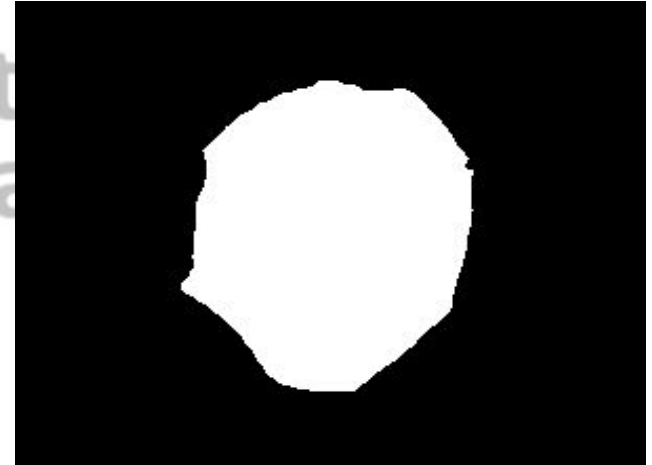
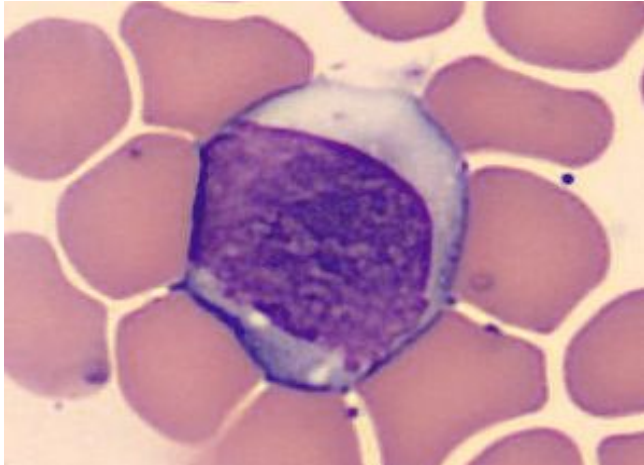


# Approach 1 - Simple methods for Image Segmentation

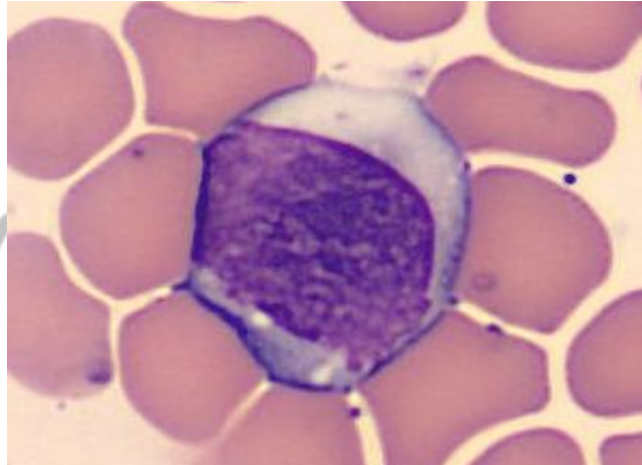
# What we will be covering in this module?

- Introduction to Image Segmentation
- How to solve Image Segmentation problems?
- Approaches for Image Segmentation
  - Use Traditional Methods
  - Leverage Deep Learning
- Understanding Deep Learning Architectures for Image Segmentation
- Project on Lane Segmentation for Self Driving Cars
- What's Next?

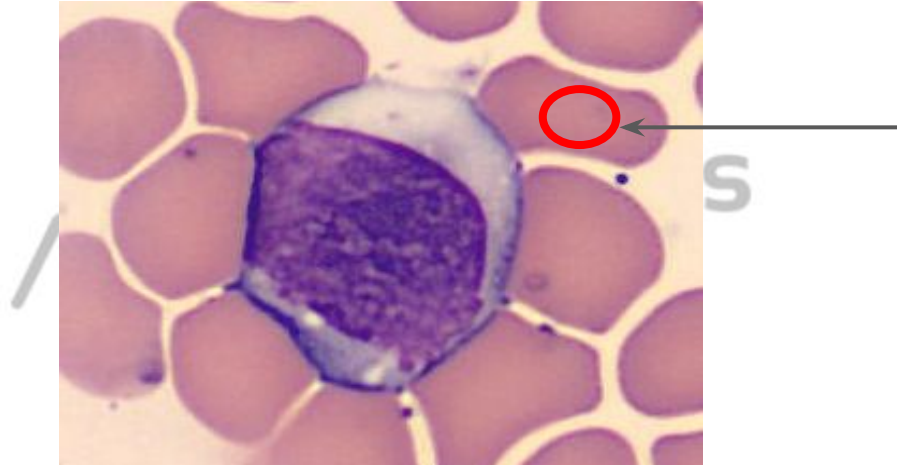
# Approach to solve Blood Cell Segmentation



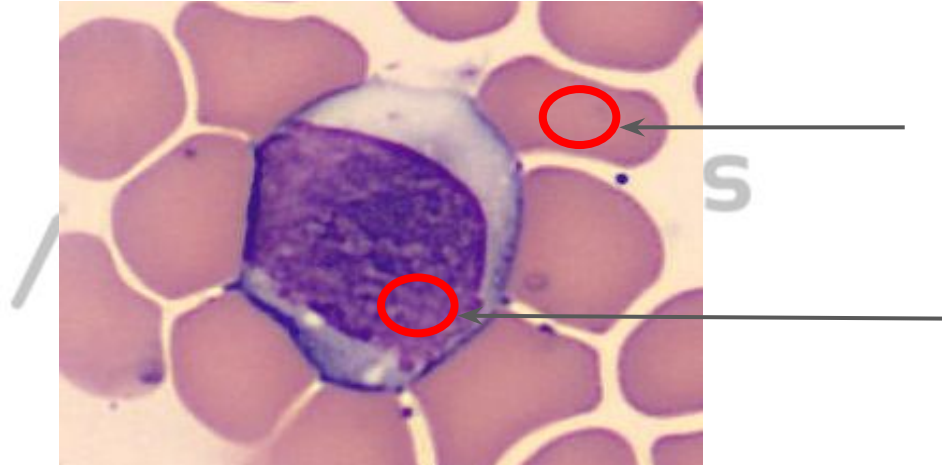
# Color as a feature for classification



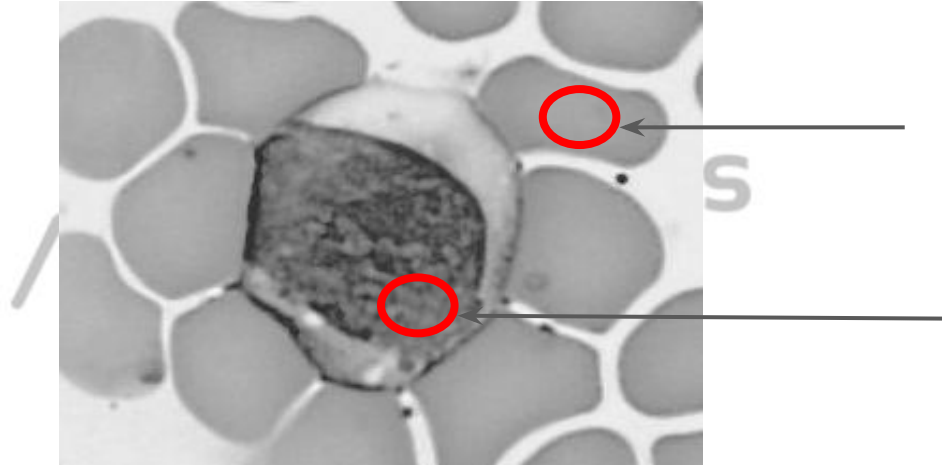
# Color as a feature for classification



# Color as a feature for classification



# Color as a feature for classification



# Concept of Thresholding

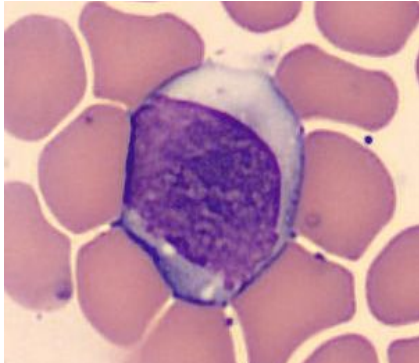


0	2	15	0	0	11	10	0	0	0	9	9	0	0	0
0	0	0	4	60	157	236	255	255	177	95	61	32	0	29
0	10	16	119	238	255	244	245	243	250	249	255	222	103	10
0	14	170	255	255	244	254	255	253	245	255	249	253	251	124
2	98	255	228	255	251	254	211	141	116	122	215	251	238	255
13	217	243	255	155	33	226	52	2	0	10	13	232	255	255
16	229	252	254	49	12	0	0	7	7	0	70	237	252	235
6	141	245	255	212	25	11	9	3	0	115	236	243	255	137
0	87	252	250	248	215	60	0	1	121	252	255	248	144	6
0	13	113	255	255	245	255	182	181	248	252	242	208	36	0
1	0	5	117	251	255	241	255	247	255	241	162	17	0	7
0	0	0	4	58	251	255	246	254	253	255	120	11	0	1
0	0	4	97	255	255	255	248	252	255	244	255	182	10	0
0	22	206	252	246	251	241	100	24	113	255	245	255	194	9
0	111	255	242	255	158	24	0	0	6	39	255	232	230	56
0	218	251	250	137	7	11	0	0	0	2	62	255	250	125
0	173	255	255	101	9	20	0	13	3	13	182	251	245	61
0	107	251	241	255	230	98	55	19	118	217	248	253	255	52
0	18	146	250	255	247	255	255	255	249	255	240	255	129	0
0	0	23	113	215	255	250	248	255	255	248	248	118	14	12
0	0	6	1	0	52	153	233	255	252	147	37	0	0	4
0	0	5	5	0	0	0	0	14	1	0	6	6	0	0

0	2	15	0	0	11	10	0	0	0	0	9	9	0	0
0	0	0	4	60	157	236	255	255	177	95	61	32	0	29
0	10	16	119	238	255	244	245	243	250	249	255	222	103	10
0	14	170	255	255	244	254	255	253	245	255	249	253	251	124
2	98	255	228	255	251	254	211	141	116	122	215	251	238	255
13	217	243	255	155	33	226	52	2	0	10	13	232	255	255
16	229	252	254	49	12	0	0	7	7	0	70	237	252	235
6	141	245	255	212	25	11	9	3	0	115	236	243	255	137
0	87	252	250	248	215	60	0	1	121	252	255	248	144	6
0	13	113	255	255	245	255	182	181	248	252	242	208	36	0
1	0	5	117	251	255	241	255	247	255	241	162	17	0	7
0	0	0	4	58	251	255	246	254	253	255	120	11	0	1
0	0	4	97	255	255	255	248	252	255	244	255	182	10	0
0	22	206	252	246	251	241	100	24	113	255	245	255	194	9
0	111	255	242	255	158	24	0	0	6	39	255	232	230	56
0	218	251	250	137	7	11	0	0	0	2	62	255	250	125
0	173	255	255	101	9	20	0	13	3	13	182	251	245	61
0	107	251	241	255	230	98	55	19	118	217	248	253	255	52
0	18	146	250	255	247	255	255	255	249	255	240	255	129	0
0	0	23	113	215	255	250	248	255	255	248	248	118	14	12
0	0	6	1	0	52	153	233	255	252	147	37	0	0	4
0	0	5	5	0	0	0	0	14	1	0	6	6	0	0

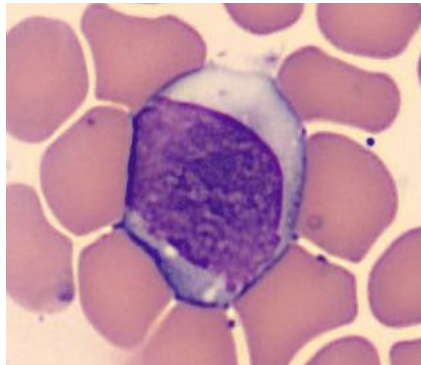


# Image Segmentation through Thresholding

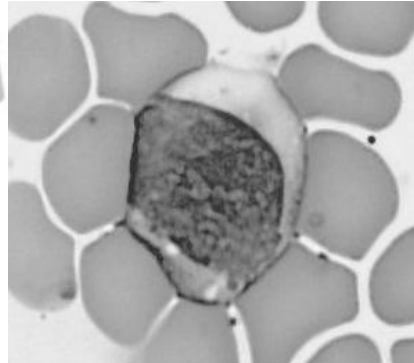


 Analytics  
Vidhya

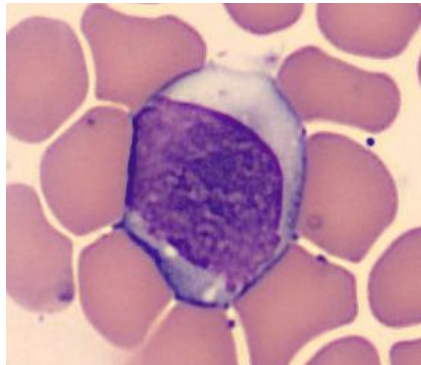
# Image Segmentation through Thresholding



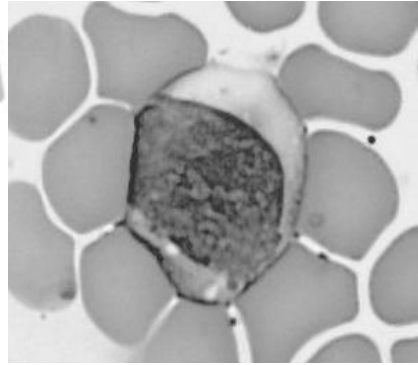
grayscale



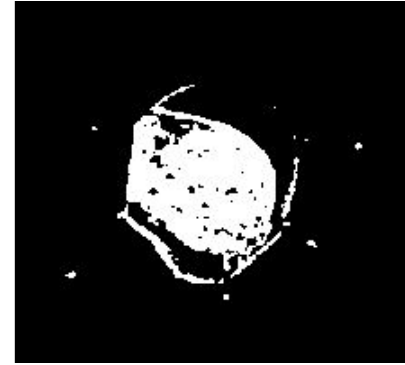
# Image Segmentation through Thresholding



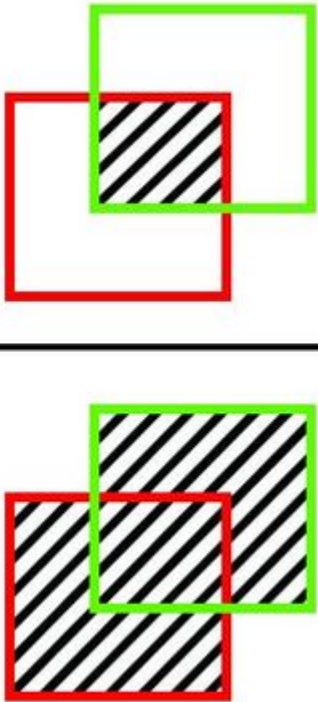
grayscale



threshold



# Evaluation metric for Image Segmentation

$$\text{IoU} = \frac{\text{Area of Intersection}}{\text{Area of Union}} > \text{threshold}$$


The diagram illustrates the Intersection over Union (IoU) metric for image segmentation. It consists of two parts. The top part shows two overlapping rectangles: a red one and a green one. The intersection area, where the two rectangles overlap, is shaded with black diagonal lines. The bottom part shows the same two rectangles, but the entire union area, which is the combined area of both rectangles, is shaded with black diagonal lines. The formula  $\text{IoU} = \frac{\text{Area of Intersection}}{\text{Area of Union}} > \text{threshold}$  is displayed, with the numerator corresponding to the shaded intersection in the top diagram and the denominator corresponding to the shaded union in the bottom diagram.

# Steps for Image Segmentation through Thresholding

## 1. Data Loading and Preprocessing



# Steps for Image Segmentation through Thresholding

## 1. Data Loading and Preprocessing

### 1.1 Load the Data



# Steps for Image Segmentation through Thresholding

## 1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Data Exploration



# Steps for Image Segmentation through Thresholding

## 1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Data Exploration

1.3 Data Preprocessing





# Steps for Image Segmentation through Thresholding

## 1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Data Exploration

1.3 Data Preprocessing



## 2. Image Segmentation through Thresholding

# Steps for Image Segmentation through Thresholding

## 1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Data Exploration

1.3 Data Preprocessing



## 2. Image Segmentation through Thresholding

2.1 Convert image to grayscale

# Steps for Image Segmentation through Thresholding

## 1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Data Exploration

1.3 Data Preprocessing



## 2. Image Segmentation through Thresholding

2.1 Convert image to grayscale

2.2 Apply the right threshold

# Steps for Image Segmentation through Thresholding

## 1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Data Exploration

1.3 Data Preprocessing



## 2. Image Segmentation through Thresholding

2.1 Convert image to grayscale

2.2 Apply the right threshold

2.3 Calculate IoU score

# Code Walkthrough of Thresholding

# Image Segmentation through Thresholding

## Pros:

- Simple Approach - Easy to understand



# Image Segmentation through Thresholding

## Pros:

- Simple Approach - Easy to understand

## Cons:

- Involves hard coding threshold values

# Image Segmentation through Thresholding

## Pros:

- Simple Approach - Easy to understand

## Cons:

- Involves hard coding threshold values
- Different images can have different thresholds



# Image Segmentation through Thresholding

## Pros:

- Simple Approach - Easy to understand

## Cons:

- Involves hard coding threshold values
- Different images can have different thresholds
- Different objects can have same color

# Approach to solve Blood Cell Segmentation

