

# Road Sign Recognition by Single Positioning of Space-Variant Sensor Window

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## Abstract

*A biologically plausible model of traffic sign detection and recognition invariantly with respect to variable viewing conditions is presented. The model simulates several key mechanisms of biological vision, such as space-variant representation of information (reduction in resolution from the fovea to retinal periphery), orientation selectivity in the cortical neuron responses, and context encoding of information. The model was tested on British traffic signs and demonstrated the ability to recognize these signs from a single position of a space-variant sensor window. After performing colour segmentation and classification and finding the sign centre, 85% of the traffic signs tested were identified under various environmental conditions.*

## 1. Introduction

Many methods for automatic traffic sign identification have been developed with some promising results [1, 5, 9, 13]. However, identification of traffic signs invariantly with respect to various natural viewing conditions still remains a challenging task. In particular, with the account of safety requirements on public roads, more robust and fast algorithms are required to provide the necessary accuracy in recognition of traffic signs.

A biologically plausible model of visual recognition BMV (Behavioural Model of Vision) [8] was previously implemented for solution of the task of traffic sign recognition [1]. That model version required visual processing in multiple positions of the space-variant sensor window (SW) and demonstrated the ability of recognition of traffic signs, invariantly with respect to viewing and environmental conditions, with recognition rate about

80%. Several means for the improvement of recognition efficiency (i.e., increasing recognition rate and reduction of computations) have been proposed. In particular, it was suggested that the signs could be quickly recognized from a single position of SW if this position is close to the sign centre, since for most traffic signs the geometrical centre is also the centre of information content.

Choice of informative image fragments for detailed processing is one of the most important problems in the field of image recognition [2, 7]. There are many algorithms for detection of most informative parts of images in the frameworks of both conventional and biologically plausible approaches. Most of them are image-dependent because each type of images has specific important fragments. For example, for face images the most informative fragments are eyes, nose, and mouth, [2, 7, 12]. As mentioned above, for most traffic signs the most informative fragments are concentrated around the sign centre. However, in traffic sign recognition only a few approaches are known that attempt to use a selection of most informative fragments of signs for detailed processing [1, 5, 9].

Colour is a dominant visual feature, which undoubtedly represents a key piece of information used by drivers. Therefore colour is widely used in traffic sign recognition systems [5, 13], especially for segmentation of traffic sign images from the rest of a scene. The colour segmentation can be also used for finding the sign center.

In this study, traffic signs were segmented from road scenes under various environmental conditions by colour contents using a standard colour appearance model CIECAM97 [4, 6, 11]. First, the colour segmentation and classification based on colours and shapes provided the detection of the sign centre. After that, the sign was recognized from a single position of a space-variant sensor window centered in the sign centre.

