CMP\_SC 8690: Computer Vision

Homework 4A: Semantic Segmentation Using Pre-Trained Deep Learning Networks

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Due: 4/2/2024

Abstract:

The goal of this assignment is to dabble in video analysis using computer vision techniques. More specifically to segment motion from the image utilizing a simple background subtraction algorithm that utilizes a gaussian to model the background of the image and to detect differences of the pixels with the variance, high differences mean something in the frame is moving.

Experiments and Results:

Alpha = 0.01 and TM = 2:

Frame 5

A long shot of a hallway

Description automatically generatedBlack and white texture with random black and white specks

Description automatically generated with medium confidence

Frame 100

A long shot of a hallway

Description automatically generatedA person walking in the dark

Description automatically generated

Frame 400

A blurry image of people walking in a building

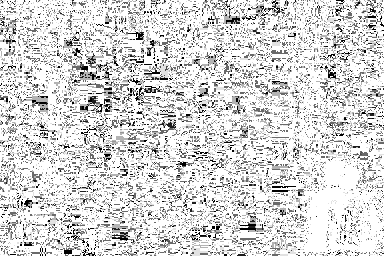
Description automatically generatedA person standing in a dark room

Description automatically generated

Alpha = 0.001 and TM = 2:

Frame 5

A long shot of a hallway

Description automatically generated

Frame 100

A long shot of a hallway

Description automatically generatedA person walking on a stone wall

Description automatically generated

Frame 400

A long shot of a hallway

Description automatically generatedA group of people walking down a hill

Description automatically generated

Alpha = 0.01 and TM = 3:

Frame 5

A long shot of a hallway

Description automatically generatedA black and white image of a broken screen

Description automatically generated

Frame 100

A long shot of a hallway

Description automatically generatedA person standing in the dark

Description automatically generated

Frame 400

A blurry image of people walking in a building

Description automatically generatedA white lines in the sky

Description automatically generated

Alpha = 0.001 and TM = 3:

Frame 5

A long shot of a hallway

Description automatically generatedA black and white speckled background

Description automatically generated

Frame 100

A long shot of a hallway

Description automatically generatedA person walking down a stone wall

Description automatically generated

Frame 400

A long shot of a hallway

Description automatically generatedA black and white image of people walking

Description automatically generated

Conclusion:

In this assignment we were asked to implement a simple background subtraction algorithm given the boiler plate code over the CAVIAR1 video set. We were then supposed to experiment with a couple of different parameters for the model to see how it effects the result. I believe my algorithm had an adequate result. Based on the results it is clear that the alpha parameter, or the learning rate parameter, effects how much the BG model actually changes through time. A larger alpha allows for more change, meaning the BG model changes a lot. You can see proof of this because the person on the bottom right of the video stays in the BG model for longer when the alpha is smaller. The TM thresholding parameter effects the resulting mask. If we have a TM that is lower, there is more noise in the resulting mask. Check the 1st and 3rd experiment on frame 100, as you can see the first one (the one with a lower TM) had more noise in the resulting image. The best parameter setup for the given model based on the parameters tried was probably alpha=0.001 and TM=3, however there are probably different parameters that were not tried that give a clearer result. There seems to be a lot of noise in the resulting mask, especially at the beginning of the video, this could possibly be combatted by using a more complex background subtraction model, or utilizing another method to perform the classification of the pixels.

References:

* Libraries and tools: PyCharm, OpenCV, NumPy, Preview.
* Lec18\_MotionAnalysis.pdf
* CV2024\_HW4B\_SimpleBackgroundSubtraction\_Python.pdf