Identification of Novel Classes in Object Class Recognition

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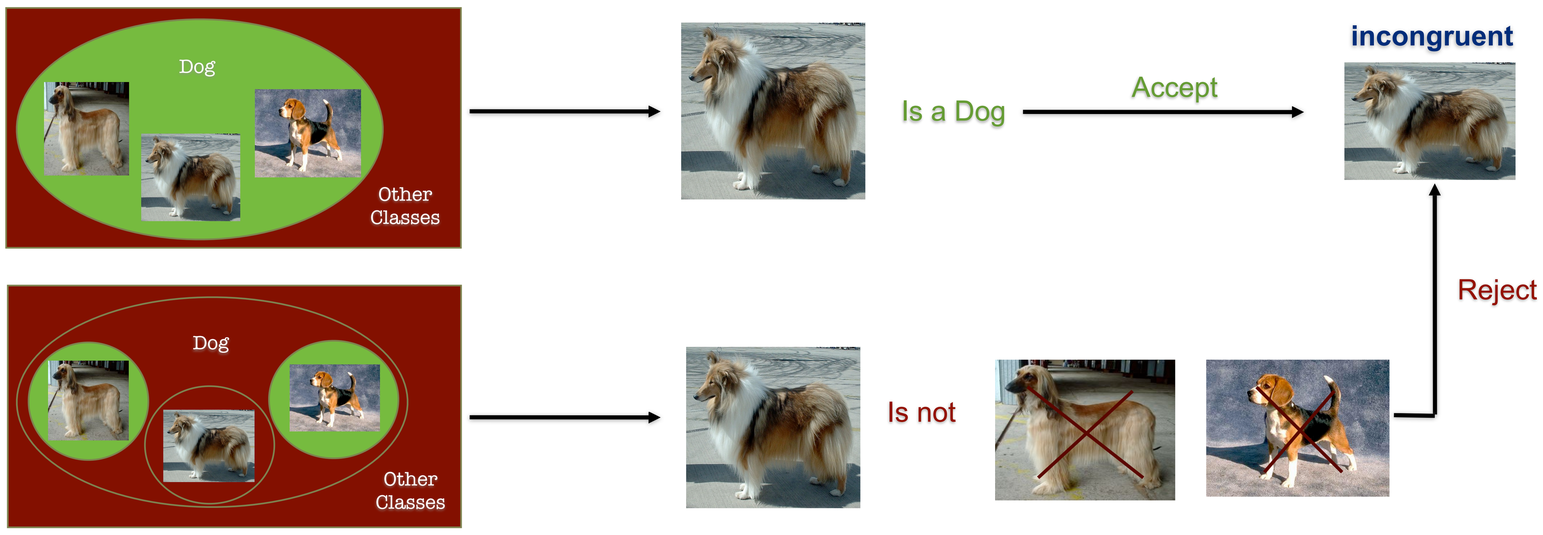
- Common practice when dealing with novelty is to identify it by **rejection**. Thus, an event is novel if it does not fit our model of the world.
- Observing that there are different types of novel/unexpected events, we focus on a specific type of novel events, namely: **Incongruent events**.
- Contrary to common practice we first look for a level of description where the novel event is highly probable.
- Novel **Incongruent events** are detected by the **acceptance** of a general level classifier and the **rejection** of the more specific level classifier.
- Adopting the above scheme we implement a straight forward algorithm in two different variants, one based on the Relational Model learning of Bar-Hillel's et al. and the other on Leibe's Implicit Shape Model.
- We show the specificity of this method in detecting images from unknown related classes as novel class samples, while rejecting noised or images from unrelated classes.
- We examine the importance of discriminative information and correct modeling of the hierarchical relations.

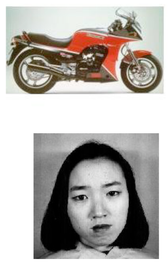


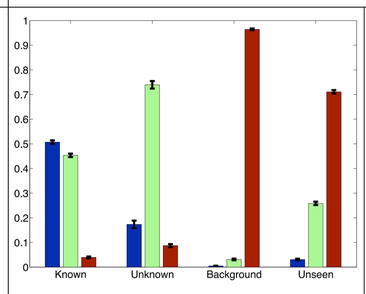
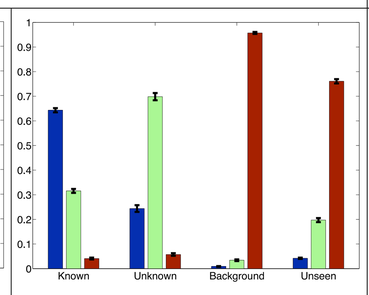
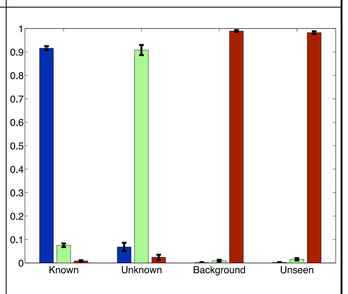
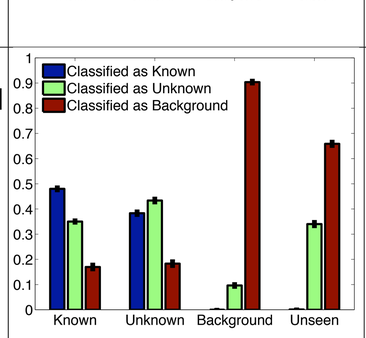
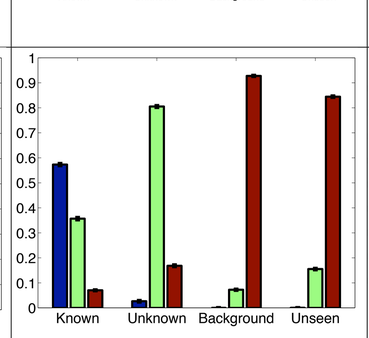
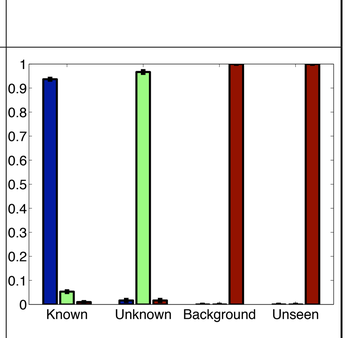
	Specific level	General level	Possible reason
1	reject	reject	noisy measurements, or a totally new concept
2	***reject***	***accept***	***incongruent concept***
3	accept	reject	inconsistent with partial order, models are wrong
4	accept	accept	known concept

Basic Results

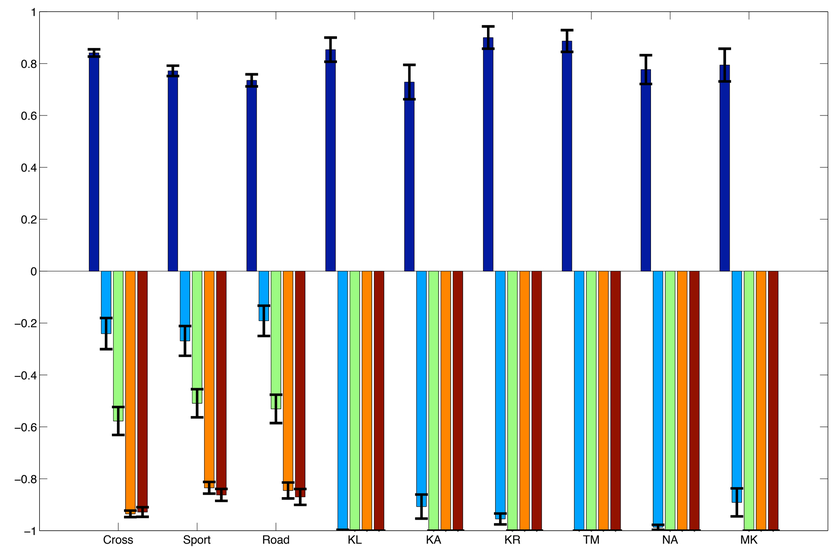
Known

Unknown



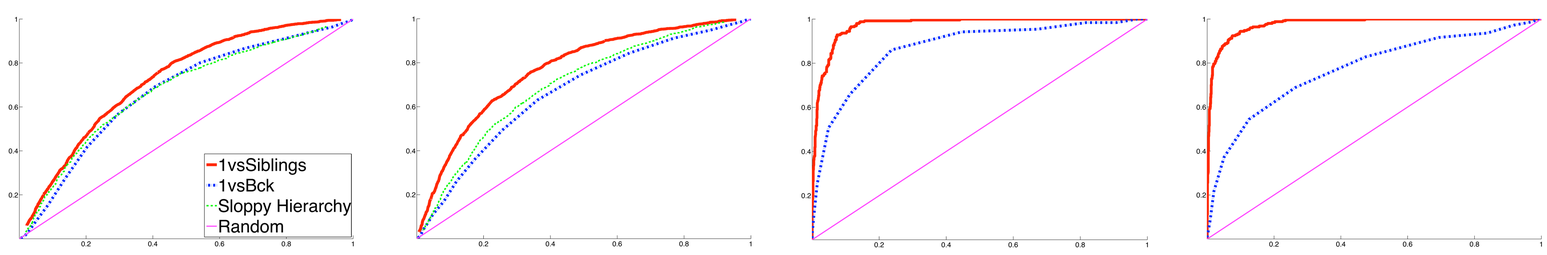
	Motorbikes		Faces
Relational Model			
Implicit Shape Model			

Noise Effect

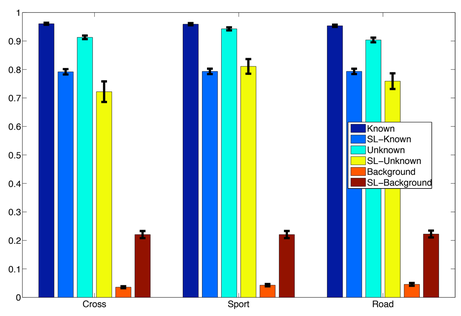


Each bar shows the average over all experiments of (FU-FB)/(FU+FB), where FU denotes the false classification of known objects as unknown, and FB denotes the false classification of known objects as background (rejection by the general level classifier). Lower values correspond to higher tendency to misclassify known class samples as Background rather than as an Unknown class. Each group of bars shows results for a different class left out as the unknown. In each group of bars, the bars correspond to increasing levels of noise, from the left-most bar with no noise to the fifth right-most bar with the most noise.

Discriminative information and Strict vs. Sloppy Hierarchy



ROC curves showing True-Unknown classification rate on the Y-axis vs. False-Unknown Classification rate on the X-axis. We only plot examples accepted by the General level classifier.



General level classifier acceptance rates, with Strict and sloppy hierarchies.