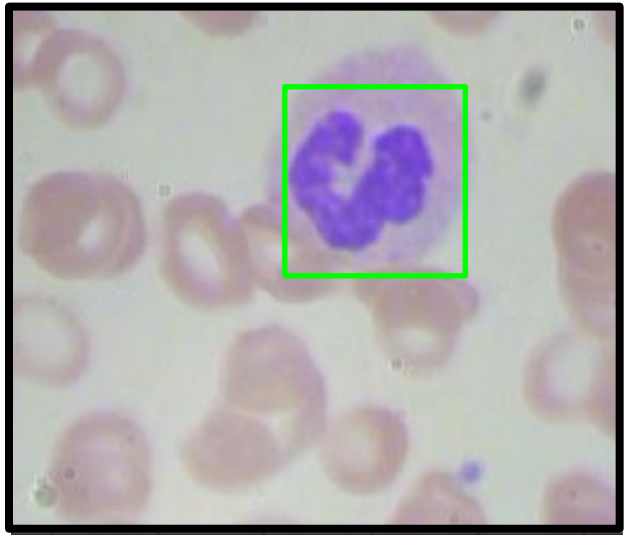
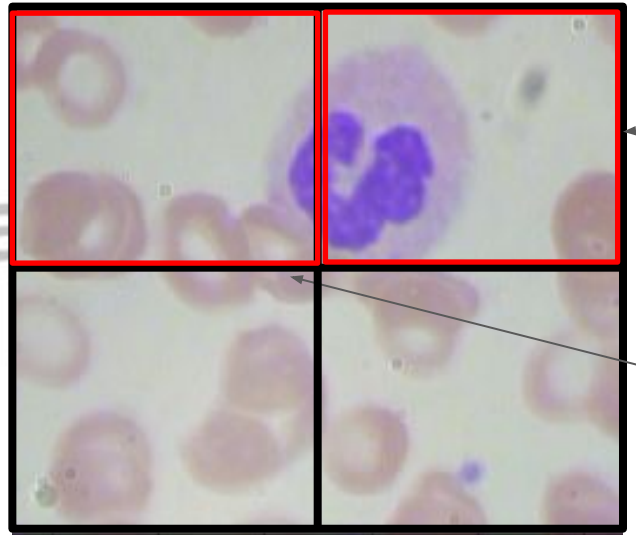
Understanding Intersection Over Union

Selecting Bounding Box



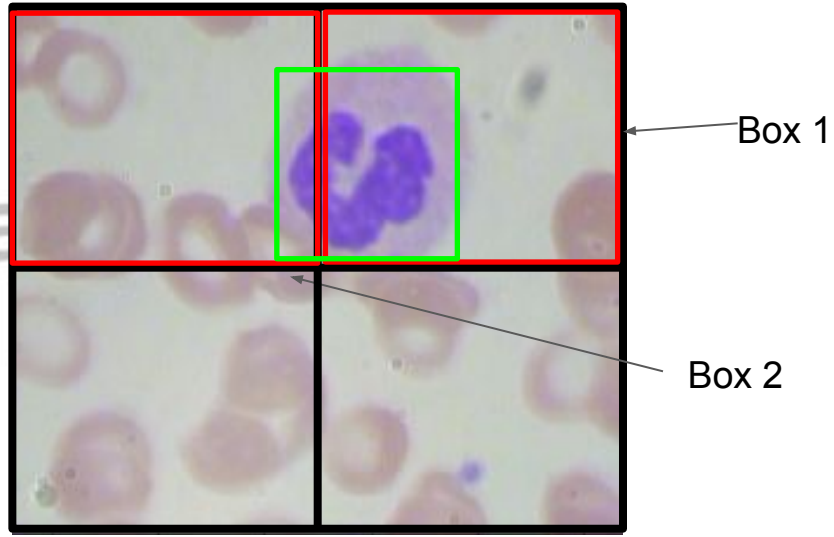
Original Bounding Box



Predicted Bounding Boxes

Selecting Bounding Box

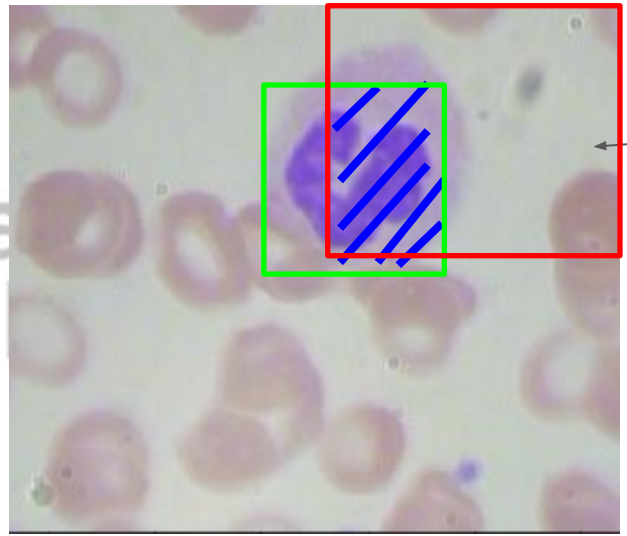
Which Bounding Box is more accurate?



Predicted Bounding Boxes

Bounding Box Intersection

Which Bounding Box is more accurate?

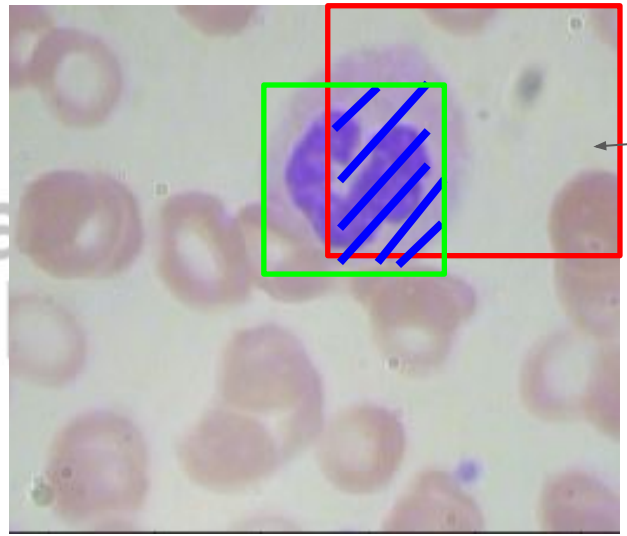


Predicted Bounding Boxes

Bounding Box Intersection

Which Bounding Box is more accurate?

Area of Intersection = 70%

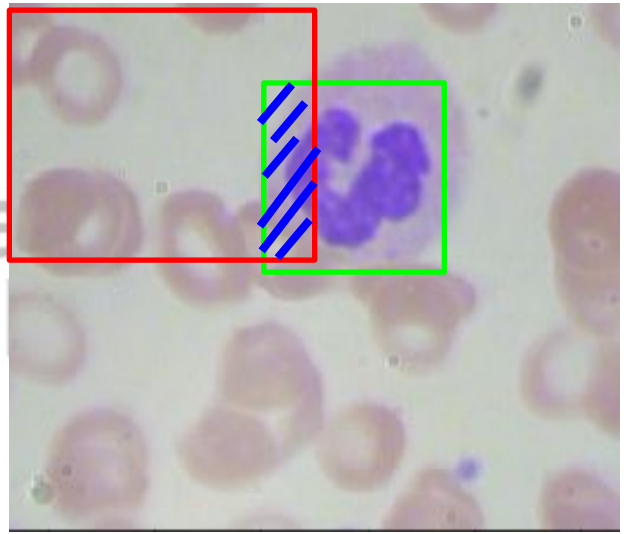


Predicted Bounding Boxes

Bounding Box Intersection

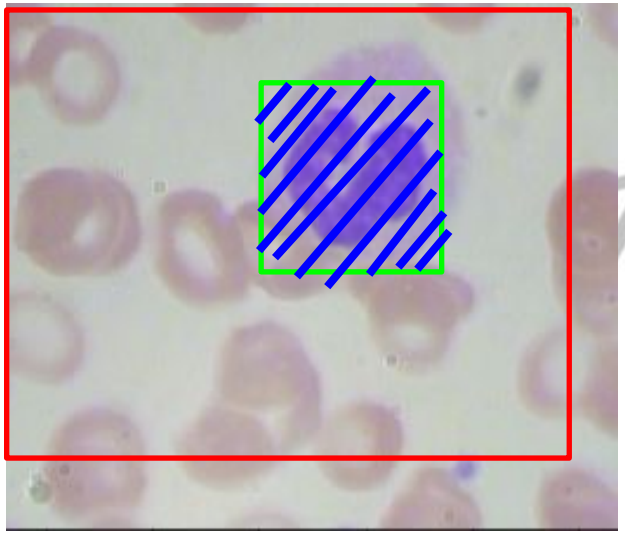
Which Bounding Box is more accurate?

Area of Intersection = 20%

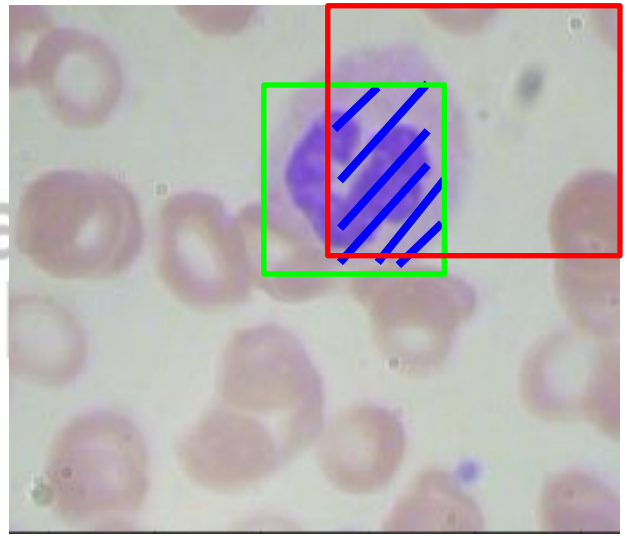


Predicted Bounding Boxes

Problem with Bounding Box Intersection



Area of Intersection = 100%

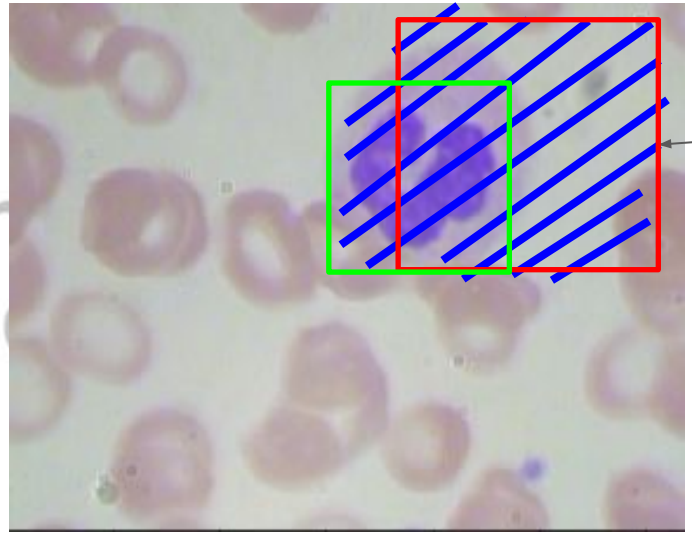


Area of Intersection = 70%

Intersection over Union (IoU)

Which Bounding Box is more accurate?

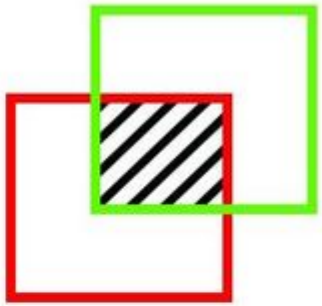
$$IoU = \frac{\text{Area of Intersection}}{\text{Area of Union}}$$

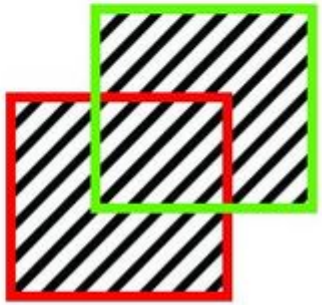


Predicted Bounding Boxes

Intersection over Union (IoU)

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





Range of Intersection over Union (IoU)

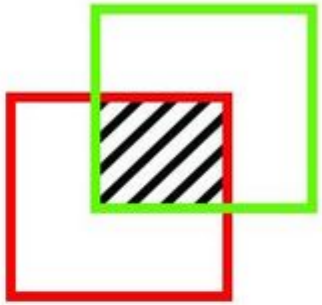
$$IoU = \frac{\text{Area of Intersection}}{\text{Area of Union}} = 0$$

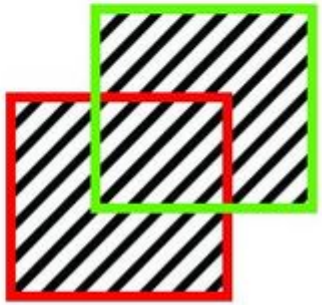
Range of Intersection over Union (IoU)

$$IoU = \frac{\text{Area of Intersection}}{\text{Area of Union}} = 1$$

Intersection over Union (IoU)

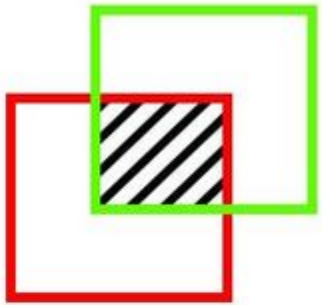
$$IoU = \frac{\text{Area of Intersection}}{\text{Area of Union}} > \text{threshold}$$

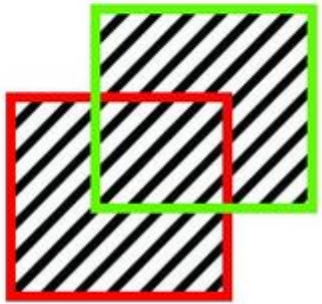




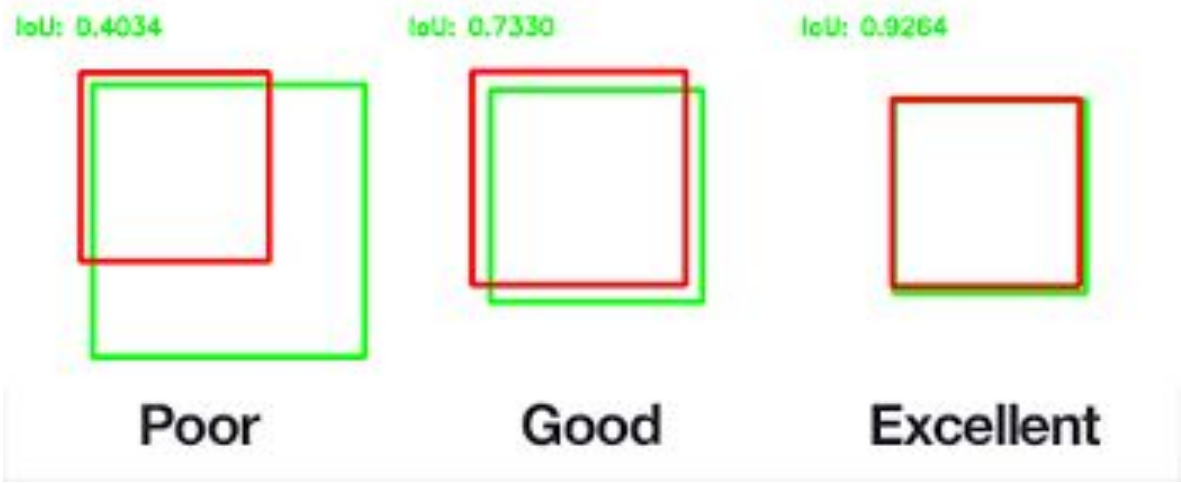
Intersection over Union (IoU)

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

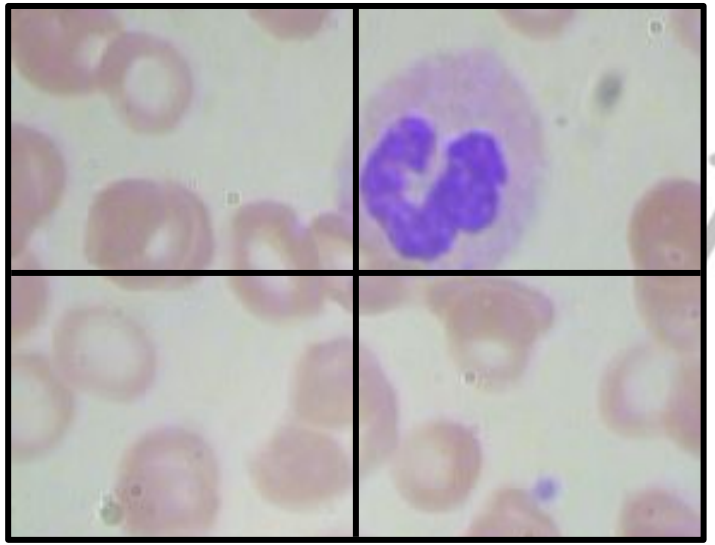




Intersection over Union (IoU)

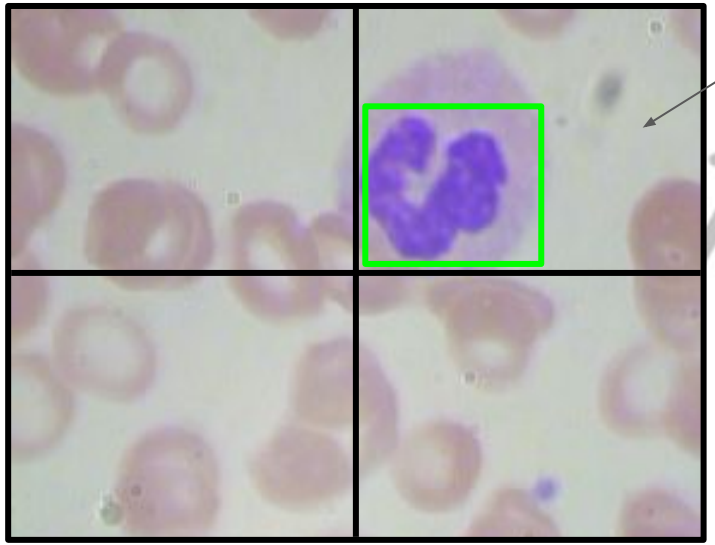


Prepare Train Data for Naive Approach



filename	patch	xmin	xmax	ymin	ymax	WBC (1/0)
1.jpg	1	0	320	0	240	0
1.jpg	2	320	640	0	240	1
1.jpg	3	0	320	240	480	0
1.jpg	4	320	640	240	480	0

Calculating IoU



IOU > 0.5

filename	patch	xmin	xmax	ymin	ymax	WBC (1/0)
1.jpg	1	0	320	0	240	0
1.jpg	2	320	640	0	240	1
1.jpg	3	0	320	240	480	0
1.jpg	4	320	640	240	480	0

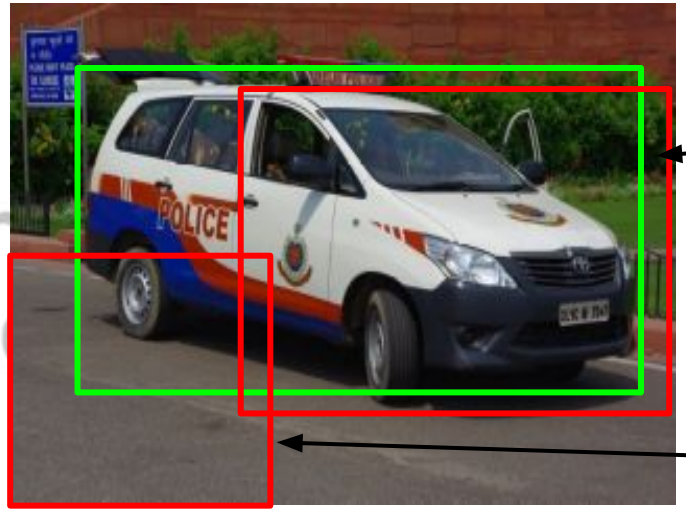
Intersection Over Union (IoU)

- IoU can be used Can be used -
  - For selecting the best bounding box
  - As an Evaluation Metric

Thank You

Intersection over Union (IoU)

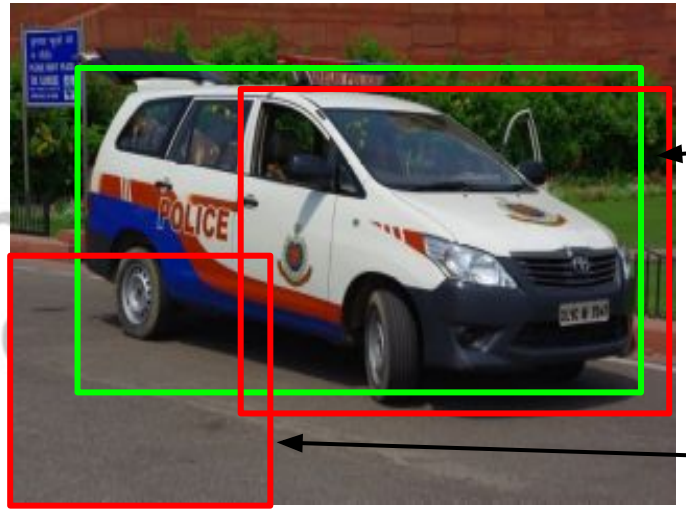
Original Bounding Box



Predicted Bounding Boxes

Intersection over Union (IoU)

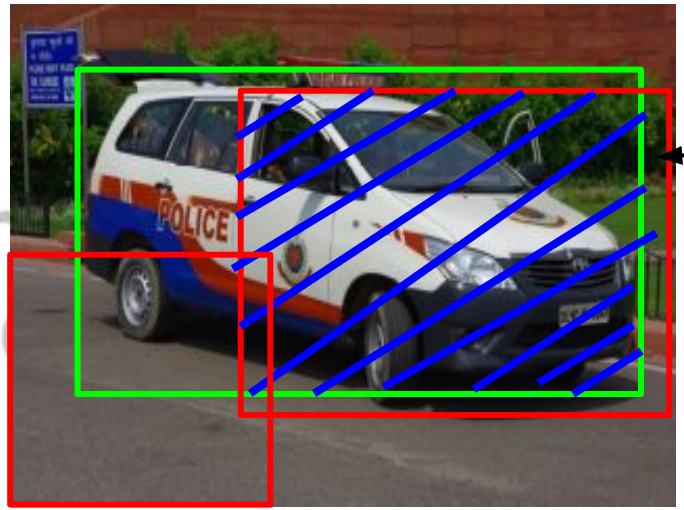
Which Bounding Box is more accurate?



Predicted Bounding Boxes

Intersection over Union (IoU)

Which Bounding Box is more accurate?

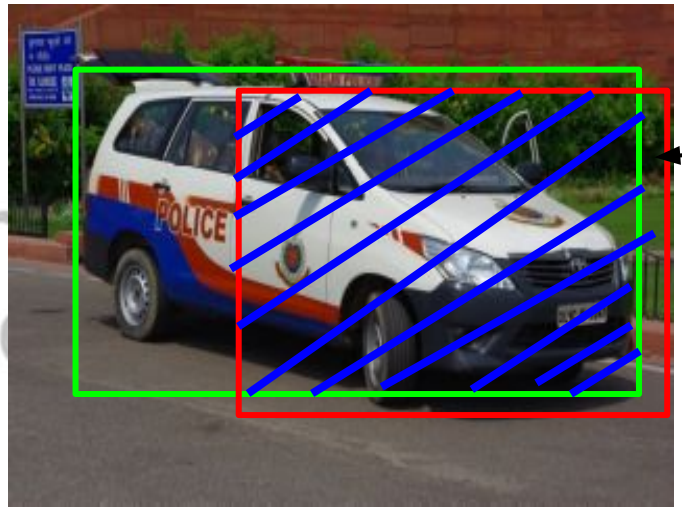


Predicted Bounding Boxes

Intersection over Union (IoU)

Which Bounding Box is more accurate?

Area of Intersection = 70%



Predicted Bounding Box 1

Intersection over Union (IoU)

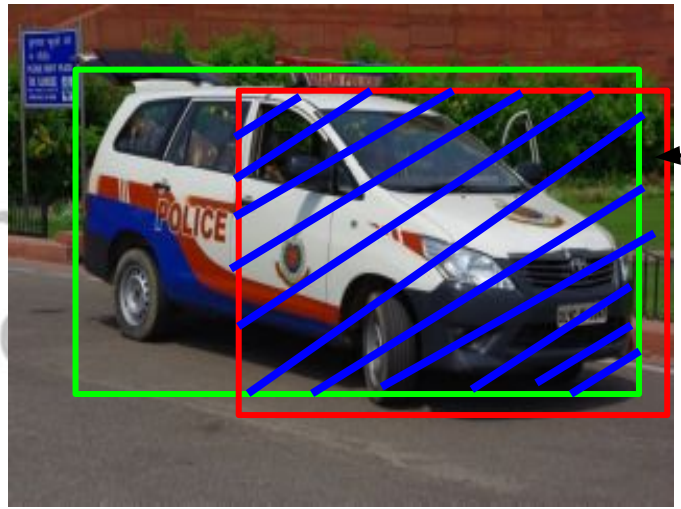
Which Bounding Box is more accurate?

Area of Intersection = 20%

Predicted Bounding Box 2

Intersection over Union (IoU)

Predicted Bounding Box 3

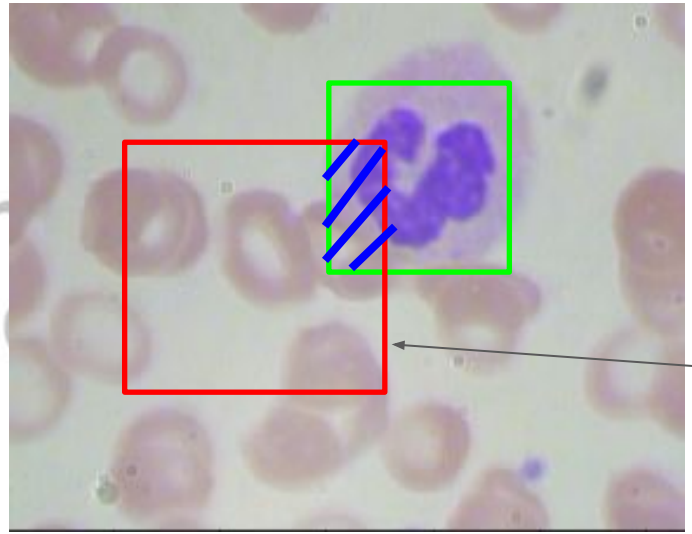


Predicted Bounding Box 1

Intersection over Union (IoU)

Which Bounding Box is more accurate?

IoU = Area of Intersection

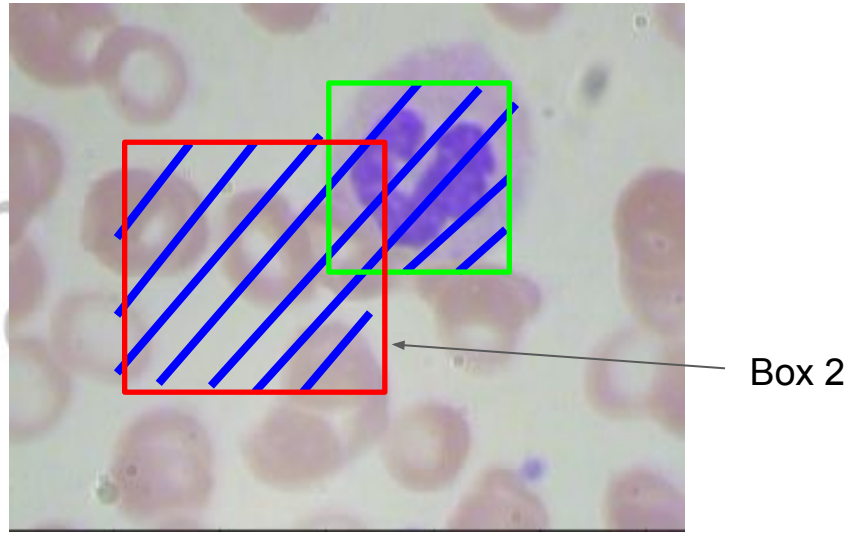


Predicted Bounding Boxes

Intersection over Union (IoU)

Which Bounding Box is more accurate?

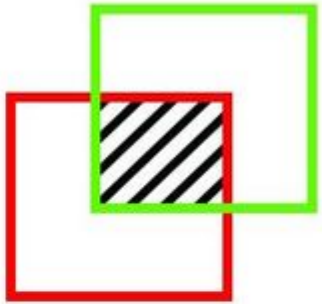
$$IoU = \frac{\text{Area of Intersection}}{\text{Area of Union}}$$

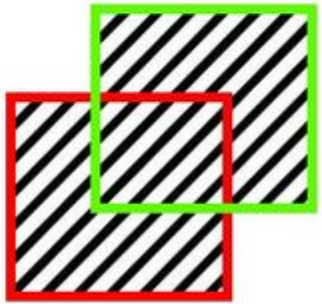


Predicted Bounding Boxes

Intersection over Union (IoU)

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

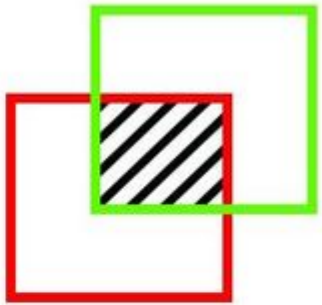


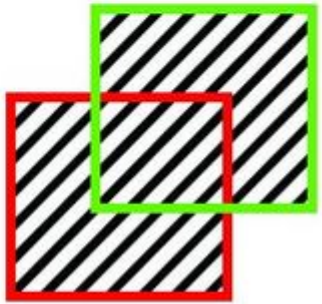


True Positive

Intersection over Union (IoU)

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

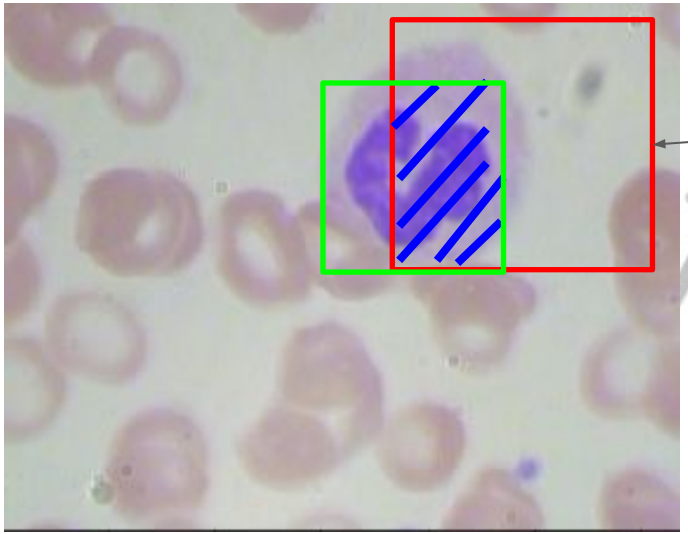


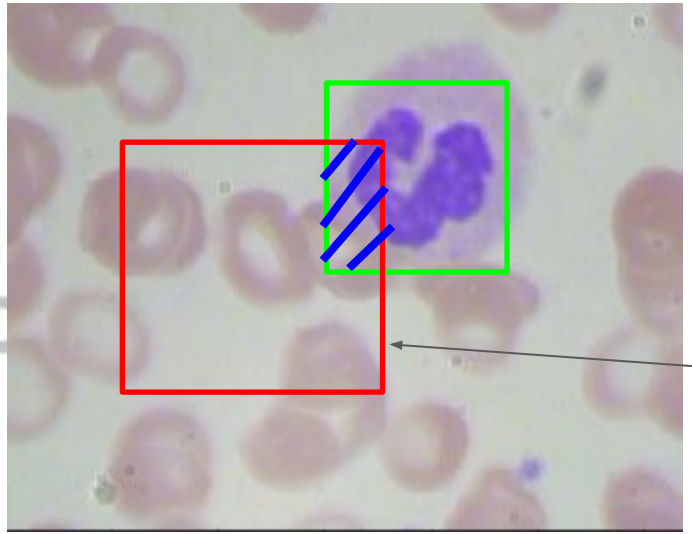


< threshold

False Positive

Intersection over Union (IoU)





True Positive

Actual class and predicted class

False Positive

Object not present in the bounding box