MCV dissertation
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Automatic Performance Analysis in Trampoline from RGB-Depth Data

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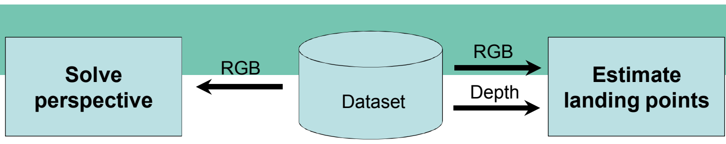
Abstract

The evaluation of the movement in videos or image sequences implies different tasks as: acquisition, detection, tracking, recognition or behavioral study. The purpose is to interpret this movement which for us is clear as can be: know which are the different objects or people, where they come from and where they go, know their behavior and deduce their purposes. In this context, it is proposed in collaboration with CAR Sant Cugat and ASCAMM to capture multi-modal RGB-Depth data obtained by a Microsoft Kinect TM device due to the potentially uses in sports training [1], coaching, education [2] and rehabilitation [3][4]. Then synchronize and align the captured modalities with a frame rate near 30FPS, and use computer vision techniques to extract a relevant indicator as is the landing point concerning a jump in the trampoline Olympic gymnastic sport [5]. Among the problem in measuring the performance of athletes jumping on a trampoline, we have focused on solving two sufficiently specific parts. One reason is to divide the problem in easier parts, and also there are already implemented many methods and techniques that help us to solve each part, that are: segment the athlete from the rest thanks to the clustering of objects in 3D and to detect the flat surfaces as in this case is the trampoline. Furthermore, there is another point to be solved. Since the camera is located at the side of the trampoline, the sequence is filmed in perspective. This perspective must be transformed by a homography in 2D to build a model of the mesh where we can see the results. This step is necessary because there are different sizes of trampoline depending on the type, age and weight of athletes, so we cannot take a single model for all cases.

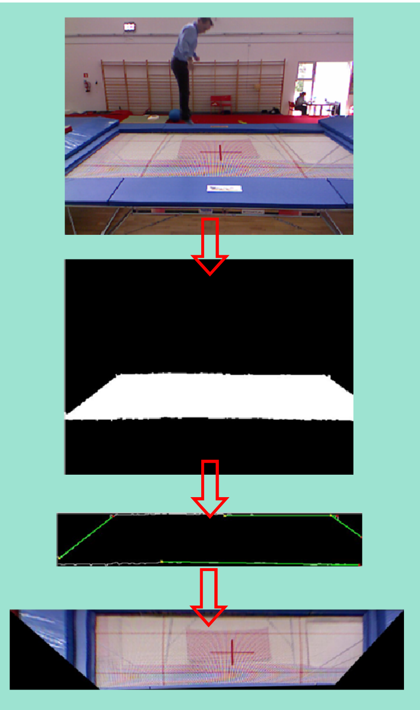
Method

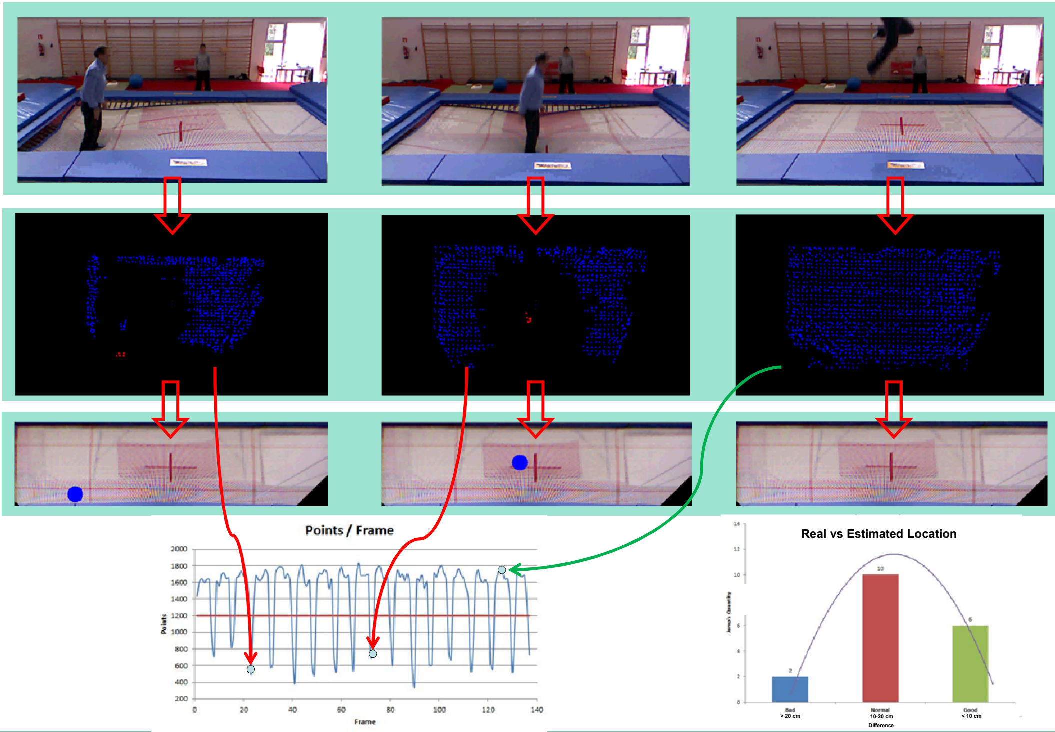


- A GMM is performed to find the optimal threshold in the Hue channel of the HSV color space, to segment the blue mat.
- Morphological operations are applied to the foreground, followed by a flood-fill algorithm to get the inner area.
- The lines are detected using Canny as edge detector and the Hough transform.
- Knowing the intersection points of the lines, the homography is computed in order this points must had a rectangular shape.

- The point cloud is constructed from the depth map and the mesh is segmented as in the perspective problem.
- A planar segmentation algorithm is used to get the plane parameters of the surface.
- The 3D transformations are computed in order to match the surface with the x-z plane and define a bounding box filter.
- The filter is applied to each frame to segment the mesh at trampoline level and an euclidean cluster extraction method is performed to estimate the landing point of the athlete.

Results





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