

Child-seat Detection system

When used properly, only children should be sitting on the child-seat. This assumption would imply a completely different approach for the detection of the presence of the child in the car.

Instead of relying on the face detection and classification, we can assume that, when a child seat is detected in a certain region, if a face is detected in the same region that would belong to a child. Under this assumption it would be possible to perform the face classification task fewer times in order to increase the general speed of the system.

Child-seat Detection system

In order to find the region where the child-seat is, we decided to employ SIFT descriptors in order to store features from the child seat owned by the user and use them to recognise future instances of the same.

The collection of the SIFT descriptors would be performed through the same camera used for the detection in order to ensure little variation in the point of view over the child-seat. The collection of the descriptors is bound to the presence of the child-seat, therefore the system must include a detector for a generic child-seat.

Child-seat Detection system



The steps for our generic child seat detection system are:

- Step 1:** Collection of SIFT descriptors from child-seat pictures.
- Step 2:** Creation of a Bag Of Visual Words \mathcal{B} using KMeans clustering algorithm
- Step 3:** Collection of SIFT descriptors from the camera input and representation in the BOVW feature space
- Step 4:** We assume that the input \hat{x} contains a child seat if the following statement holds true for at least n patterns in \mathcal{B} :

$$\|\hat{x} - x_B\| < \gamma, \quad x_B \in \mathcal{B}$$

Generic Child Seat Detection

Using 275 pictures gathered from the internet, 50 clusters when creating the BOVW and as parameters $n = 10, \gamma = 0.1$, we obtained the following result:

Input frames

Frames where a child-seat has been
detected

User's Child-seat Detection

From the frames where a generic child-seat is detected the SIFT descriptors are computed.

Ideally, if the car's backseat is free from clutter, the descriptors should gather around the child-seat. A good way to remove descriptors not belonging to the child-seat, would be to use the mean and standard deviation of the key-points' position to exclude the outliers.

The detection of the user's child seat is performed by comparing the SIFT descriptors gathered in the previous step with the new ones from the camera input.

User's Child Seat Detection

Using two frames (and their horizontally flipped versions) from the unprocessed version of the video below, we obtained the following result.

The red circle is the mean of the key-points (black circles), the green bounding box includes all the keypoints while the blue one is a 200x200 pixels square centered in the mean.