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Lab 6 report – Computer Vision 19/20

The algorithm, developed in order to track and detect a set of objects within a video, is composed of the following steps:

1. Extract features from the first frame of the video;
2. For each object, extract features (to track) and match them with the ones extracted at step 1;
3. For each object, compute an homography from its features to the features of the first frame of the video and use it to draw a rectangle around the object;
4. For each frame and for each object:

   - compute the motion of the keypoints using Lukas-Kanade method;

   - compute an homography that relates the position of the keypoints in the previous frame with their new position;

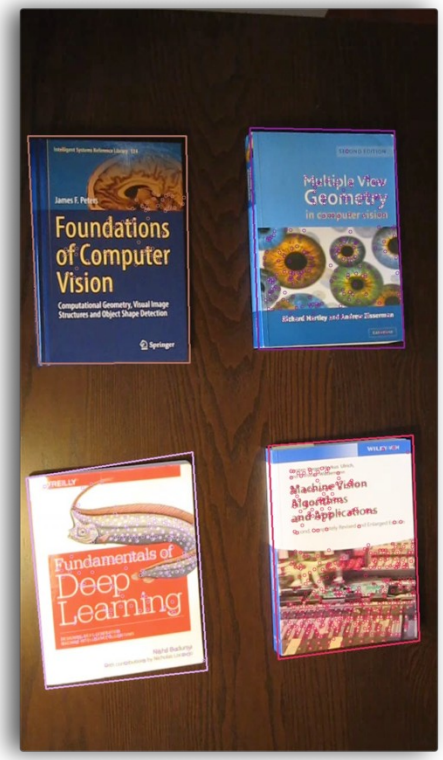
   - use the homography to update the rectangle around the object.

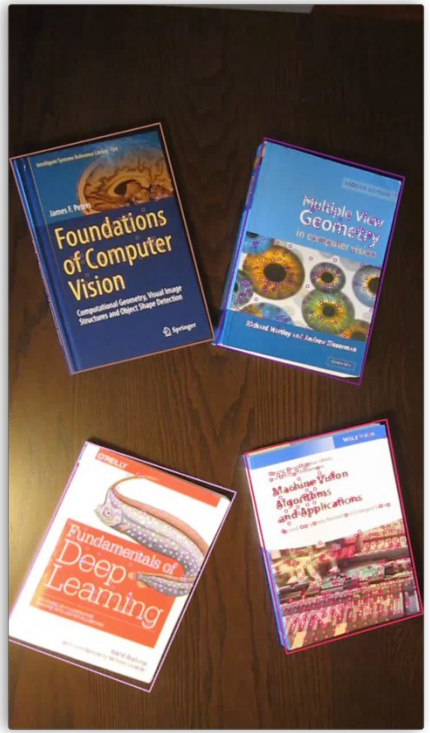
The extraction & matching of the features is essential for the algorithm to succeed: too few features (and matches) make the algorithm weak and prone to errors. In our case the number of matches was improved by applying a Gaussian filter to the object images. Without blurring, the algorithm isn't able to track the first object.

Another important part of the algorithm is the motion tracking: in order to make the Lukas-Kanade method successful it's important to choose the right size of the window surrounding the keypoints. By choosing a window size of 17x17 only one keypoint is discarded, while using a window of size 7x7 the keypoints discarded are sixteen.

The maximal pyramid level is not relevant for the given video as it contains slow motions, but an high number of levels makes the execution of the Lukas-Kanade method slower. This problem could be partially solved by caching the pyramid level of the frame being analyzed and using the cached level for the upcoming computation (so a level is not computed twice).

We were able to track the keypoints in the frames after the first one using the point 4. explained before. Below we have considered three different frames of the video, i.e. the first frame, a middle frame and the last frame, in order to show the results:


Foundations of Computer Vision
Computational Geometry, Visual Image Structures and Object Shape Detection
Springer
Multiple View Geometry in computer vision
Richard Hartley and Andrew Zisserman
Fundamentals of Deep Learning
Machine Vision Algorithms and Applications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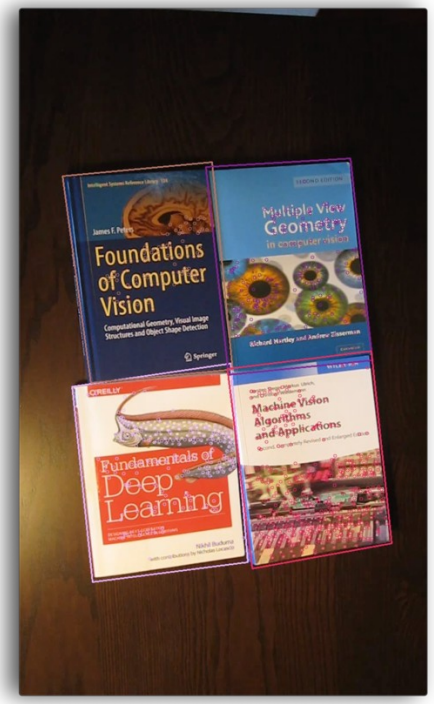
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