

# **EEE-451 Special project**

# **Robot tracking equation**

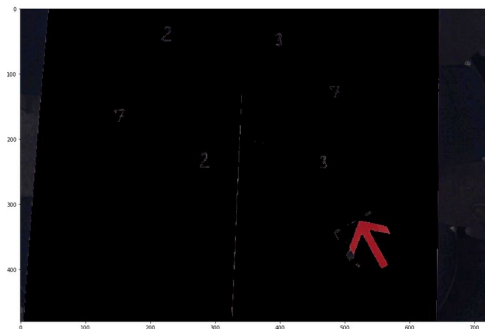
**Spring 2020**

**Contributors :**

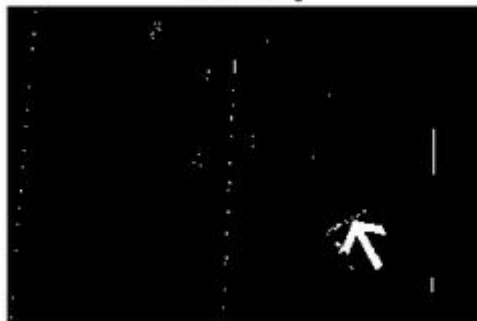
**Canton Diego, Emery Sébastien and Heusghem Pauline**

# Segmentation

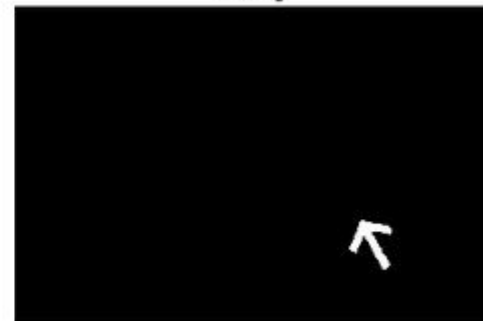
Red mask



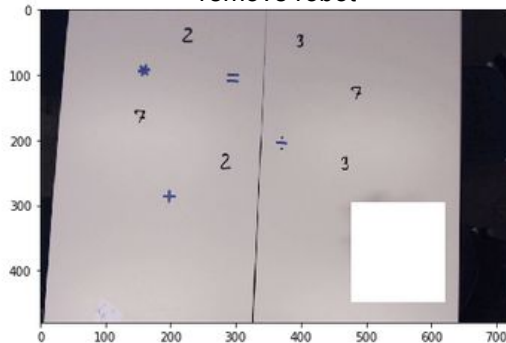
thresholding



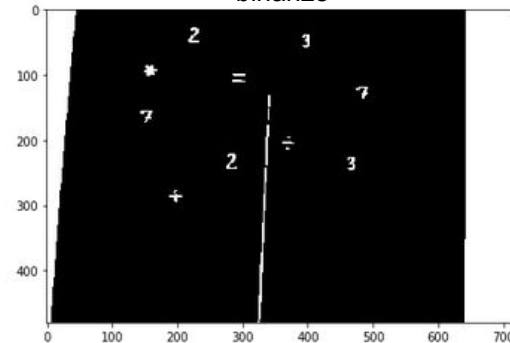
closing



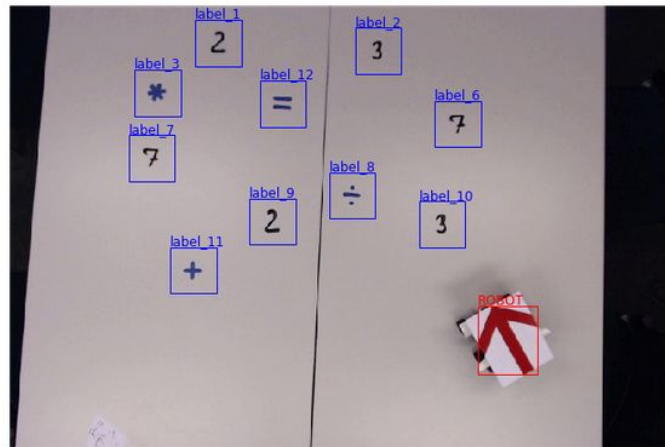
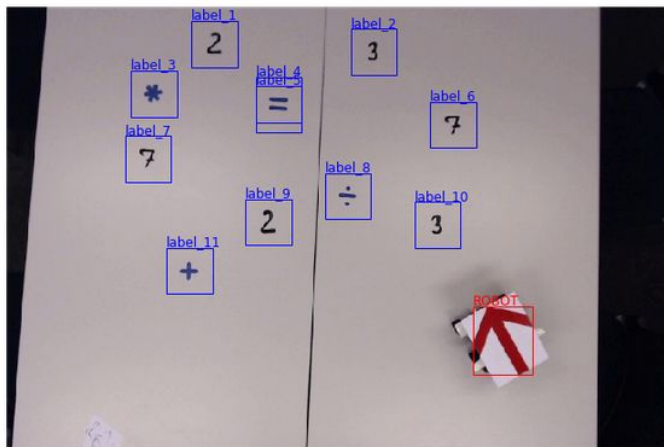
remove robot



binarize



# Bounding boxes



- ❖ From the binarized image we get all labels
- ❖ First discriminate non object label removing the small ones and thin ones (which correspond to the middle line)
- ❖ Overlap test to merge the disjoint labels

- ❖ Positions are stored and boxes are drawn on each image
- ❖ For each image overlap tests between robot and object boxes. If touching, crop first image with box position and give it to the classifiers

# Operator Classifier

## □ A two steps classification

- ❖ Number of disjoint contours
  - Minus, addition and multiplication : one contour
  - Equal operator : two contours
  - Division operator : three contours
- ❖ K-nearest neighbors classifier
  - Compute Fourier descriptors of the minus, addition and multiplication operators' contour to feed the algorithm making them translation, rotation and scaling invariant
  - Training done by generating 360 rotation of each operators individually with ground truth from the image provided

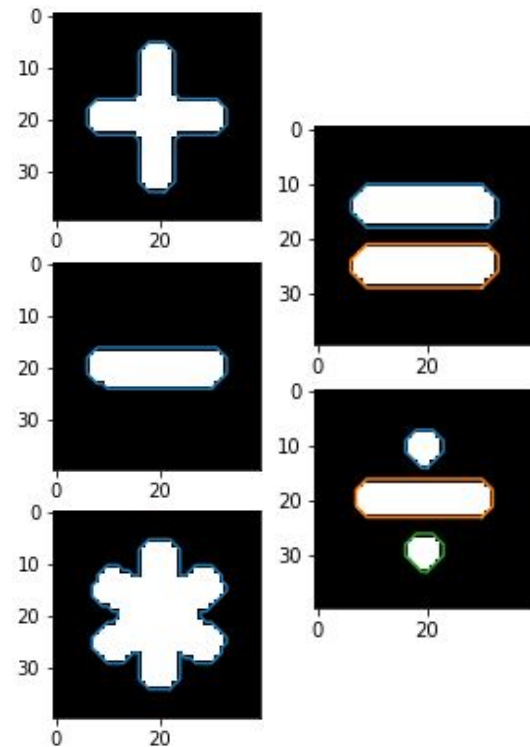


Figure : Five operators mask binarized. The contour of each of the operators is found using the `find_contours` function from `skimage`. The number of disjoint contours is represented by different color

# Digits Classifier

## □ Rotation invariance CNN

- ❖ Use affNIST untransformed 40x40
  - Create uniform distribution
  - Generate random rotations
- ❖ Add rotated crop images from video
  - Crop images from video + processing
  - Generate random rotations
  - Add to train set

rotations

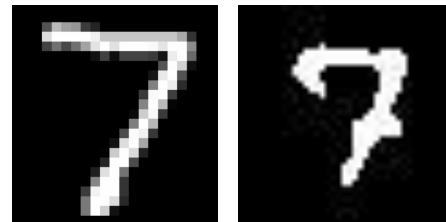


Figure 1: on the left 7 without middle bar, on the right 7 of the video with the middle bar.



Figure 2: the rotated seven often confused as a 4.

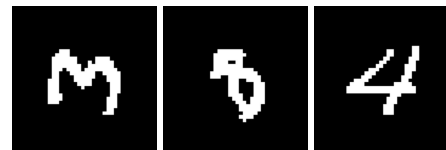


Figure 3: examples of rotated digits of the training set.

**END**