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### One-Shot Learning of View-based Object Representations

#### Abstract:

Object recognition in digital images is a fundamental task for various applications, such as (mobile) robot control and navigation, surveillance, scene interpretation, and human-computer interaction. Many object recognition systems require extensive prior training or are adapted to particular object types. Additionally, it is difficult to combine these systems with further algorithms. As a result, these systems have a limited scope of applications and can only be used for previously known objects of interest. On the contrary, especially for mobile robots that operate in many different environments, it is advantageous if also objects that are not known in advance can be handled. This work addresses these challenges by one-shot learning algorithms which only require a single training example and are not adapted to particular object types.

This presentation focuses on optimizing one-shot learning algorithms by integrating specific local image features. While global features are easily affected by partial occlusions and deformations of objects, often only a subset of local features is affected by these influences. Local features are typically determined in gray-value images using scale-space analysis of texture. Most importantly, a characteristic scale and rotation are assigned to each feature to form a corresponding feature vector. This work presents a new method to transfer this concept to contours using curvature scale-space analysis. Psychophysical studies motivate the specific approach. Moreover, box-filtering techniques are introduced to significantly accelerate the convolution operations for scale-space computation. The method developed in this work is intended to complement texture-based features in a modular fashion. In comparison to many existing approaches, the method not only works with closed but also with open contours. This is essential to analyze natural edge images. Finally, a new method to preprocess the output images from modern edge detection algorithms is presented.