Color-based Real-time Recognition and Tracking

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Robust real-time tracking of non-rigid objects is a challenging task and is required by many vision applications such as augmented reality, smart rooms and surveillance. Particle filtering has proven very successful for non-linear and non-Gaussian estimation problems. We use color-based image features instead of the edge-based image features which have typically been used. The integration of color distributions into particle filtering has many advantages for tracking non-rigid objects as color histograms in particular are robust to partial occlusion, are rotation and scale invariant and are calculated efficiently. Based on different known histograms, objects are distinguished from each other and tracked in real-time with the proposed framework. An application is shown where the recognized objects are replaced by artificial objects.

The real-time tracking software is running on a Linux-laptop which is connected to a SONY DFW-VL500 camera. The capturing software is able to grab 15-30 frames per second which are used as input for the tracker (image size 320×240 or 640×480 pixels). The operator marks an object of interest with the mouse pointer on a snap-shot of the scene. The selected target is described by the color-histogram of the marked region and is used for the recognition as well as for the tracking process.

For the recognition, color-histograms of a fixed number of objects are recorded and managed in a database. An object is recognized on the basis of a similarity measure between the target and the stored histograms. The proposed framework is using the Bhattacharyya coefficient, which is a popular similarity measure between two distributions. The larger the coefficient for two distributions is, the more similar they are. Consequently, the target is recognized and a virtual object is assigned to it.

As particle filters are based on sample sets, these elements are strategically placed at positions where the target is expected to appear. Each hypothetical object state is represented by a region respectively its underlying color-histogram. If a fraction of the samples show a high Bhattacharyya coefficient during initialization, the object is considered to be found and the tracking process is started. Likewise, the same rule is used to determine if an object is lost during the tracking.

The proposed framework has real-time capability and can be tested easily for several objects and by different users.