How to focus robot's attention?

Maja Rudinac, Pieter P. Jonker
Mekelweg 2, 2628 CD Delft
Biorobotics lab, 3ME, Delft University of Technology
+31 15 27 82616 ; m.rudinac@tudelft.nl
http://www.3me.tudelft.nl/live/pagina.jsp?id=8c6c48e9-ed24-4ae5-91db-6de01d476968&lang=en

Keywords: Saliency detection, object localization, clustering, robotic applications
Purpose of the research: The main question that we are trying to solve is how to focus robot's attention to the most interesting regions in an environment without having any prior about that environment and how to process and learn from these regions afterwards. Limitations that we have are that processing should be done in real time and using low cost platform with single camera.
Approach: For that we proposed novel, computationally inexpensive method for localization of multiple salient objects in scene. Our method consists of two stages. First, we generate a saliency map of the scene based on the spectral residual of the three color channels and interest points are detected in this map. Second, we propose and evaluate a method for the clustering of neighboring interest regions, the rejection of outliers and the estimation of the positions of potential objects. Once the location of objects in the scene is known, recognition of objects / object classes can be performed or the locations can be used for grasping the object. The method is applied and tested on the mobile robotic platform equipped with a single camera. Scenes are acquired in the real indoor settings and taken under different illumination conditions, in the presence of motion blur and the background clutter Scenes are divided in 7 categories as can be seen in the row "Category" of Table 1 and contain in average 5 objects.
Results and conclusion: In the Table 1 we show the Precision recall results of object localization using our method. Highest results are obtained for categories "Coffee corner" and "Table" that contain large number of occluding objects. Speed analysis showed that our method is quite inexpensive compared to representative approaches we found in literature while having a similar or better performance. Results are quite promising and we plan to apply this method for detection and learning of novel objects and robot grasping.

Table 1: Precision recall results

Category	Precision	Recall	F-measure
Blurred images	0.900	0.750	0.818
Coffee corner	0.943	0,846	0.892
Entrance	0.809	0.809	0.809
Hallway	0.850	0.872	0.861
Kitchen	0.908	0.831	0.831
Office	0.883	0.855	0.869
Table	0.934	0.925	0.923

Figure 1: Results of object localization