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# Context-based Reasoning for Object Detection and Object Pose Estimation

## Introduction / Objective

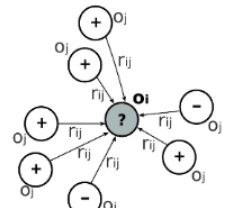
In recent years, contextual information has been successfully used for improving object detection precision by removing false hypotheses. Our objective is to investigate the potential of contextual information for improving object pose estimation performance. In addition, we analyze methods to discover underlying higher-order relations between objects. Finally, we analyze how to exploit object relations to improve object detection recall by retrieving object instances missed after an initial detection step.

## Research Methodology

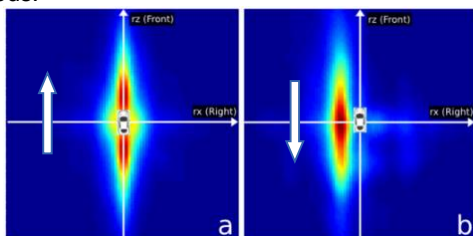
The first part of this thesis focuses on investigating the effect of contextual information to improve object pose estimation. Our first approach exploits pairwise relations between objects within a collective classification setting to estimate the pose of each object. Our second approach focuses on exploiting scene-driven contextual cues for the same task. In the second part of the thesis, we focus on exploiting object relations for improving object detection. We propose a cautious approach that uses the most certain/reliable object hypotheses as source of contextual information. In addition, we propose a Topic Model formulation to discover underlying higher-order relationships between objects. Finally, we propose a method to use relations-based methods to generate object proposals and improve object detection recall.

## Results & Conclusions

- Relations between objects can be used as a cue to improve object pose estimation performance.
- Cautious inference increases the gains in performance brought by contextual information for object detection.
- The scene can serve as a source of contextual information for the task of object pose estimation.
- Assuming that objects are associated by underlying relationships increases the performance of relations-based methods.



Contextual reasoning based on object relations



Top-view of the distribution of object-centered relations for cars with the same pose (a) and opposite pose (b), respectively.



a) Detector and b) Detector + Proposals.  
( Undetected object instances in red )

## Key publications

Oramas M., J., De Raedt, L. Tuytelaars, T. (2013). Allocentric Pose Estimation. ICCV'13.  
 Oramas M., J., De Raedt, L. Tuytelaars, T. (2014). Towards Cautious Collective Inference for Object Verification. WACV'14.  
 Oramas M., J., Tuytelaars, T. (2014). Scene-driven cues for Viewpoint Classification of Elongated Object Classes. BMVC'14.

