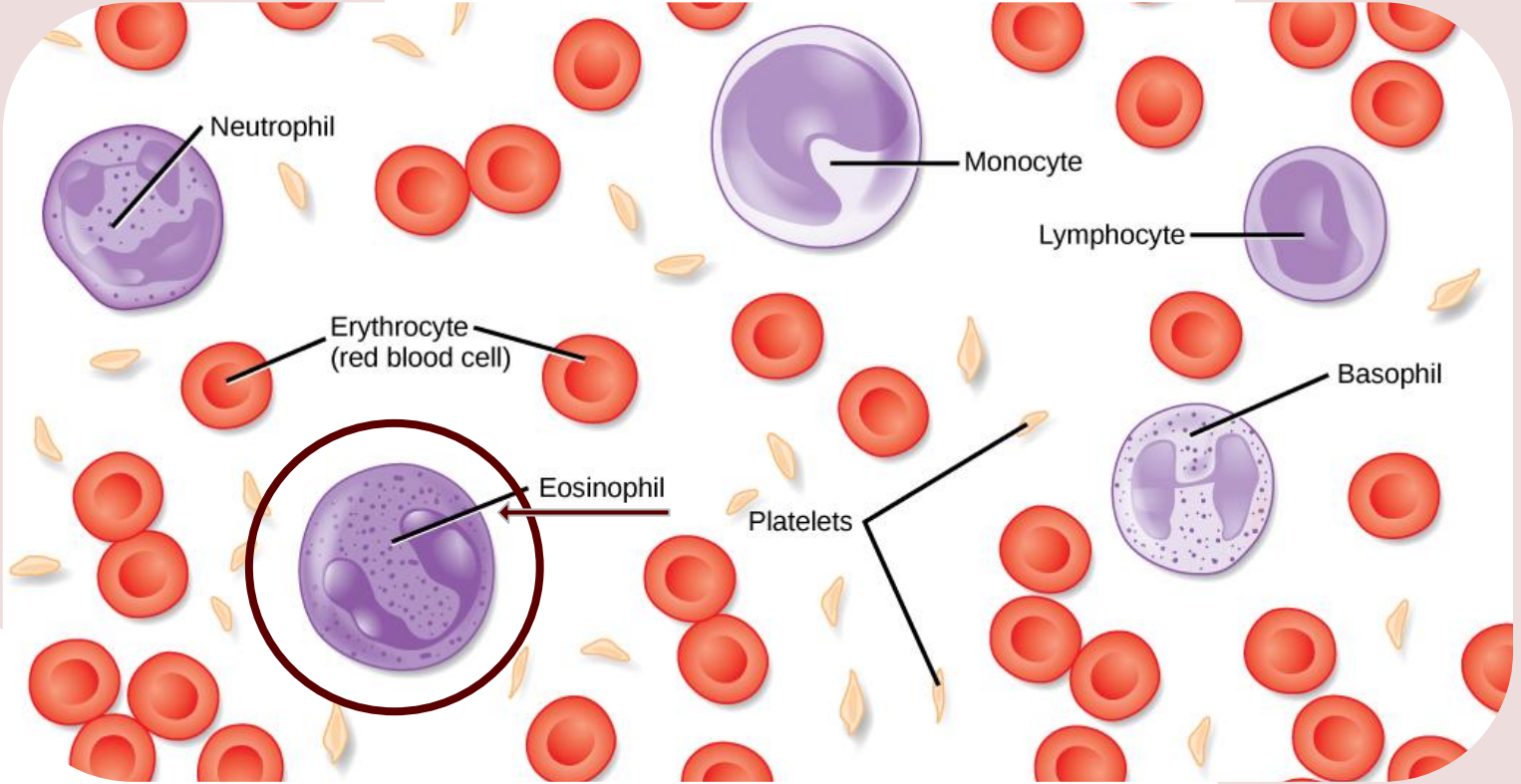
Data

Data



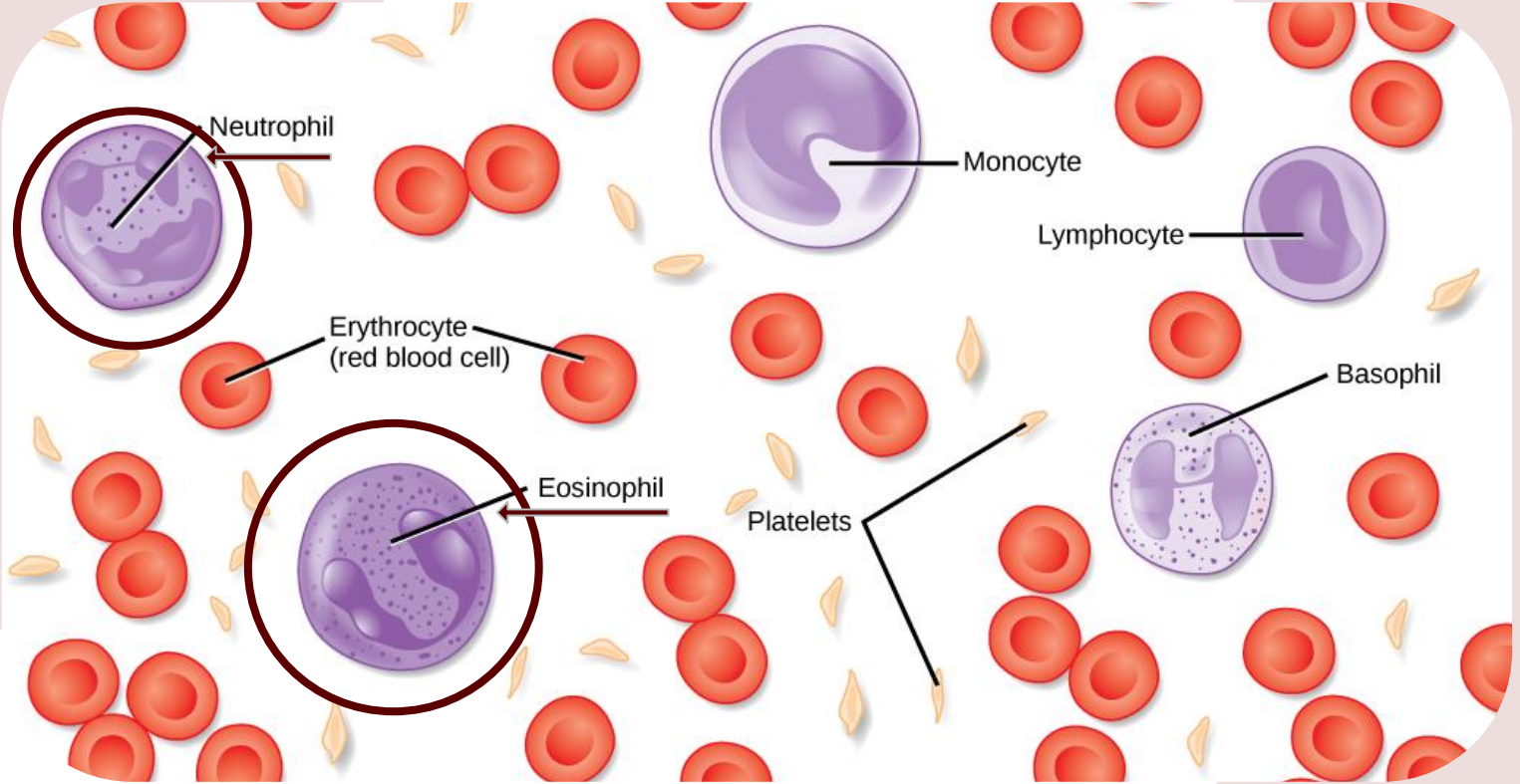
5 main types of white blood cells

Data



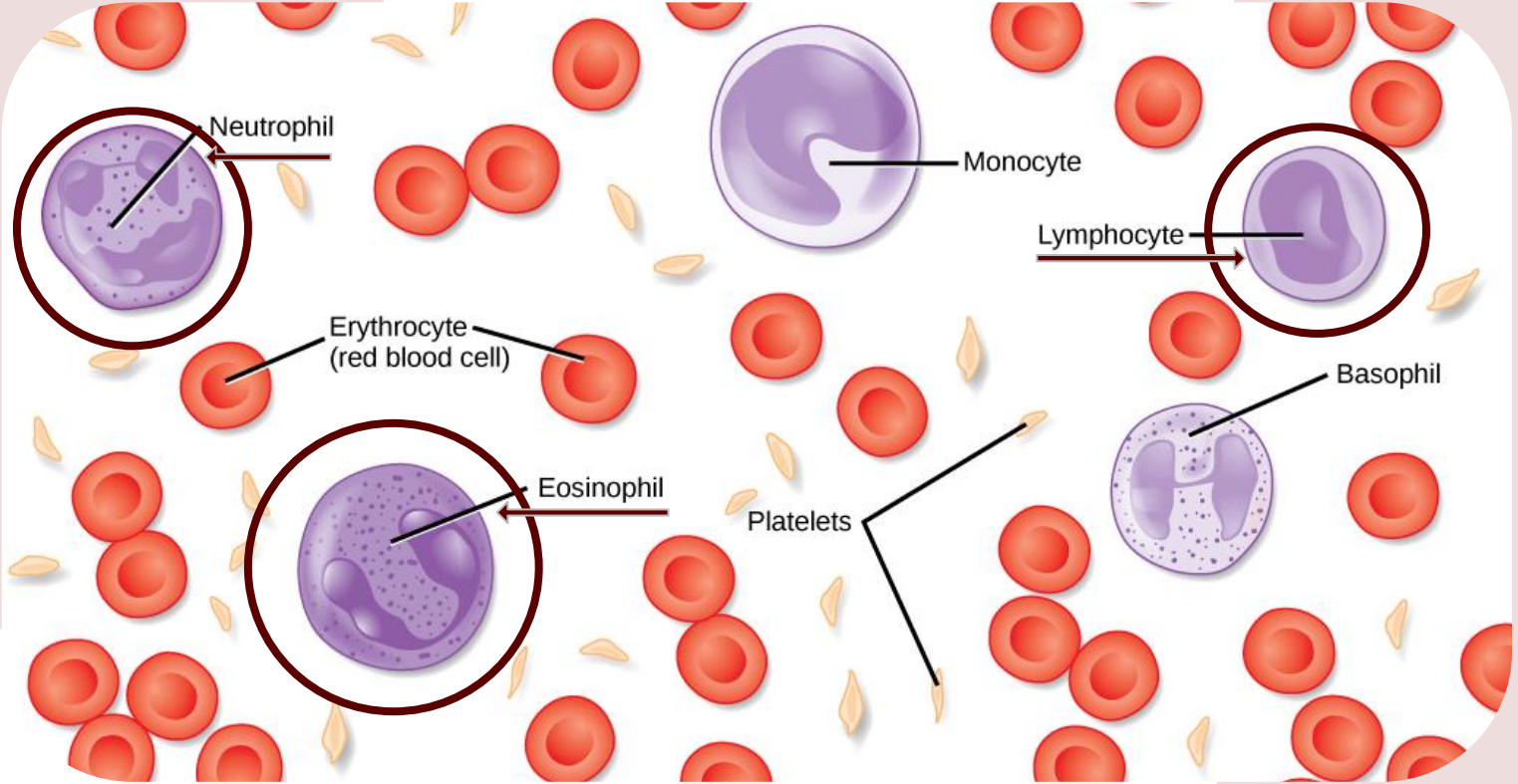
5 main types of white blood cells

Data



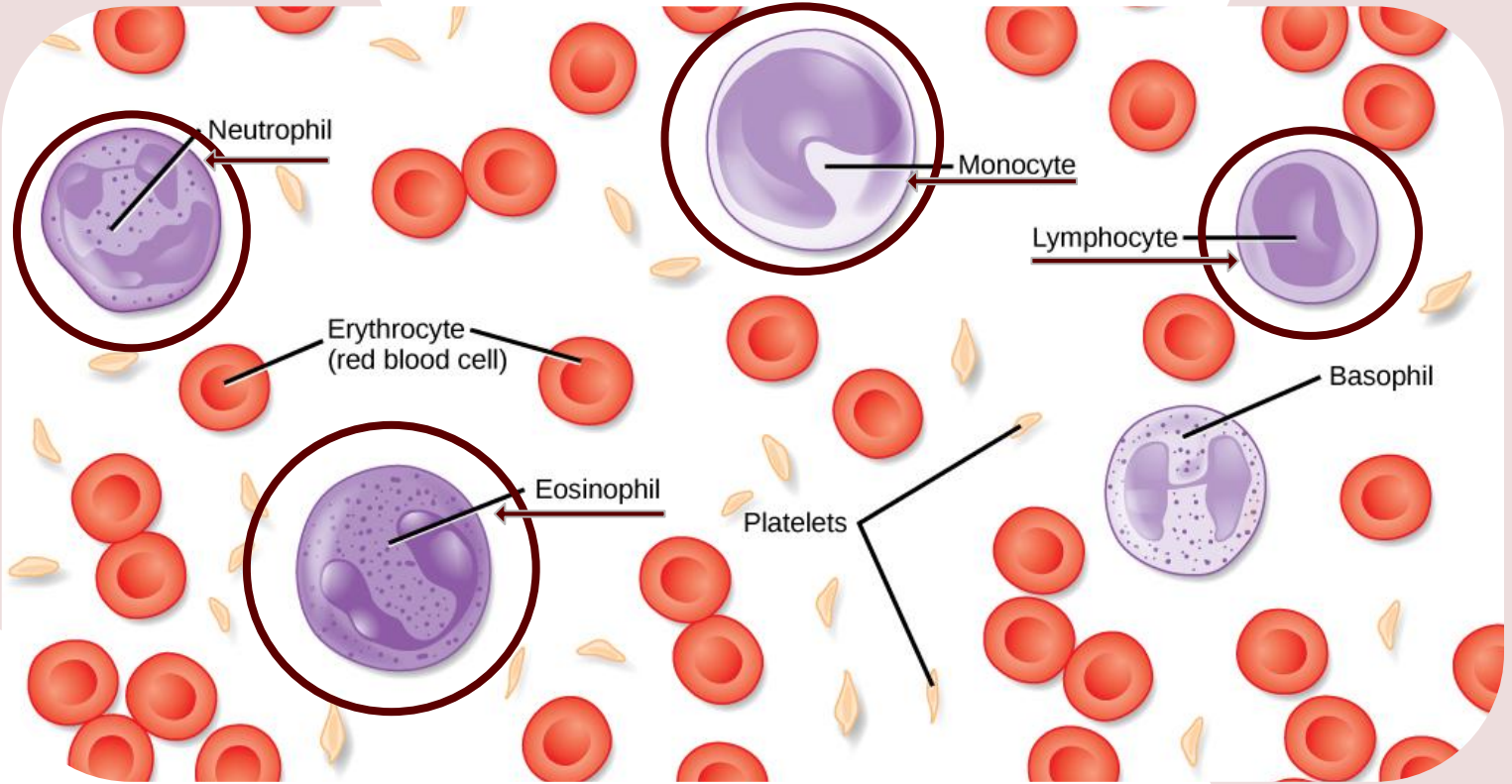
5 main types of white blood cells

Data



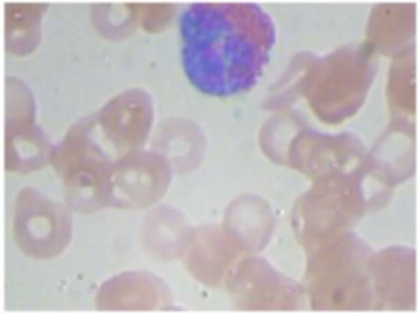
5 main types of white blood cells

Data

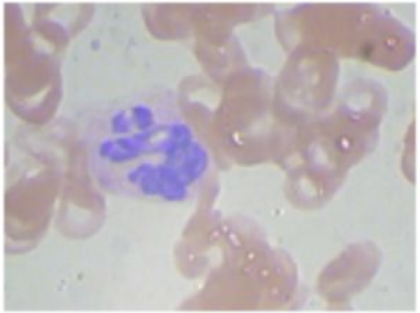


5 main types of white blood cells

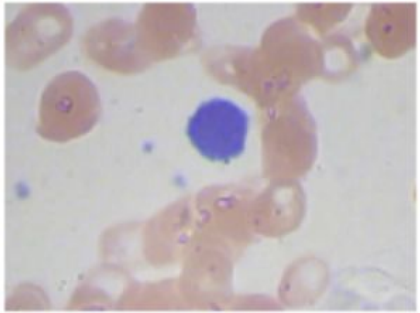
Examples



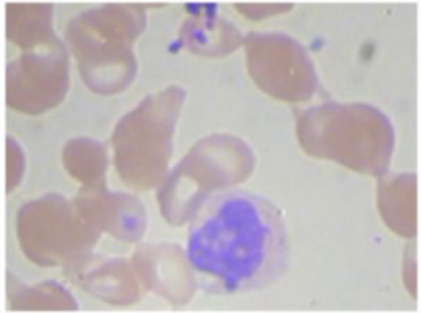
Eosinophil



Neutrophil

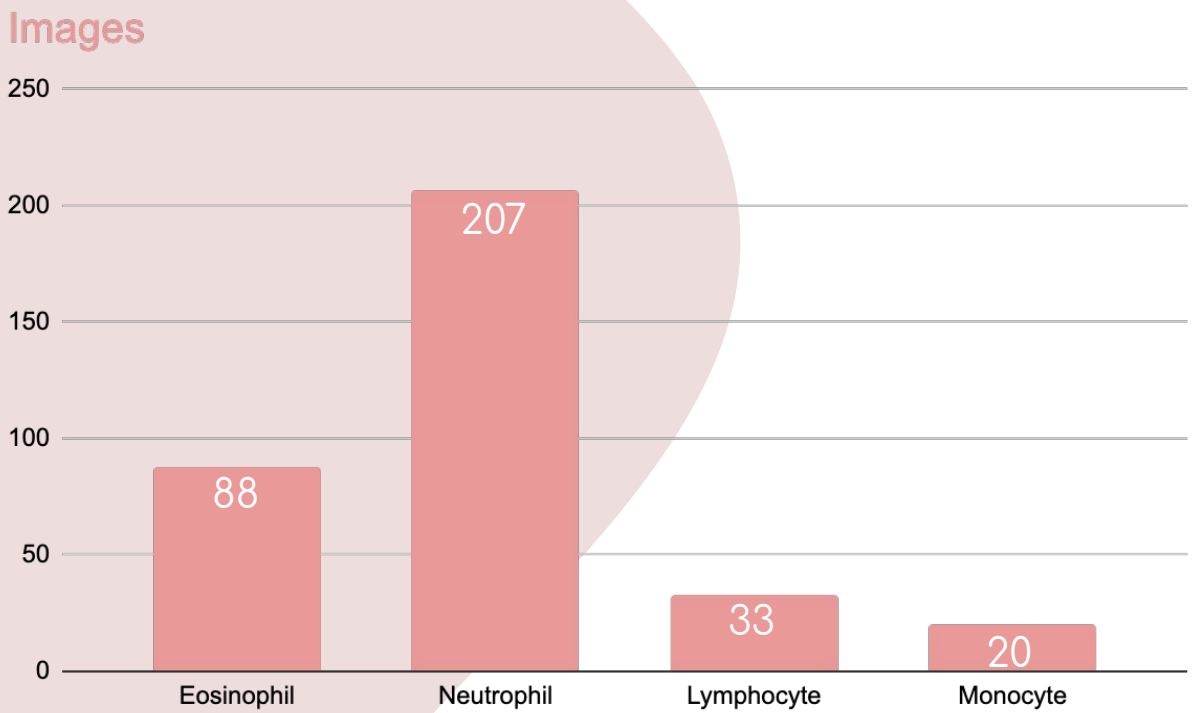


Lymphocyte



Monocyte

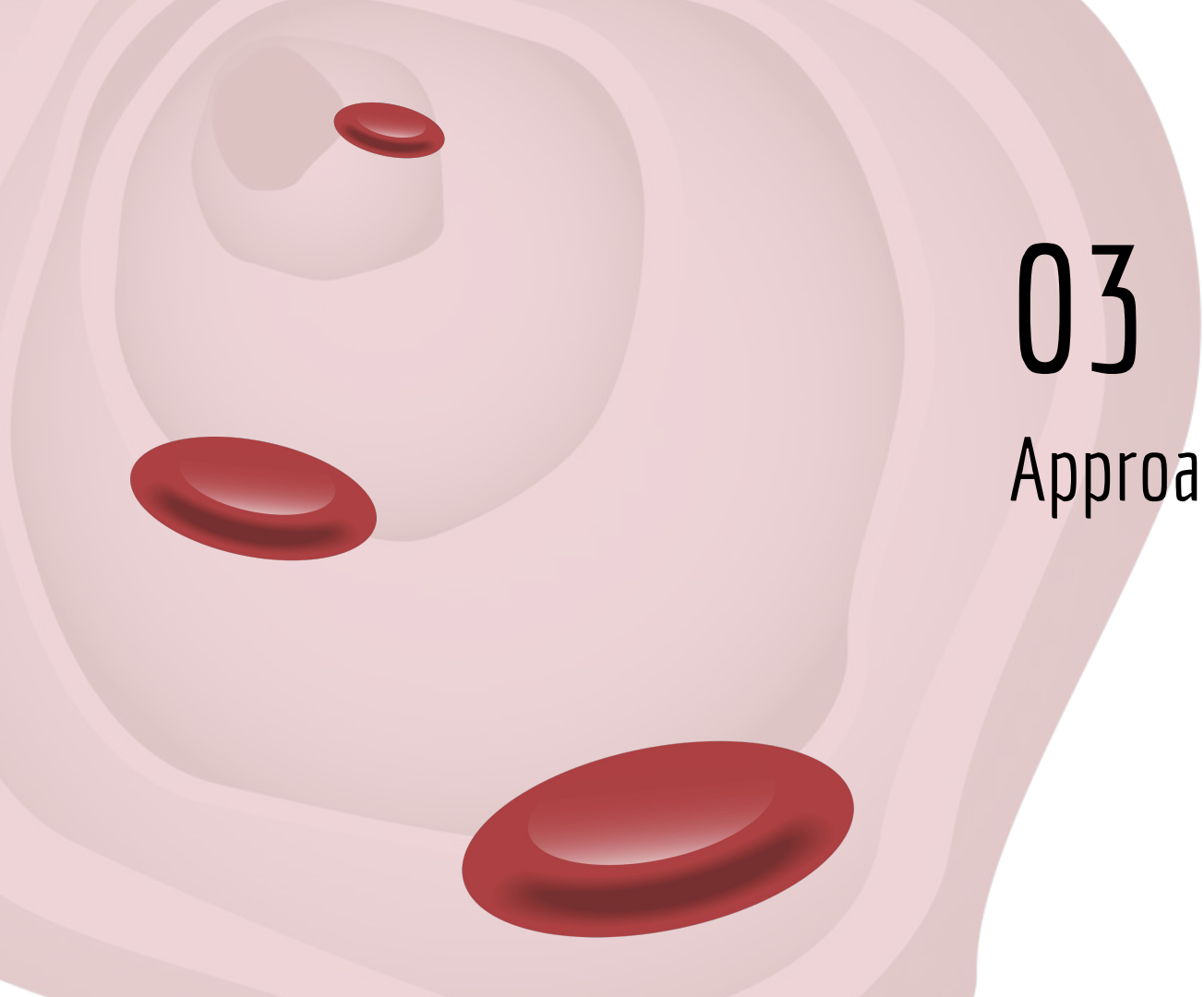
Data



348 images **total**

Images have been **augmented** to about **2500** for each category

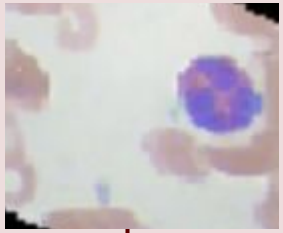
Data Source: https://www.kaggle.com/paultimothymooney/blood-cells

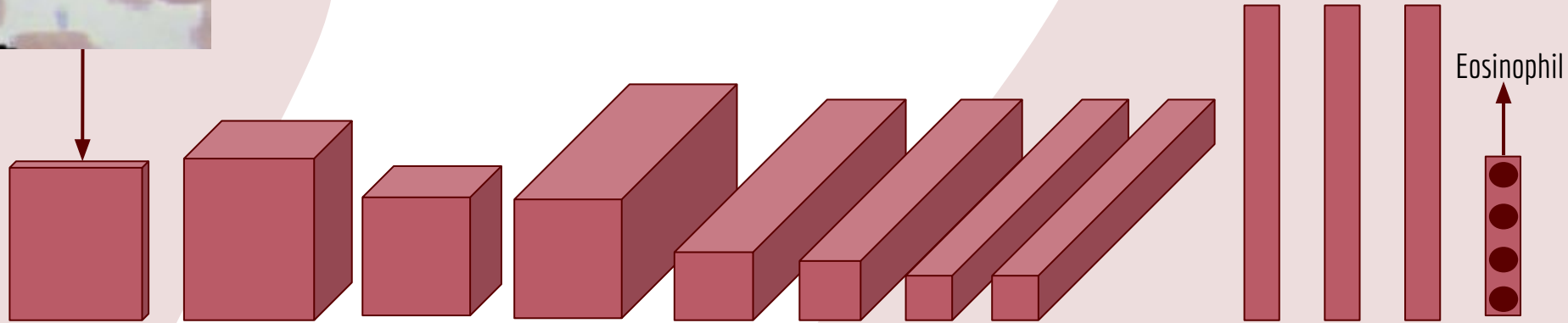


03

Approach

Convolutional Neural Network





Input Image
60x80x3

ConvLayer
Filter: 3x3
Kernels: 32
58x78x32

MaxPool
Stride: 2
Ksize: 2
29x39x32

ConvLayer
Filter: 3x3
Kernels: 64
27x37x64

MaxPool
Stride: 2
Ksize: 2
13x18x64

ConvLayer
Filter: 3x3
Kernels: 64
11x16x64

MaxPool
Stride: 2
Ksize: 2
5x13x64

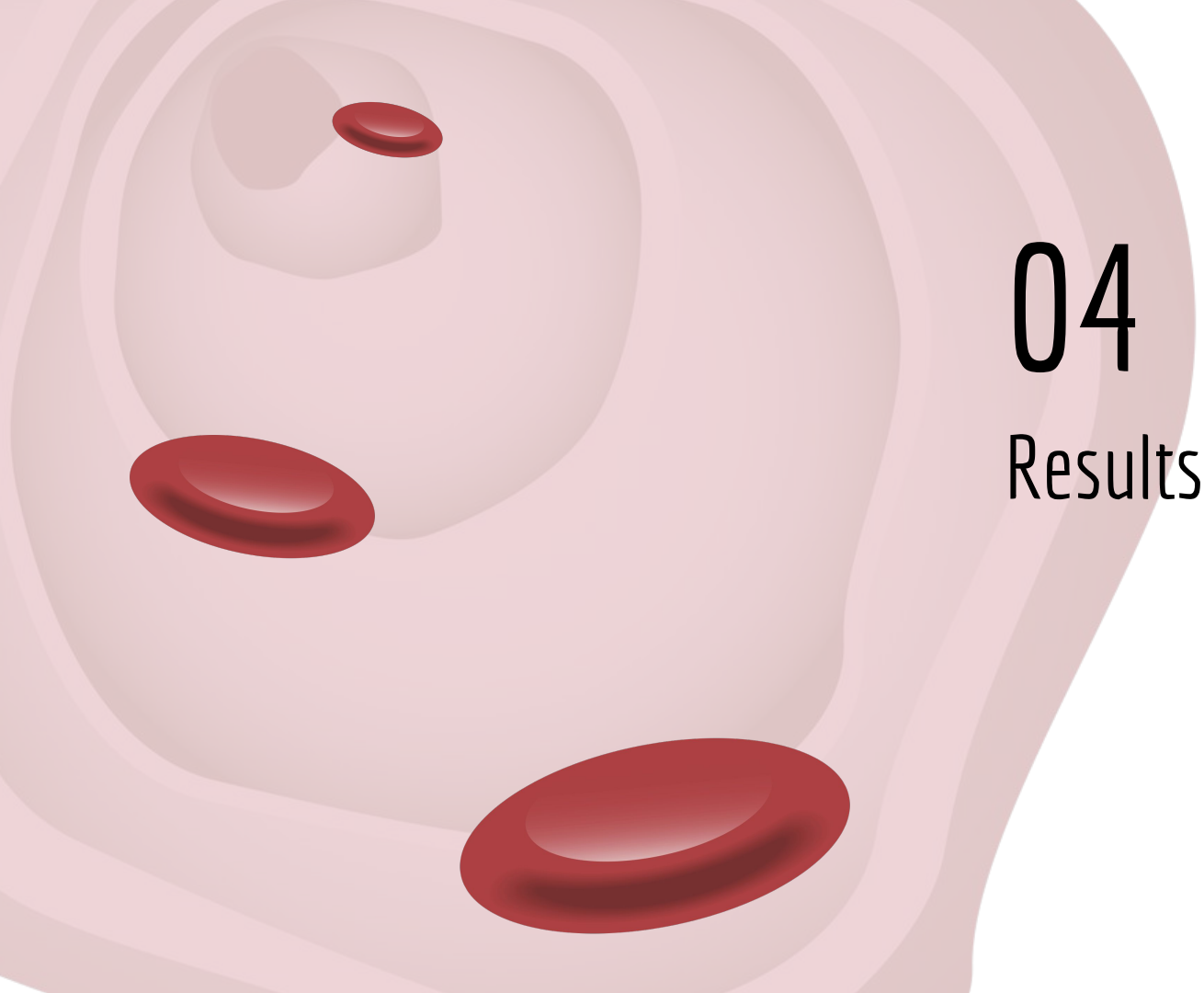
Dropout

FC
128

BN

Dropout

Output
4

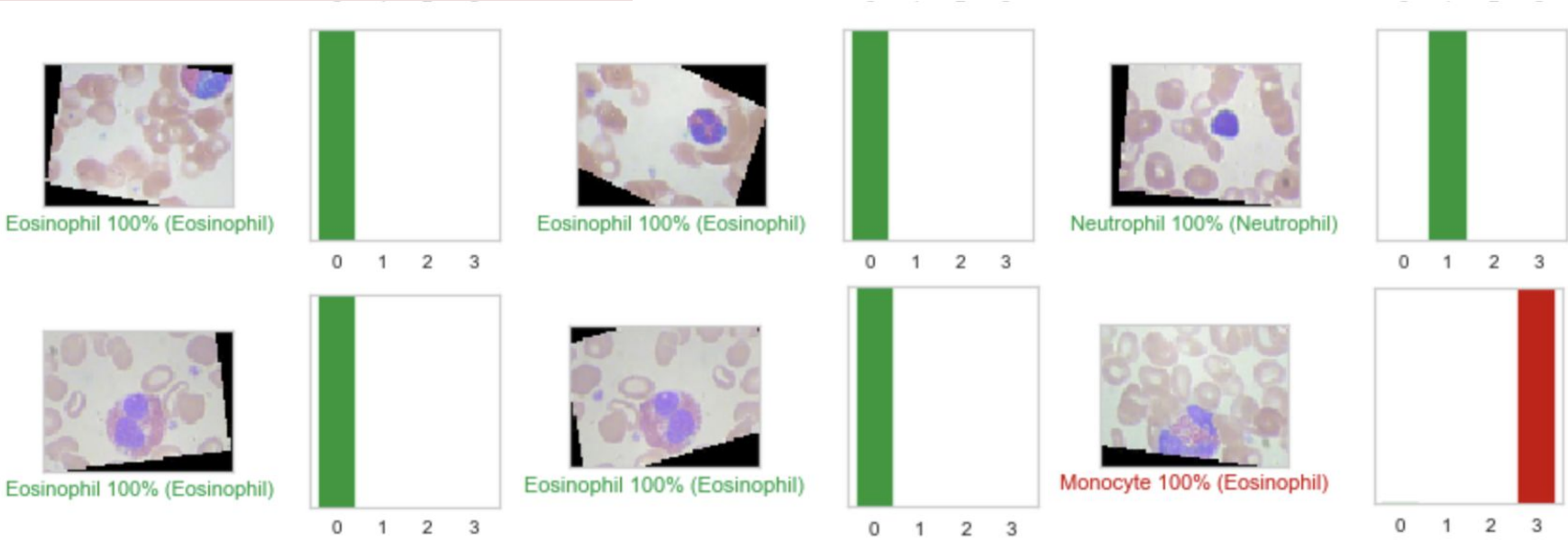


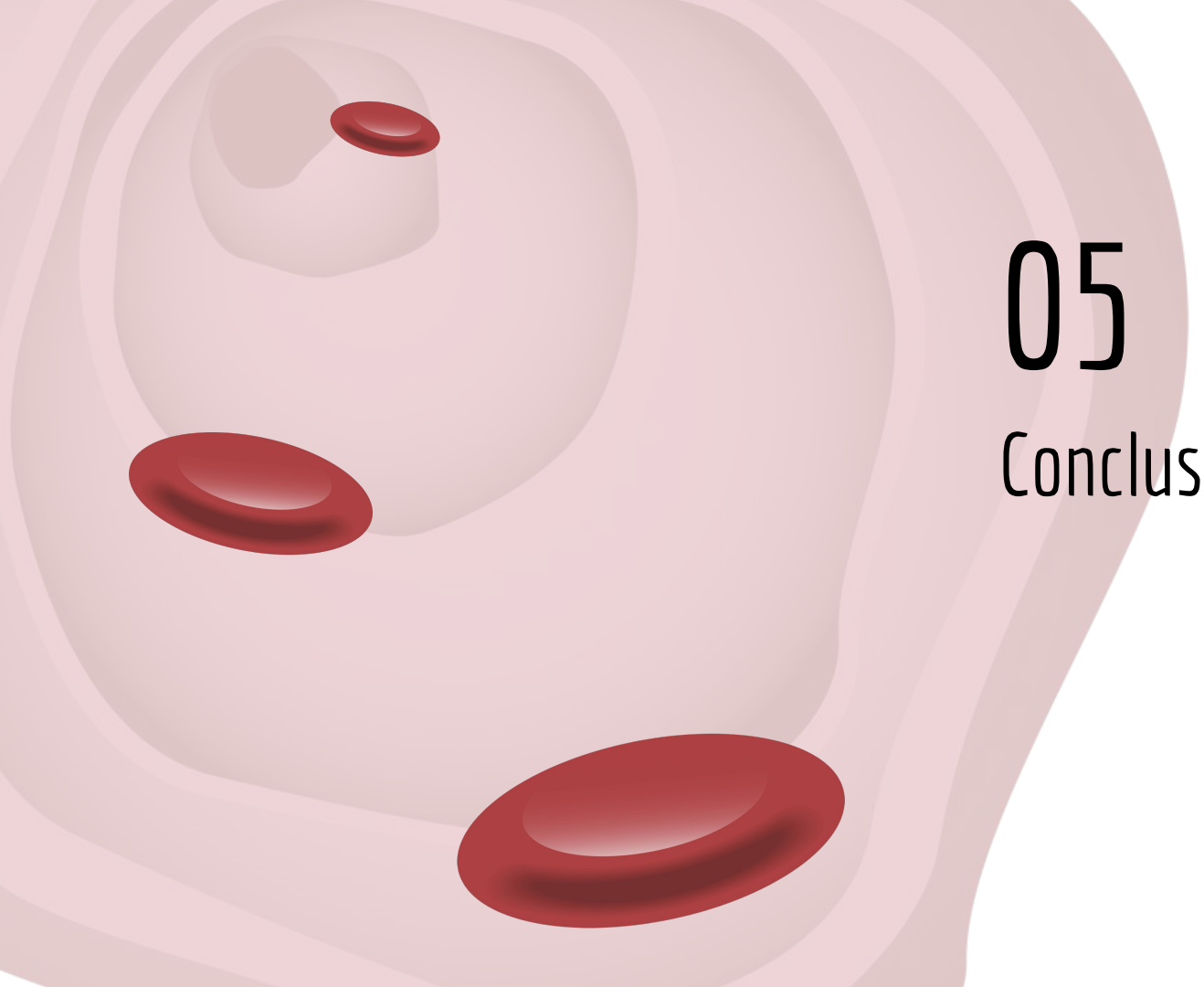
04

Results

Results

Accuracy 85%



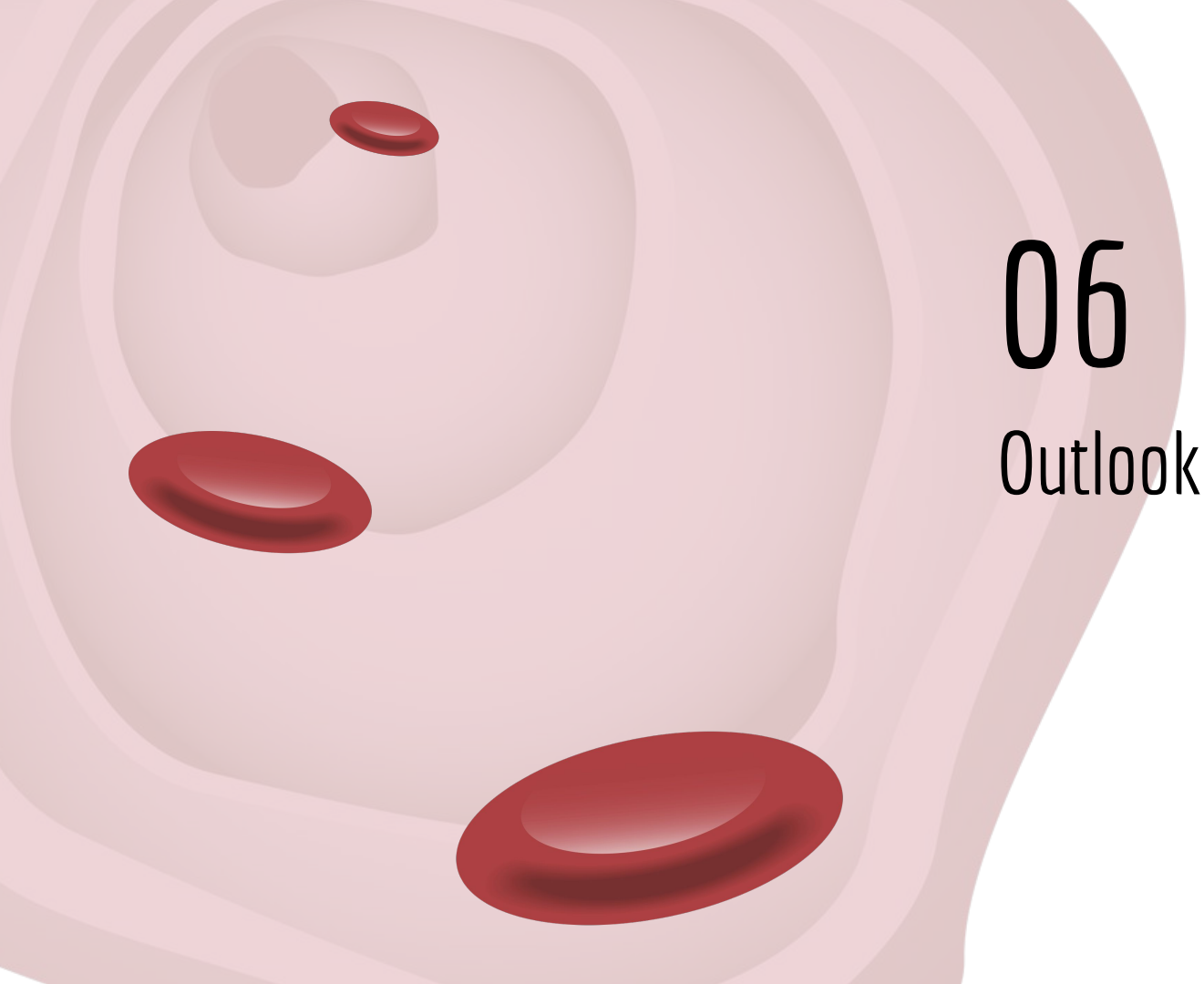


05

Conclusions

Conclusions

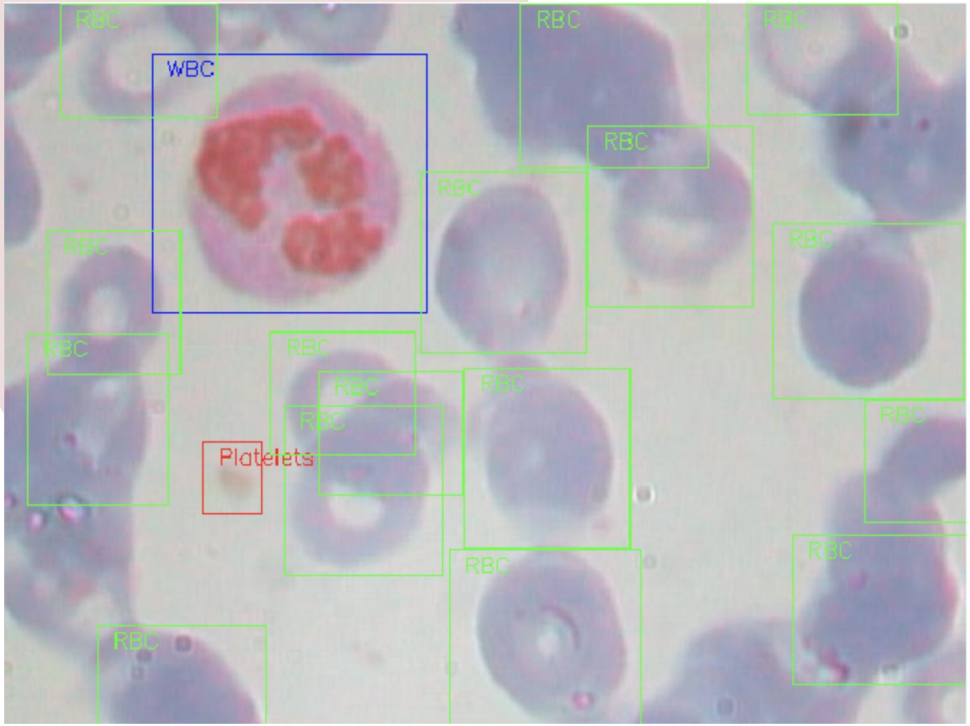
- Developed automated tool for blood cell classification from images
- Classified 4 types of cells
- 85% accuracy
- First step to a bigger problem:
  In practice important to detect and count white blood cells

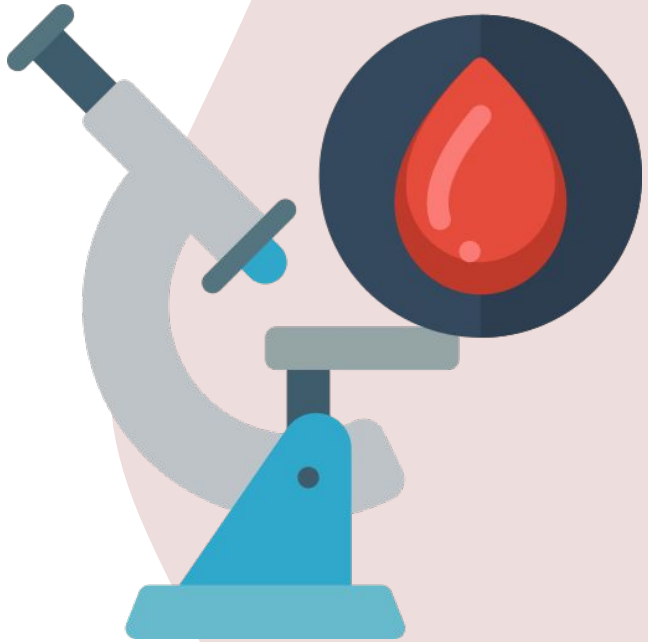


06

Outlook

Outlook: Object Detection





An increased or decreased number of leukocytes indicates the presence of a disorder.

Thank you.

falbrechtg@gmail.com

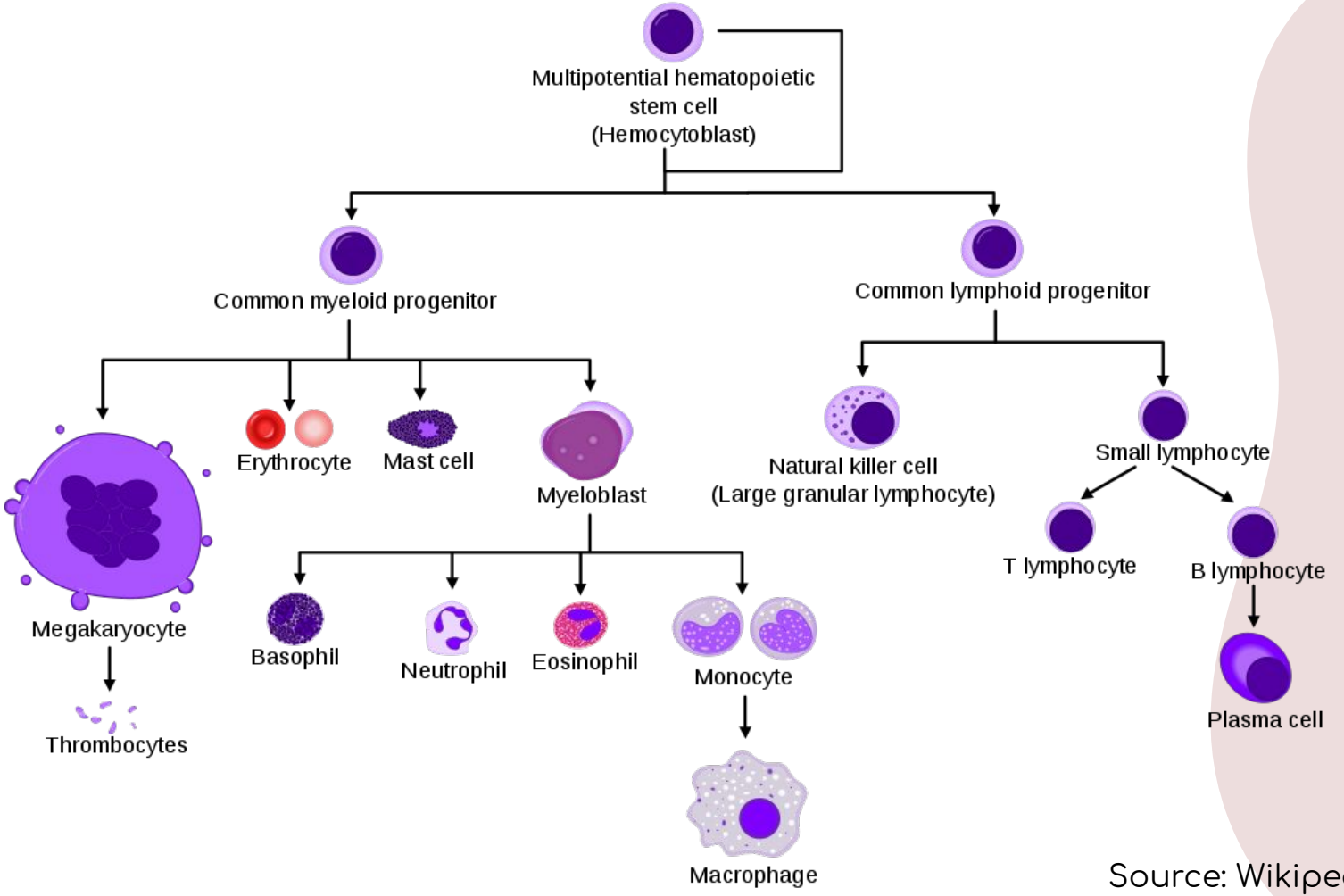
https://github.com/froukje/

Data

Category	
Eosinophil	Responsible for combating multicellular parasites and certain infections; control mechanisms associated with allergy and asthma
Neutrophil	Kill bacterias. Migrate toward sites of infection or inflammation
Lymphocyte	Lysis of virally infected cells and tumour cells; Release cytokines and growth factors that regulate other immune cells; Immunoregulation and cytotoxicity; Secretion of antibodies
Monocyte	Replenishing resident macrophages under normal conditions; migration in response to inflammation signals; differentiation into macrophages or dendritic cells to effect an immune response.

Data

Category	Type	Size	%
Eosinophil	granulocyte/ myeloid	12–17μm	1 - 3%
Neutrophil	granulocyte/ myeloid	12–15μm	60 - 70%
Lymphocyte	mononuclear leukocyte (agranulocyte)/ lymphoid	6-10μm	25 - 40%
Monocyte	mononuclear leukocyte (agranulocyte)/ myeloid	12-10μm	2 - 10%

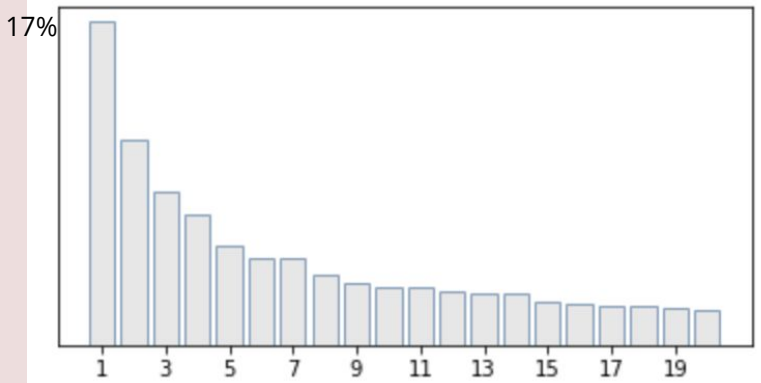


Source: Wikipedia

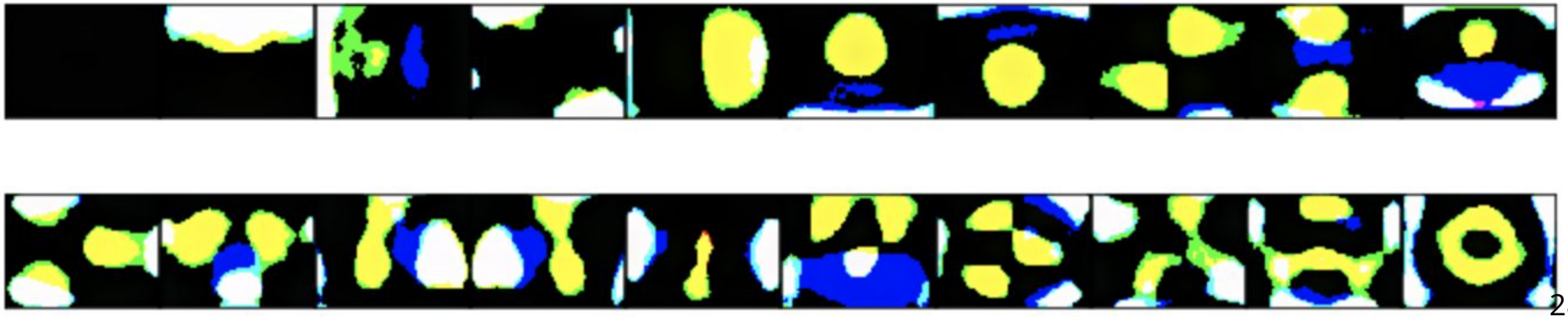
Principal Component Analysis

Principal Component Analysis

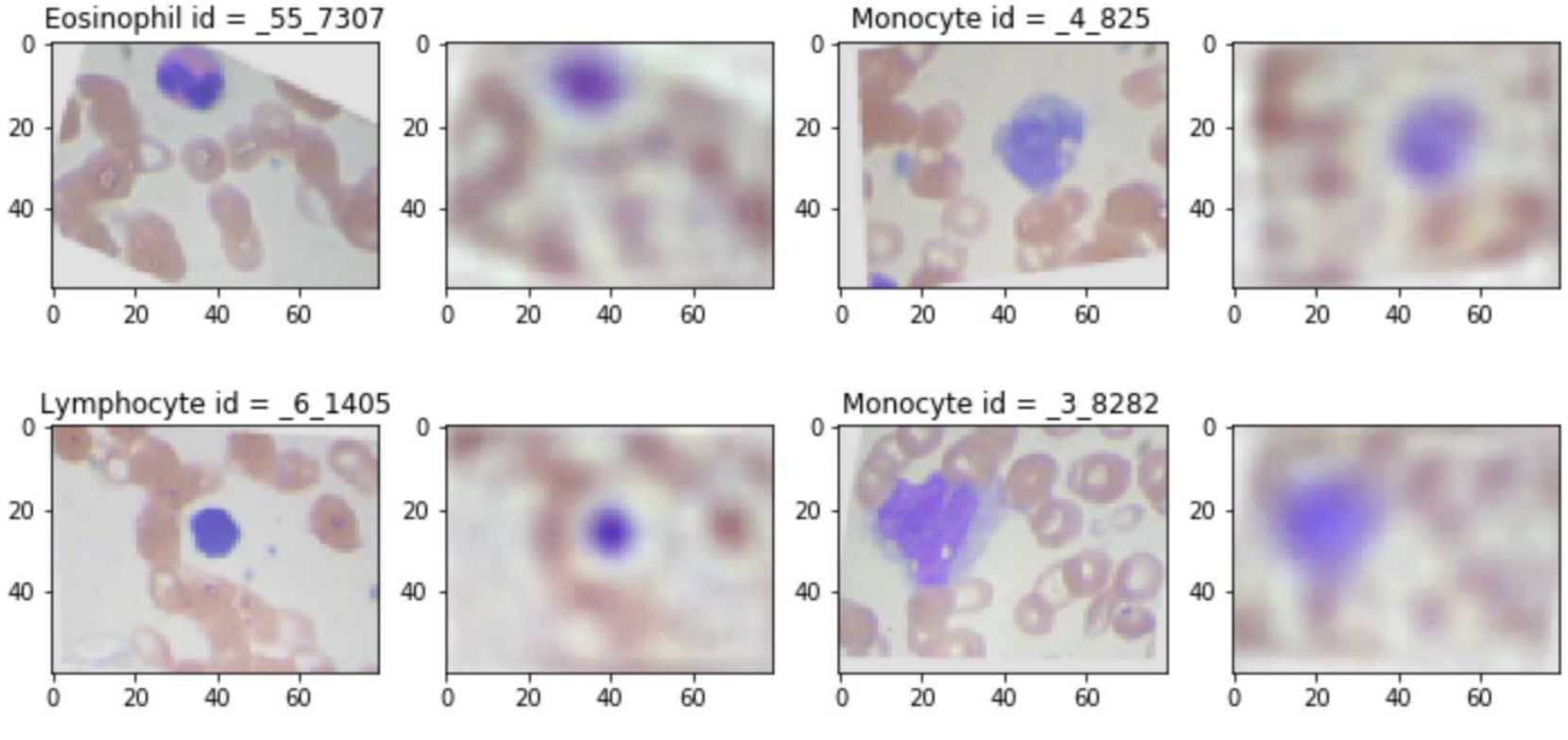
Explained Variance

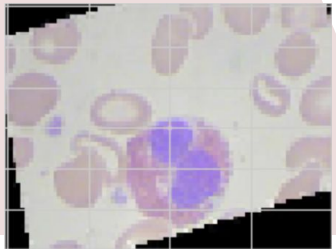


Eigenvectors



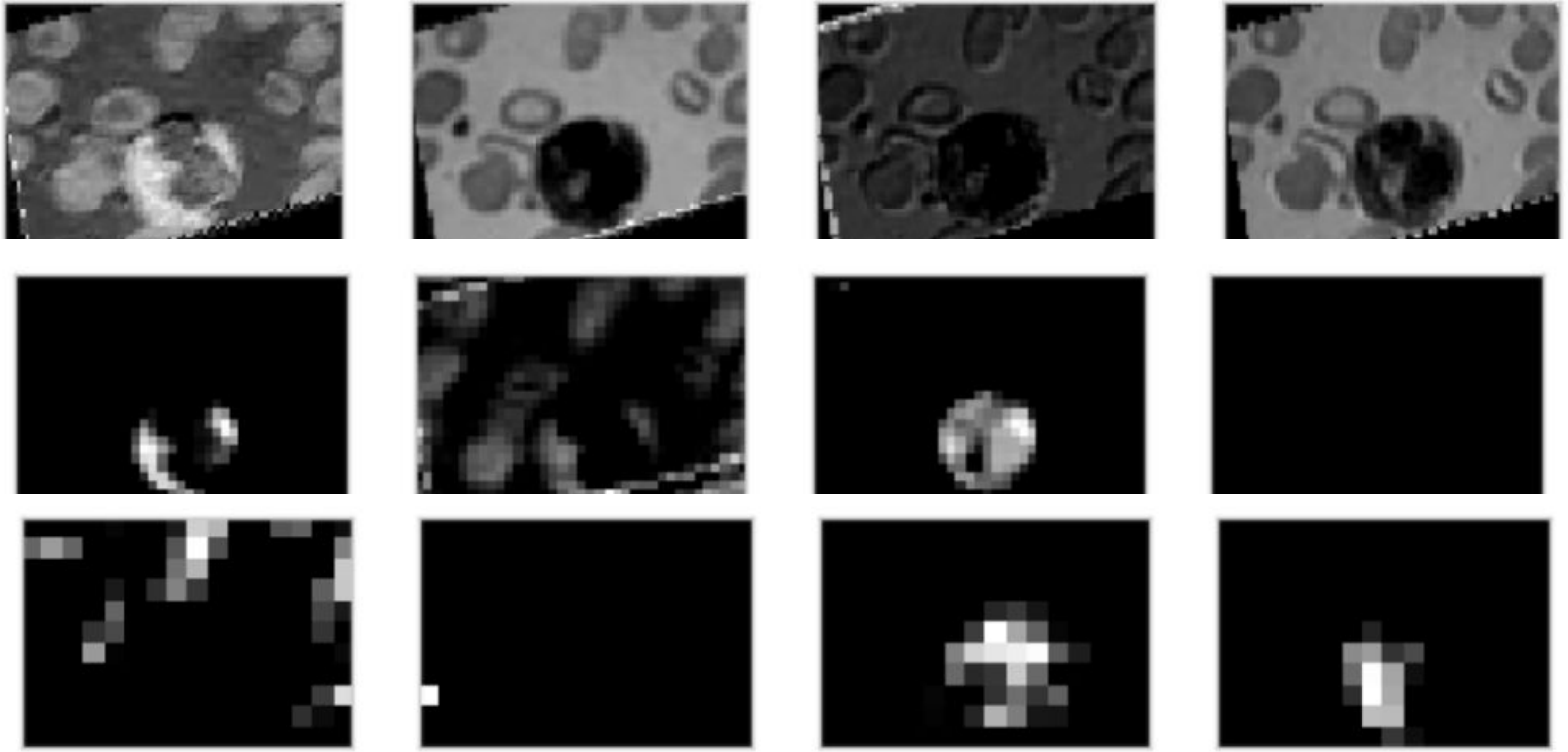
Principal Component Analysis





input

Feature Importance

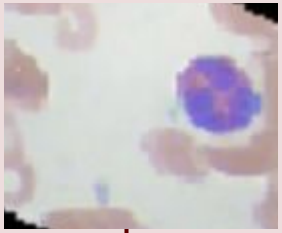


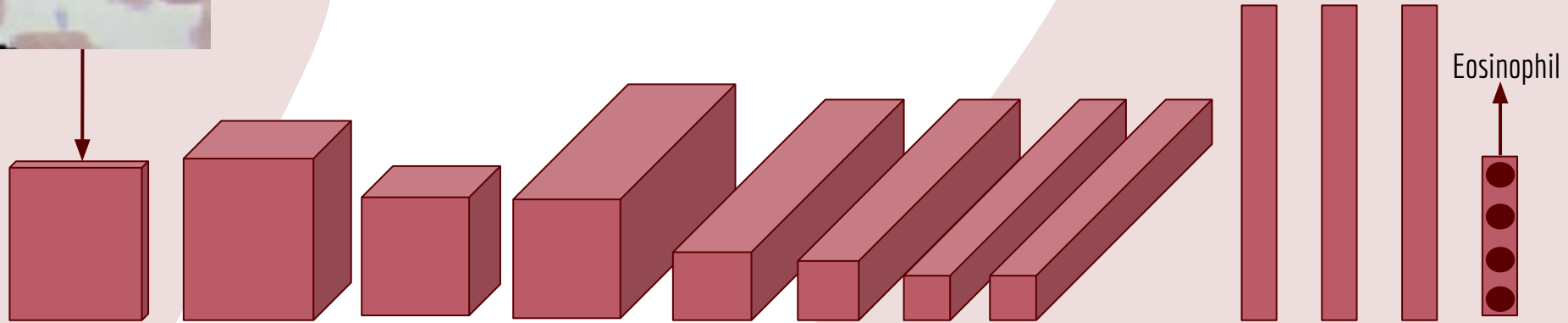
1. ConvLayer

2. ConvLayer

3. ConvLayer

Convolutional Neural Network





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MaxPool
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Dropout

FC
128

BN

Dropout

Output
4