

# Supplemental Document 2: Sample Results of Simultaneous Detection and Classification of Traffic Signs

This supplemental document provides sample results for the simultaneous detection and classification of traffic signs using the method in the paper entitled “Traffic Sign Detection and Classification in the Wild”. Each input image has resolution  $2048 \times 2048$ . Green rectangles indicate correctly detected and classified signs; the annotation indicates the type of sign detected. Red rectangles indicate wrongly classified signs; in the annotation, to the left of the arrow is the classification result of our network, while to the right is the ground truth. Blue rectangles indicate signs undetected by our network.

Below, we give 8 pairs of contrasting conditions. In each, we show two ‘easier’ cases, and two ‘harder’ case: for example, smaller signs are harder to correctly detect and classify than larger signs. These generally indicate that our methods work well on more difficult cases as well as easier one. Nevertheless, we also give some cases in which the method has failed to deliver the correct result.

## 1 EASY AND DIFFICULT PAIRS

For each pair, we first give two ‘easier’ cases followed by two ‘harder’ cases.

## 1.1 Countryside and city

Images (a) and (b) were captured in the countryside, while (c) and (d) images were captured in the downtown region of a city. In the former, there are few other things, that might be confused with traffic signs. In the latter, there are many advertisements, logos, other signs, etc. that might be confused with traffic signs, yet traffic signs are still correctly detected and classified, and false positives rarely arise.



(a)



(b)



(c)



(d)



## 1.2 Large and small

Traffic signs in (a) and (b) are of large size so are easily detected and classified. Those in (c) and (d) are much smaller, yet most of this size are also still correctly detected and classified. Only a very small mandatory sign in (c) is missed.



(a)



(b)



(c)



(d)



### 1.3 Frontal lighting and lighting from behind

Images (a) and (b) were captured under frontal lighting, while (c) and (d) were captured with lighting from behind. Images of the former kind generally have stronger colours and better contrast than the latter. Even under more challenging illuminance conditions, our network still performs well. In (a) the rightmost prohibitory sign with a red contour is ignored as it is of a rare kind we do not classify. In (d) a warning sign is missed because it is not one of the signs belonging to the official standard set of signs.



(a)



(b)



(c)



(d)



#### 1.4 Orthogonal and oblique views

Traffic signs in (a) and (b) are more or less orthogonal to the direction to the camera, so our network has no difficulty in correctly detecting and classifying them. In (c) and (d), the signs are obliquely presented to the viewing direction. Nevertheless, our network still performs well in the latter cases.



(a)



(b)



(c)



(d)



### 1.5 Single and multiple adjacent signs

There is only one traffic sign in each of images (a) and (b) while in (c) and (d) there are multiple traffic signs, some of which are almost touching. All traffic signs are correctly detected and classified in all of these images—multiple adjacent traffic signs can be correctly handled.



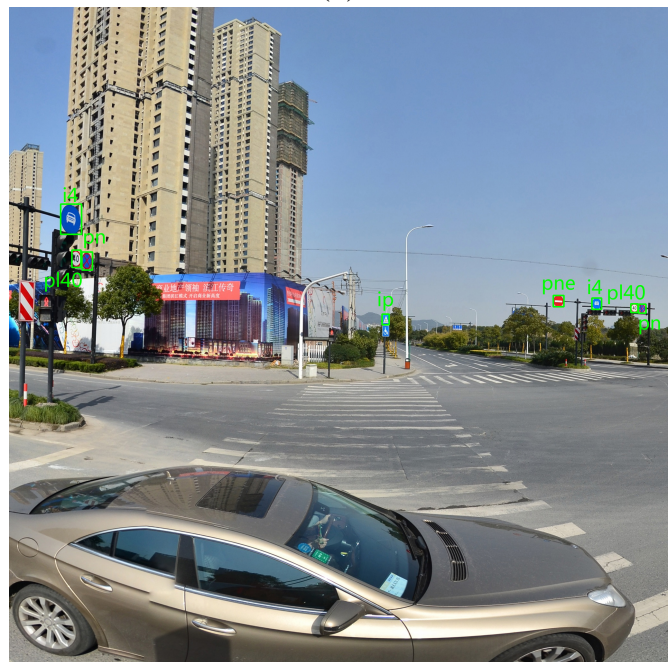
(a)



(b)



(c)



(d)



## 1.6 Signs with simple and complex backgrounds

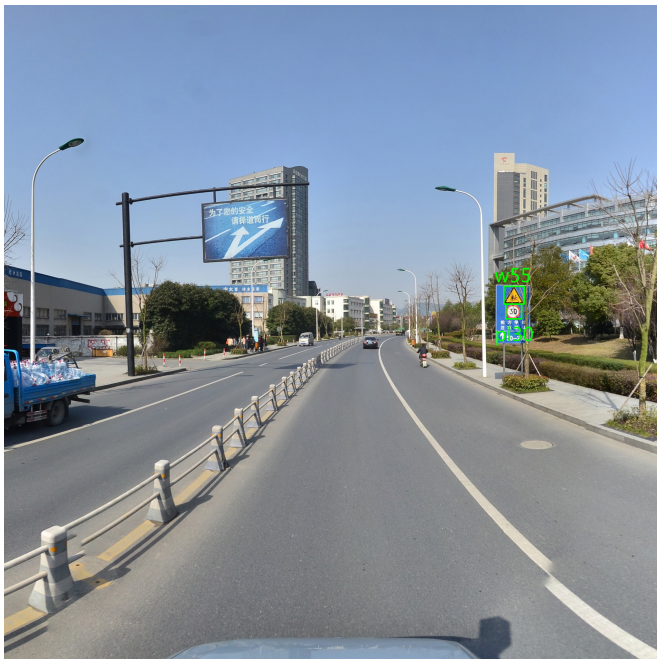
Traffic signs in images (a) and (b) are suspended at height, and have simple backgrounds, making it easy to detect and classify them. In images (c) and (d) the traffic signs are nearer the road level; such signs are more likely to have cluttered, complex backgrounds. In (c) and (d), the background has a richer texture but our network still performs well.



(a)



(b)



(c)



(d)



### 1.7 Occluded and unoccluded

There is no occlusion of the traffic signs in images (a) and (b), and our network performs well. In (c) the speed limit sign is partially occluded but our network can still recognize it. To the upper left of this speed limit sign is a prohibitory sign we have failed to detect, as it is of a kind not included in the training set. In (d) the bottom of the no parking sign and the top of the no bicycles sign are occluded. Both of them are correctly detected and classified.



(a)



(b)



(c)



(d)



### 1.8 Cloudy and sunny

Images (a) and (b) were captured on cloudy days while (c) and (d) were captured on sunny days. The results show that our network is robust to variations in weather conditions which cause changes in illuminance. Note that in (b) the 20km/h speed derestriction sign is ignored as it is too rare to be in the training set, so it is not in the 45 target classes.



(a)



(b)



(c)

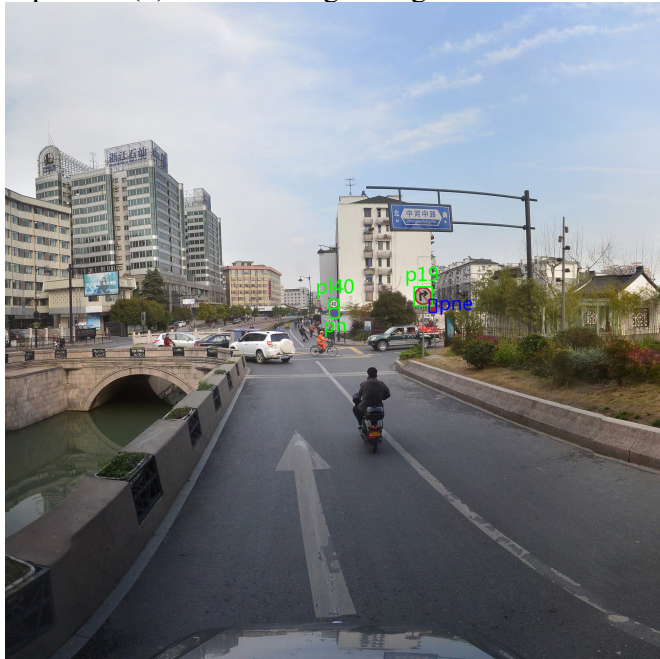


(d)



## 2 FAILURES

We now show some examples where our method has not worked correctly. In image (a) a no entrance sign is missed—it has a small size and considerable perspective distortion. In image (b) a no left turn sign is missed, again presumably because of its very small size. In (c) the blue logo of a bank is misclassified as a mandatory sign as it is small and has a similar blue circular shape. In (d) a Volkswagen logo is misclassified as a speed limit sign, also due to its small size.



(a)



(b)



(c)



(d)