Removing moving objects from a video

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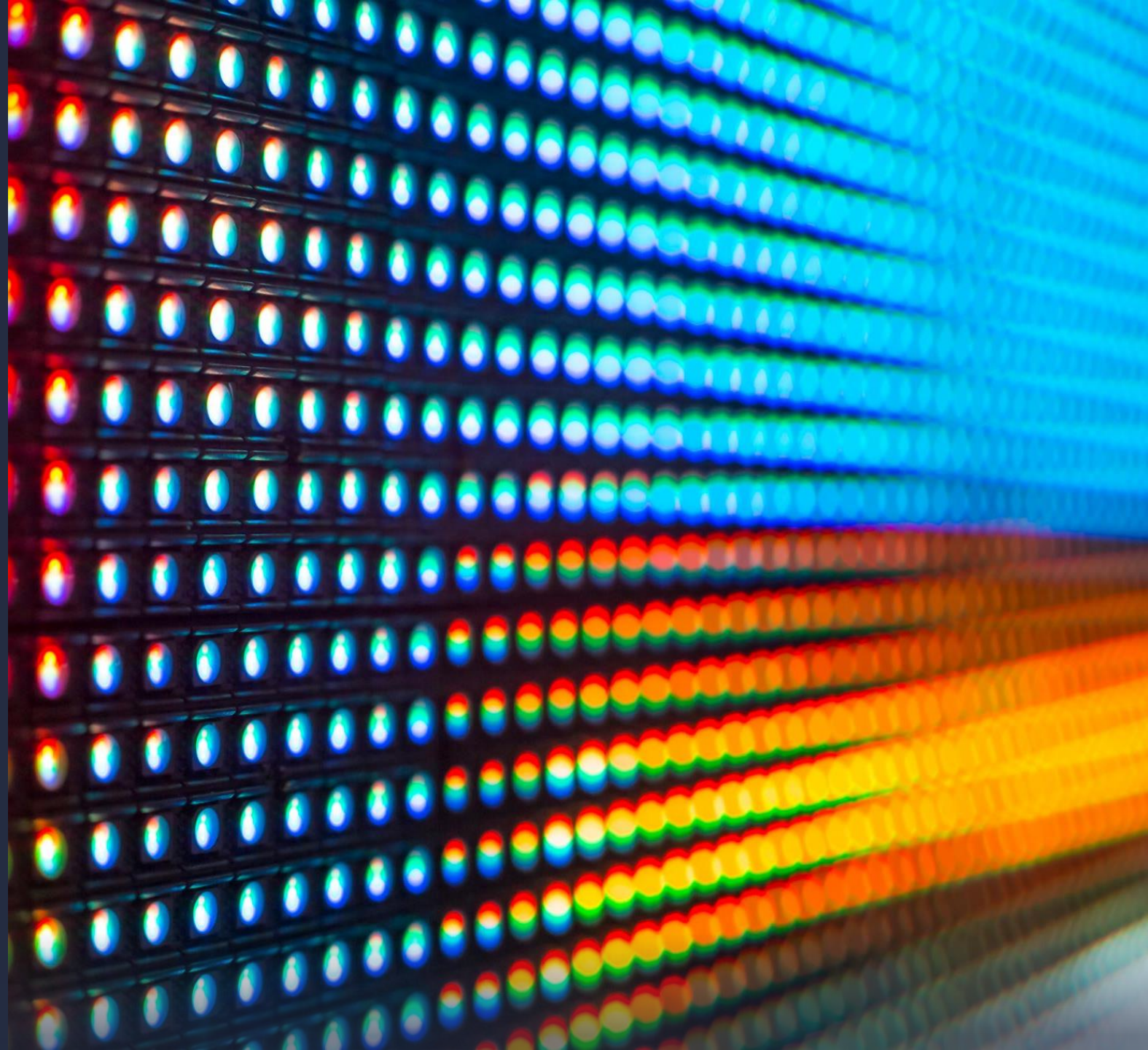
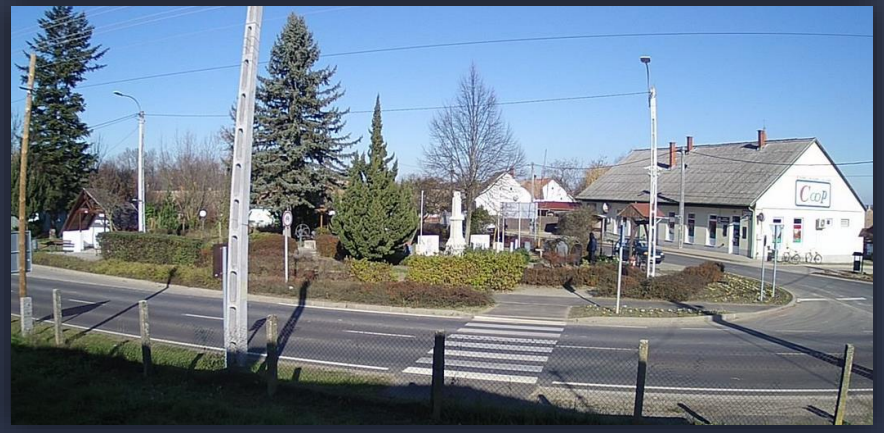


Prerequisities

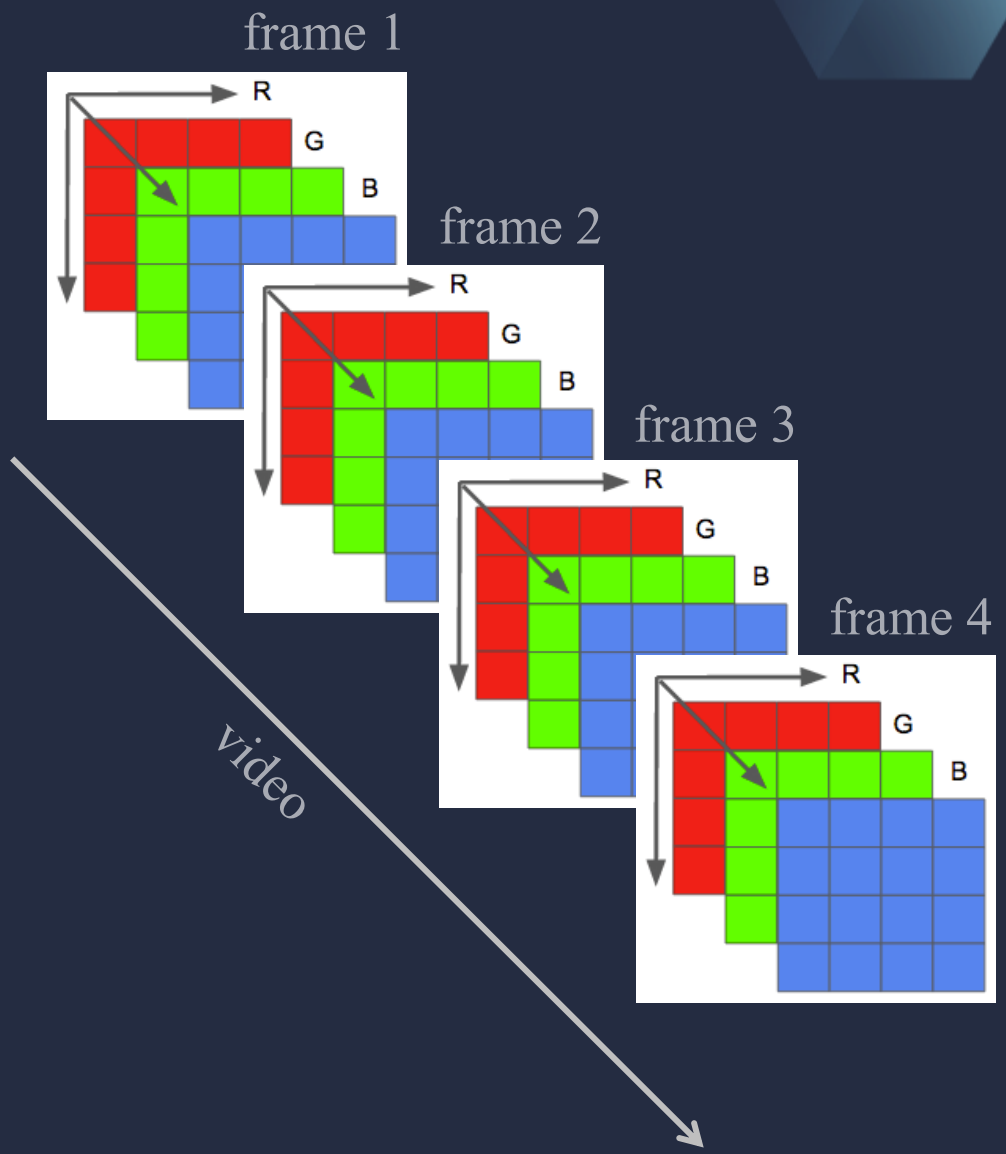
- Photos taken from with a camera matching the following criteria:
  - Similar intrinsic camerea parameters
  - Fixed place
  - Same angle
  - Moving objects
- The algorithm works best with:
  - Webcam videos
  - Tripod camera images



Median filtering

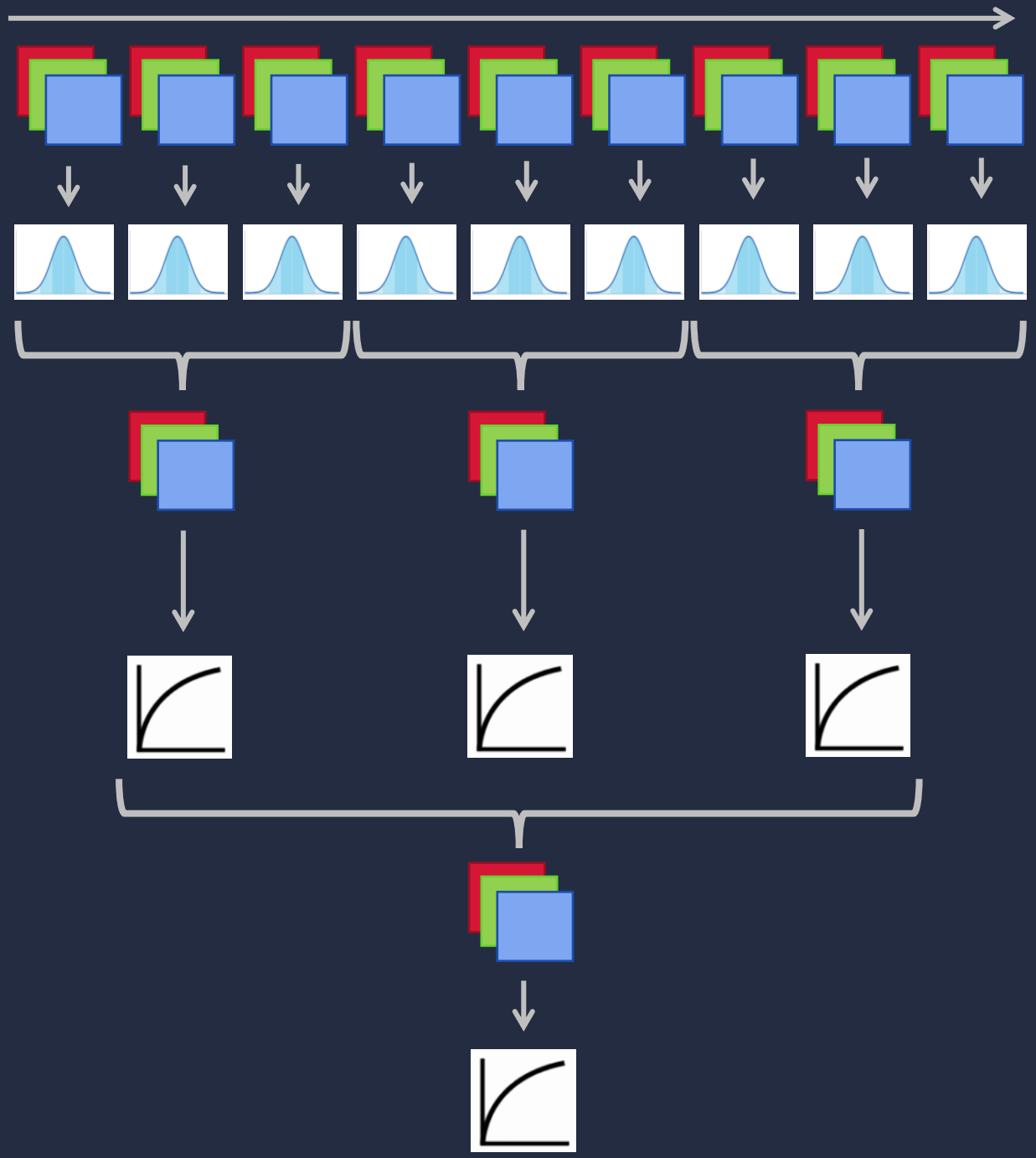
- We have a video as an input to work with
- A video can be interpreted as a 4D vector of RGB images
- Algorithm:

1. Create an empty image for result
2. Stack the images on top of eachother
3. For each stack of [R,G,B] values of each pixel:
    1. Render them in order (increasing or decreasing)
    2. If there's an even number of elements,
       write to result the mean of the two middle ones
    3. If there's an odd number of elements,
       write to result the middle element



Implementation

- If the read a 3-minute video into a matrix, it would require more than 200Gb of space
- For this reason, in the implementation, the video is read in batches
- The median filter is applied to the batches, resulting in a new batch of images
- Then, median filter is applied on the cumulated batch of images
- Normalization is applied when reading an image
- Gamma correction is run when the program outputs a median filtered image



Algorithm on 10 images

- This time batching and gamma correction wasn’t used.
- Normalization was applied.
- The algorithm works as expected.

Algorithm on a full video

- The result on a winter day is a mostly dark image, as there's less sunlight.
- This is the result of running the algorithm on a full 3/minute video.
- Gamma correction, normalization, batching was applied.
- It's interesting to notive that there's mirroring on the floor and atound the fountain: this is the result of a sudden rainfall.

Algorithm on a different video

- This was taken on a hot summer day, so there were many moving people and objects.
- On this day there was more sunlight, so the result is sunny aswell.
- Gamma correction, normalization, batching was applied.
- The algorithm passes all criteria.