Automated segmentation of red blood cells

Comparison between contour detection and deep learning approaches

Compared approaches & Methodology

Approach 1 : Contour detection

Use of *Watershed* algorithm.

The watershed is a classical algorithm used for segmentation, that is, for separating different objects in an image.

Approach 2 : Deep learning

Use of a trained YOLO model.

YOLO is real-time object detection system based on neural network.

Methodology

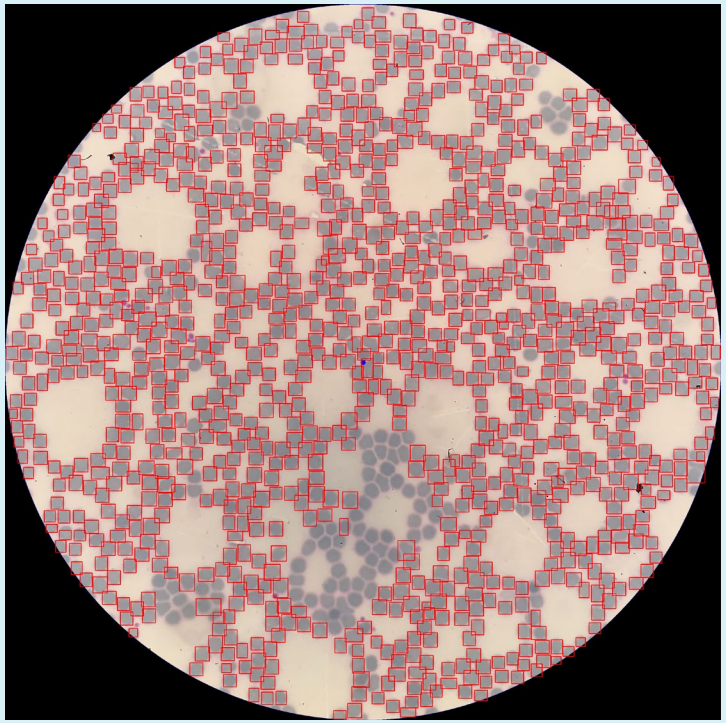
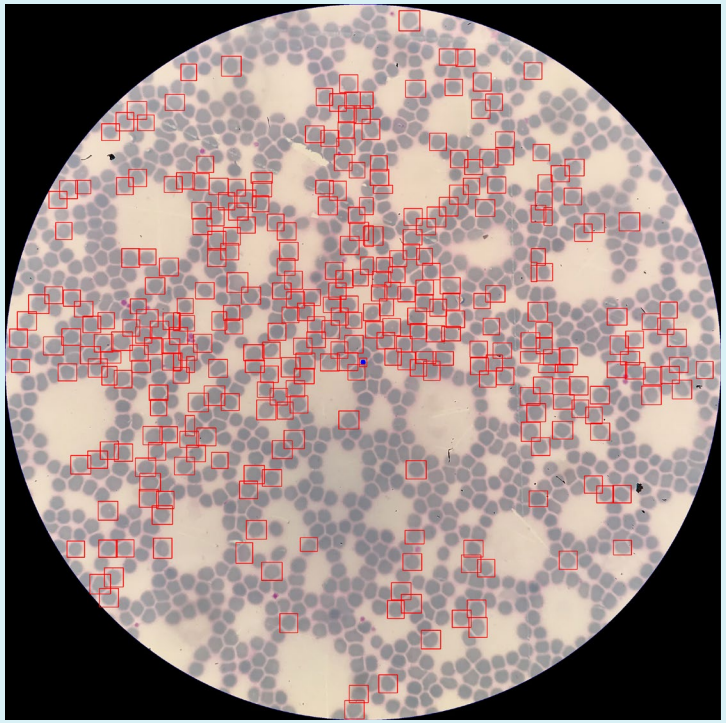
Comparison of these two approaches based on 18 blood samples.

Results

	Contour detection	Deep learning
# of compared blood samples	18	18
# of segmented red blood cells	21 243	14 337
# of positive deviation vs. other approach	18 (100%)	-
Average pourcentage of positive deviation vs. other approach	+ 64%	-
Maximum positive deviation value vs. other approach	+ 880	-
Execution time (in seconds)	16-18	10-12

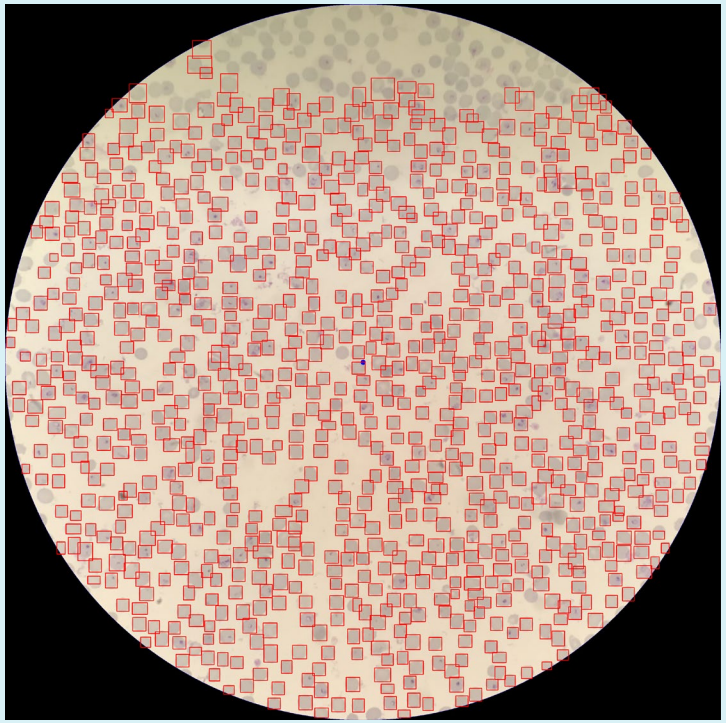
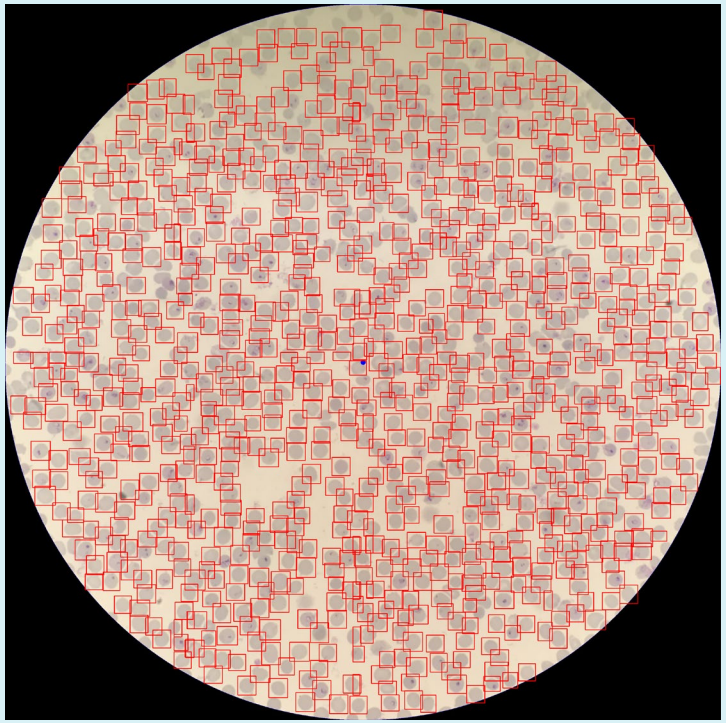
Example 1 :

Maximum positive deviation for contour detection approach

Contour detection	Deep learning
	
1213	333

Example 2 :

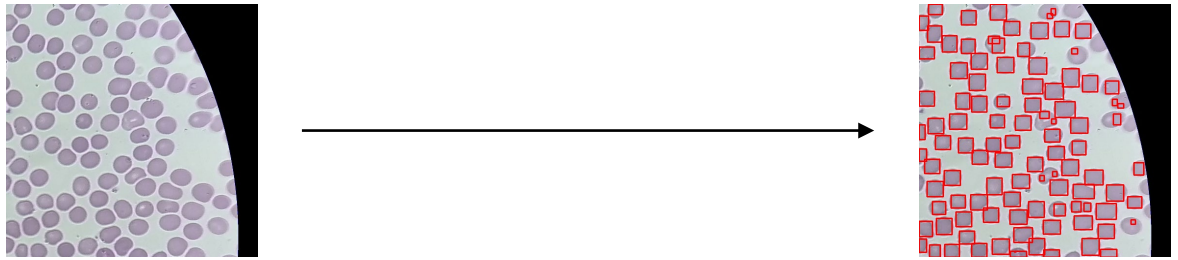
Shadow sensitivity of contour detection approach

Contour detection	Deep learning
	
1110	936

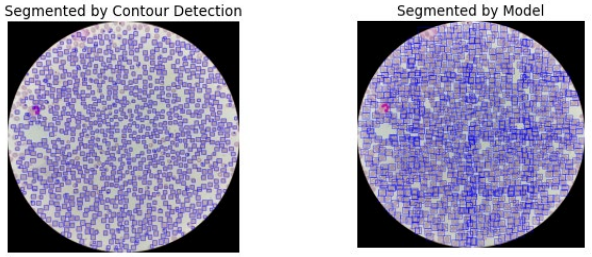
Detailed segmentation method

Step 1 : 4x4 split of the image

Step 2 : segmentation of RBCs within each splitted square



Step 3 : merge of splitted squares



Results by image

	Contour detection	Deep learning	Deviation
Image 1	1110	936	+ 19%
Image 2	1027	1007	+ 2%
Image 3	1428	956	+ 49%
Image 4	1113	588	+ 89%
Image 5	1089	871	+ 25%
Image 6	1153	844	+ 37%
Image 7	1050	783	+ 34%
Image 8	1302	421	+ 209%
Image 9	1659	825	+ 101%
Image 10	1177	855	+ 38%
Image 11	1389	624	+ 123%
Image 12	1112	1010	+ 10%
Image 13	1157	844	+ 37%
Image 14	781	577	+ 35%
Image 15	1213	333	+ 264%
Image 16	1003	700	+ 43%
Image 17	1035	966	+ 7%
Image 18	1445	1197	+ 21%

Git repository

git clone https://github.com/casusorez/plasmodium.git