Tracking and recognition of overlapping digits on video

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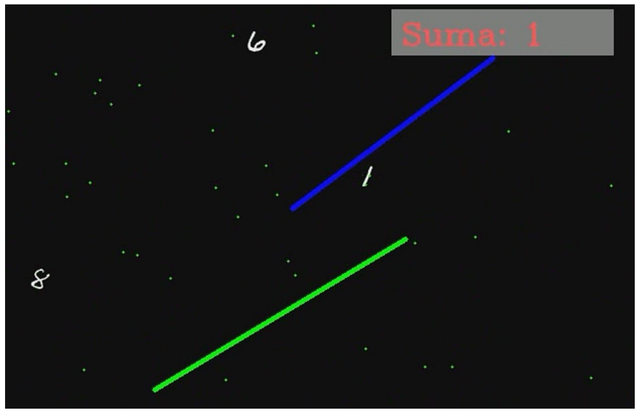
Problem

Problem is artificially created. Digits on video are floating from left to right and can overlap. There in one blue and one green line. Program is required to track digits, recognize them and do some basic calculation based on digit movement on video.



Goal

Get final sum on all numbers which pass under lines

•Action steps

- Recognise lines on video (starting and ending coordinates of lines)
- Find digits on frame
- Recognise found digits (add class from 0 to 9)
- Track digits (find new position of already found and recognised digit on new frame)
- If digit goes under blue line add its value to sum, if it goes under green line substract its value from sum.

Line recognition

For Line recognition is used Probabilistic Hough Transform which is an optimization of Hough Transform. It doesn't take all the points into consideration, instead it takes only a random subset of points and that is sufficient for line detection.

Using this transformation line end and beginning coordinates are found.

Digit recognition

For digit recognition si used Convolutional Neural Network. Network is created and trained on MNIST data set once .

After training, weights are just loaded into program and network is used to predict which number is detected from 0 to 9.

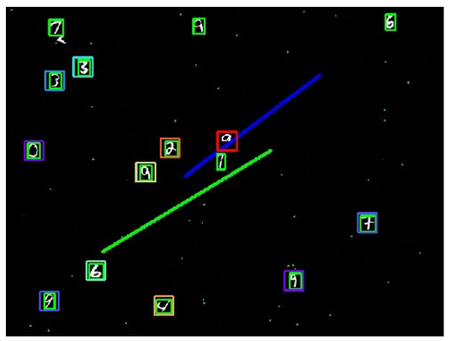
Digit tracking

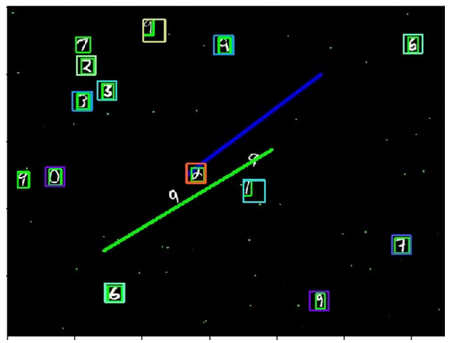
Two methods are used for digit tracking:

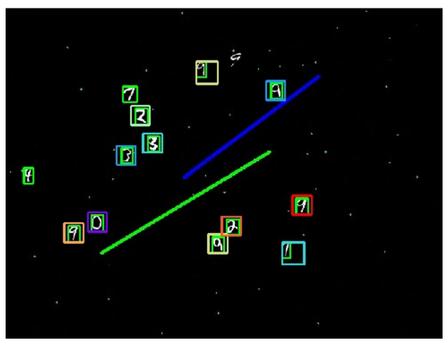
1) First method is **matchTemplate().** Digit found on last frame is saved along with its prediction, image and position. In next frame algorithm tries to find digit from previous frame but it is looking for it only in bottom right rectangle. If digit in not found in current frame **notFoundCounter** is increased. Counter affects position of rectangle in which digit will be looked for in next frame. If digit is found its position is updated.

2) If **matchTemplate()** fails to find digit then program check for any newly recognised contours in bottom right rectangle and if there in contour with same class as seeked number then number is considered found.

If new conture is found and it isn't recognized as previously found number, then program adds it as newly found number. After number is found it is given color so it can easly be tracked in the next frame.







Results

As a result of program final sum is written is file for every test video. If number went under any line its influence on final sum is recorded.

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video-0.avi -30 video-1.avi -12
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