ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Final Project

TEAM: 46

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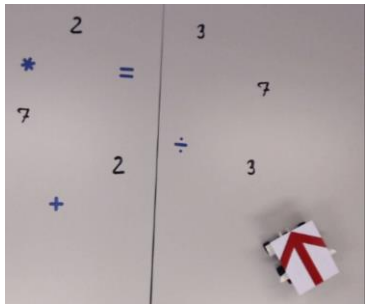
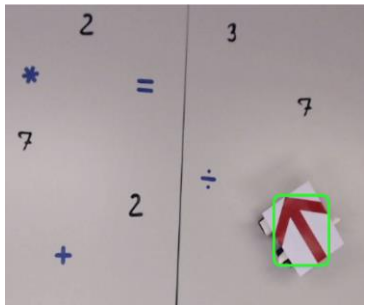
General approach

Reference frame



Arrow coordinates



Extracted image

Classifier

Output = 3

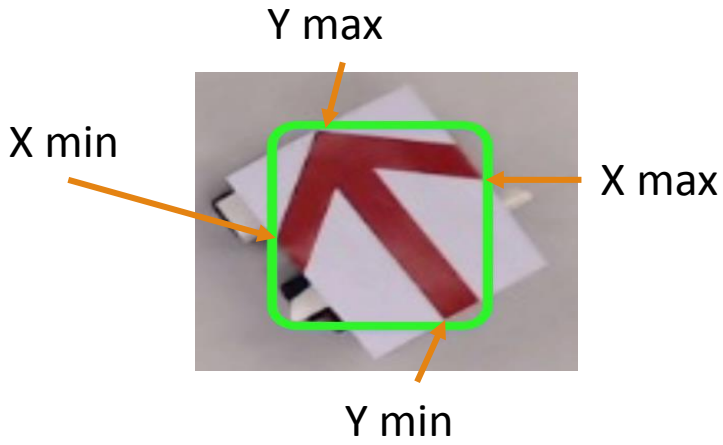
Equation

7 + 2 x 3

Arrow and number/operator extraction

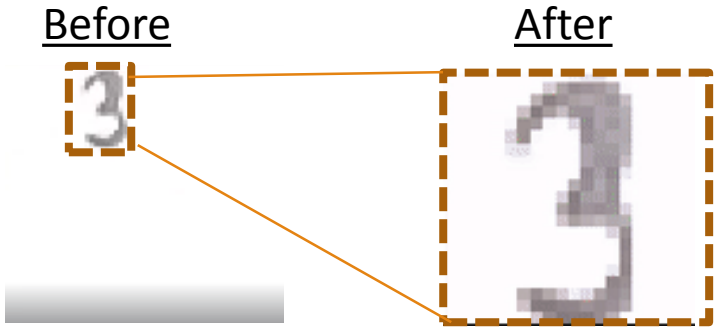
Arrow

- Region growing by thresholding for red pixels
- Extracting max and min coordinates of region to define box



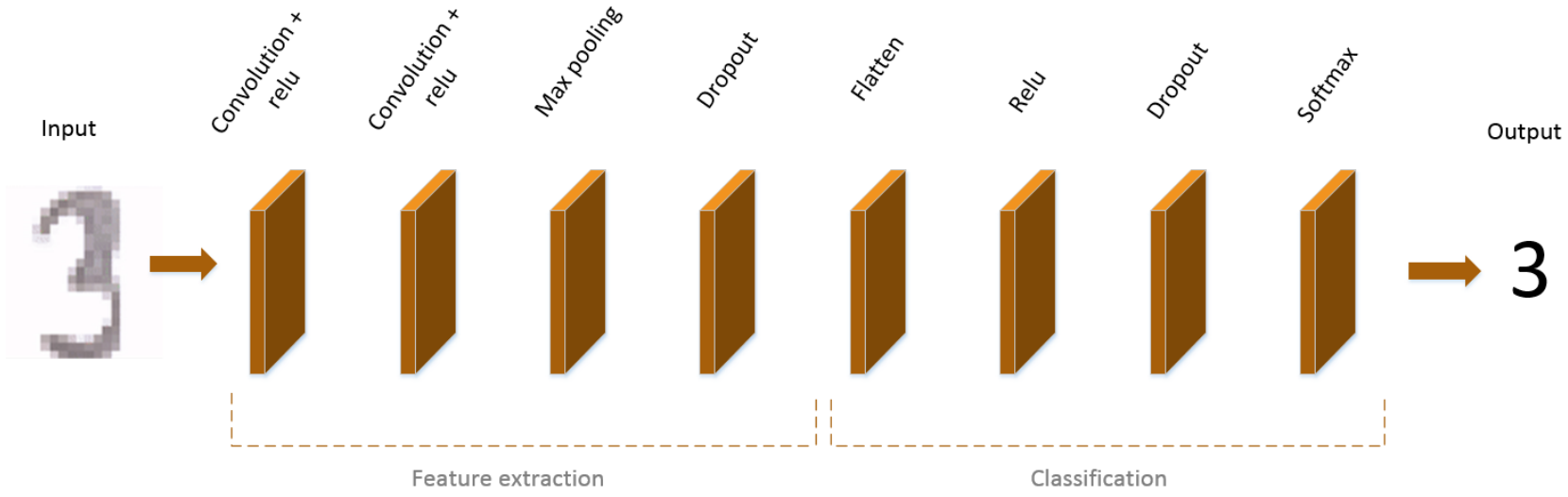
Valid candidate

- Run a test to check if box contains a number/operator by: Has '=' been classified, was previous frame a valid candidate, is the frame mostly white.
- If candidate is valid: Binarize, Crop picture tight to dark areas, make 28x28 quadratic and classification ready. After classification check last entry.



Training data and classifier

- Numbers: Mnist dataset (Zoomed, rotated, shifted) 693000 images total.
- Operators: Cropped from video (Zoomed, rotated, shifted) 308000 Images total.
- Convolutional neural network: 3 epochs, validation accuracy = 0.9377



Results

- Checking for potential candidates in box, ensures computational efficiency (no classification of non valid candidates)
- Classifier is rotation, color, size and light setting robust.
- Validation accuracy = 0.9377
- Misclassification schema:
- Further work: Binarizer a bit to harsh (gives robustness)

```
c = Counter(misclf.tuple)
c.most_common(10)
```

```
[(('7', 2), 871),
 (('2', 7), 807),
 (('1', 11), 608),
 (('6', 7), 587),
 (('8', 2), 485),
 (('3', 2), 414),
 (('5', 6), 409),
 (('7', 4), 404),
 (('2', 8), 403),
 (('4', 5), 395)]
```

Real: 2 → Classified: 7