Special Project Presentation

Group 30
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Algorithm:

- ❑ Frames extracted
- ❑ Arrow detected for each frame
- ❑ Non-arrow objects extracted from frame zero
- ❑ Objects classified
- ❑ For each frame:
    - ❑ Equation updated according to arrow location
    - ❑ Arrow trajectory drawn
    - ❑ if "=" reached, calculated, added to equation
- ❑ Frames converted to video

Arrow Detection

Algorithm:

Given an image (frame):

- ❑ Pixel intensity is rescaled
- ❑ Image is thresholded in RGB color channels for red, turned to grayscale
- ❑ Median filtered, binarized
- ❑ Region detection applied (from scikit-image)
- ❑ The sufficiently large region is selected, its center and size recorded.

Object Extraction From First Frame

Algorithm:

❏ First frame is preprocessed:

Intensity rescaled, turned to grayscale, median filtered, edges enhanced, closing applied

❏ Region detection applied (from scikit-image)
❏ Significant regions are selected based on:

   ❏ The **area of their bounding box** (within a specified range)
   ❏ Their **height to width ratio** (eliminates unwanted line segments etc)
   ❏ Their **distance to the arrow** (eliminates objects formed around arrow
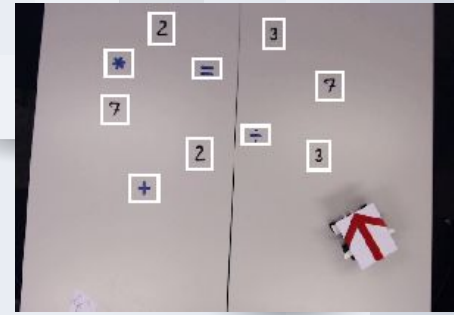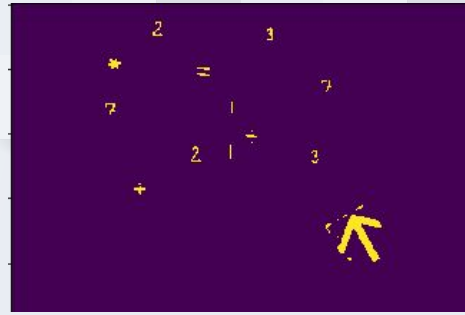
Symbol Classification

Classifier model is a CNN

❑ Classifies between 14 classes, 9 digits and 5 operators
  ❑ (If "-" and "1" are misclassified, alternation of digits and operators is used to solve it externally during equation formation)
❑ Training data is obtained as follows:
  ❑ Sources: Mnist dataset (for digits) and digital images of operators
  ❑ Data augmentation applied to datasets:

    Translation, rotation, scaling

Processing Frames

Algorithm:

For each frame:

- ❑ The new arrow location is added to the arrow locations (trajectory)
- ❑ If the arrow intersects an object, its class label is added to the equation, object is marked as passed.
- ❑ The current equation and arrow trajectory are drawn on the frame.
- ❑ If "=" is reached, the equation result is added to the equation

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