



Summer Research Project Video Based Mouse Seizure Detection

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During the last week:

- ▶ machine learning approach to tracking
- ▶ environment to allow repeating the same experiment on different components of the image
- ▶ tracking problem solved by allowing user to correct tracking

Machine Learning Approach to Tracking

Motivation

Previous experiment with template matching tells us that simple similarity measures are not enough to track the mouse. On template matching we swipe the image comparing a block of image with one or more templates. What if instead of this, we had a classifier telling whether there is a mouse in the current block or not?

In order to do this:

- ▶ We need to collect positive and negative samples. Show program `machineLearningExperiment/collectSamples.py`.
- ▶ train a classifier
- ▶ apply it to tracking. Show demo `machineLearningExperiment/experiment_detextion.py`.

Machine Learning Approach to Tracking - Details

- ▶ 60x60 images are manually cropped from the video
- ▶ every 60x60 sample is converted to a 30x30 version by low pass filtering followed by downsample
- ▶ this is know as a pyramid down operation
- ▶ the 30x30 image is made into a 1x900 vector
- ▶ the feature domain thus become 900 dimension
- ▶ A few classifiers were tried. The one the produced best result was Random Forest with 60 classifiers of deep 10 each.

Machine Learning Approach to Tracking - Results

- ▶ Ensemble methods produced accuracy on test data of 94%
- ▶ even though, when applied to tracking, too many false positives breaks the tracking.
- ▶ the method is also really computationally expensive and the tracking becomes slow
- ▶ classifying an image is actually really cheap. The expensive part is converting image samples to the desired format. For every 60x60 square in the domain we have to pyramid down it and convert it to 1x900 vector.
- ▶ multi processing approaches could improve performance
- ▶ Maybe more samples are needed since we're on a high dimensional space
- ▶ Or maybe, pixel intensity levels are not enough description. When our brain tracks the mouse it uses a lot of previous knowledge.

Environment to develop experiments on multiple components

- ▶ I develop a interface that will help applying one algorithm do several components at the same time.
- ▶ show demo
componentsExperiment/histogramEqualizationExperiment.py

'Solving' the Tracking Problem

- ▶ The conditions of the recordings do not allow us to rely on much. Geometry, color, spectrum, texture . . . all will eventually change during the video. When such a change occurs, my trackers would get lost forever.
- ▶ My current solution is to ask the user to reset the tracking when this occurs
- ▶ Although not elegant, I cannot afford spend more time on tracking. It's time to start pay attention to whatever the mouse is doing
- ▶ I hope If we're able to show that we can detect seizures based only on video that future students can get better videos to allow easier tracking.
- ▶ show demo `python/main.py`