Machine Learning Engineer Nanodegree

Capstone Proposal

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Domain Background

This project aims at building a video analysis system for surveillance purposes. It basically finds and indexes the movement-events happening in the video source (assuming a fixed camera).

Problem Statement

In video surveillance context, a common problem is having to explore large amounts of videos looking for a particular event, e.g., someone getting in or doing something in particular. Users have to deal with a sequential (and manual) search through the video-source (which can be many hours of stored video) and this is rather inefficient, boring and error prone.

Datasets and Inputs

In this section, the dataset(s) and/or input(s) being considered for the project should be thoroughly described, such as how they relate to the problem and why they should be used. Information such as how the dataset or input is (was) obtained, and the characteristics of the dataset or input, should be included with relevant references and citations as necessary It should be clear how the dataset(s) or input(s) will be used in the project and whether their use is appropriate given the context of the problem.

Solution Statement

We propose the use of unsupervised clustering techniques to find the movement-events in the movement-mask space (binary representation: 1 for pixel-moved, 0 for pixel-no-moved). The latter is computed with a foreground subtraction step resulting in a $\mathtt{M} \times \mathtt{N} \times \mathtt{T}$ binary array, for a $\mathtt{M} \times \mathtt{N}$ video source with $\mathtt{T}$ frames. Every movement event is represented in this 3D space as a 'volume' or 'body' (contiguous '1' cells of movements), and the unsupervised clustering algorithm is supposed to successfully segment most of them. A web application is envisaged to be built, receiving video files and delivering the list of detected events linked to the corresponding point in the original video source.

Benchmark Model

In this section, provide the details for a benchmark model or result that relates to the domain, problem statement, and intended solution. Ideally, the benchmark model or result contextualizes existing methods or known information in the domain and problem given, which could then be objectively compared to the solution. Describe how the benchmark model or result is measurable (can be measured by some metric and clearly observed) with thorough detail.

Evaluation Metrics

In this section, propose at least one evaluation metric that can be used to quantify the performance of both the benchmark model and the solution model. The evaluation metric(s) you propose should be appropriate given the context of the data, the problem statement, and the intended solution. Describe how the evaluation metric(s) are derived and provide an example of their mathematical representations (if applicable). Complex evaluation metrics should be clearly defined and quantifiable (can be expressed in mathematical or logical terms).

Project Design

In this final section, summarize a theoretical workflow for approaching a solution given the problem. Provide thorough discussion for what strategies you may consider employing, what analysis of the data might be required before being used, or which algorithms will be considered for your implementation. The workflow and discussion that you provide should align with the qualities of the previous sections. Additionally, you are encouraged to include small visualizations, pseudocode, or diagrams to aid in describing the project design, but it is not required. The discussion should clearly outline your intended workflow of the capstone project.