CLAIMS

1. A method for traffic sign detection, comprising:

collecting an image comprising traffic signs;

obtaining at least one candidate region feature corresponding to at least one traffic sign in the image comprising traffic signs, each of the at least one traffic sign corresponding to one candidate region feature;

obtaining, based on the at least one candidate region feature, at least one first probability vector corresponding to at least two traffic sign classes, and classifying each of the at least two traffic sign classes to respectively obtain at least one second probability vector corresponding to at least two traffic sign sub-classes in the traffic sign class; and

determining, based on the first probability vector and the second probability vector, a classification probability that the traffic sign belongs to the traffic sign sub-class.

2. The method according to claim 1, wherein the obtaining, based on the at least one candidate region feature, at least one first probability vector corresponding to at least two traffic sign classes, and classifying each of the at least two traffic sign classes to respectively obtain at least one second probability vector corresponding to at least two traffic sign sub-classes in the traffic sign class comprises:

performing, by a first classifier, classification based on the at least one candidate region feature to obtain at least one first probability vector corresponding to the at least two traffic sign classes; and

performing, by at least two second classifiers, classification on each of the at least two traffic sign classes based on the at least one candidate region feature to respectively obtain at least one second probability vector corresponding to at least two traffic sign sub-classes in the traffic sign class.

3. The method according to claim 2, wherein each of the at least two traffic sign classes corresponds to one of the second classifiers;

the performing, by at least two second classifiers, classification on each of the traffic sign classes based on the at least one candidate region feature to respectively obtain at least one second probability vector corresponding to at least two traffic sign sub-classes in the traffic sign class comprises:

determining, based on the first probability vector, the traffic sign class category

corresponding to the candidate region feature; and

performing, based on the second classifier corresponding to the traffic sign class, classification on the candidate region feature, to obtain a second probability vectors of the at least two traffic sign sub-classes corresponding to the candidate region feature;

wherein before the performing, based on the second classifier corresponding to the traffic sign class, classification on the candidate region feature, to obtain a second probability vectors of the at least two traffic sign sub-classes corresponding to the candidate region feature, the method further comprises:

processing, by a convolutional neural network, the candidate region feature, and inputting the processed candidate region feature into the second classifier corresponding to the traffic sign class.

4. The method according to any one of claims 1 to 3, wherein the determining, based on the first probability vector and the second probability vector, a classification probability that the target belongs to the traffic sign sub-class comprises:

determining, based on the first probability vector, a first classification probability that the target belongs to the traffic sign class;

determining, based on the second probability vector, a second classification probability that the target belongs to the traffic sign sub-class; and

determining, by combining the first classification probability and the second classification probability, a classification probability that the traffic sign belongs to the traffic sign sub-class in the traffic sign class.

5. The method according to any one of claims 1 to 4, wherein before the obtaining, based on the at least one candidate region feature, at least one first probability vector corresponding to at least two traffic sign classes, and classifying each of the at least two traffic sign classes to respectively obtain at least one second probability vector corresponding to at least two traffic sign sub-classes in the traffic sign class, the method further comprises:

training, based on a sample candidate region feature, a traffic classification network, wherein the traffic classification network comprises one first classifier and at least two second classifiers, and a number of the at least two second classifiers is equal to a traffic sign class category of the first classifier; and the sample candidate region feature has a labeled traffic sign sub-class category, or the sample candidate region feature has a labeled traffic sign sub-class category and a labeled traffic sign class category.

6. The method according to claim 5, wherein in response to the sample candidate region feature having a labeled traffic sign sub-class category, the labeled traffic sign class category corresponding to the sample candidate region feature is determined by clustering the labeled traffic sign sub-class category.

7. The method according to claim 5 or 6, wherein the training a traffic classification network based on a sample candidate region feature comprises:

inputting the sample candidate region feature into the first classifier to obtain a predicted traffic sign class category, and adjusting a parameter of the first classifier based on the predicted traffic sign class category and the labeled traffic sign class category; and

inputting, based on the labeled traffic sign class category of the sample candidate region feature, the sample candidate region feature into the second classifier corresponding to the labeled traffic sign class category to obtain a predicted traffic sign sub-class category, and adjusting a parameter of the second classifier based on the predicted traffic sign sub-class category and the labeled traffic sign sub-class category.

8. The method according to any one of claims 1 to 7, wherein the obtaining at least one candidate region feature corresponding to at least one traffic sign in the image comprising traffic signs comprises:

obtaining, based on the image, the at least one candidate region corresponding to the at least one traffic sign comprising traffic signs;

performing feature extraction on the image to obtain an image feature corresponding to the image; and

determining, based on the at least one candidate region and the image feature, the at least one candidate region feature corresponding to the image comprising traffic signs.

9. The method according to claim 8, wherein the determining, based on the at least one candidate region and the image feature, the at least one candidate region feature corresponding to the image comprising traffic signs comprises:

obtaining, based on the at least one candidate region, a feature of a corresponding position from the image feature to constitute the at least one candidate region feature corresponding to the at least one candidate region, each of the at least one candidate region corresponding to one candidate region feature.

10. The method according to claim 8 or 9, wherein the performing feature extraction on the image

to obtain an image feature corresponding to the image comprises:

performing, by a convolutional neural network in a feature extraction network, feature extraction on the image to obtain a first feature;

performing, by a residual network in the feature extraction network, differential feature extraction on the image to obtain a differential feature; and

performing bitwise addition on the first feature and the differential feature to obtain the image feature corresponding to the image;

wherein the performing, by a convolutional neural network in a feature extraction network, feature extraction on the image to obtain a first feature comprises:

performing, by the convolutional neural network, feature extraction on the image; processing at least one of the at least two feature maps output by the at least two convolutional layers so that the at least two feature maps have a same size; and

performing bitwise addition on the at least two feature maps having the same size to determine the first feature corresponding to the image.

11. The method according to any one of claims 1 to 10, wherein before the performing, by a convolutional neural network in a feature extraction network, feature extraction on the image to obtain a first feature, the method further comprises:

performing, by a discriminator, adversarial training on the feature extraction network based on a first sample image, wherein a size of a traffic sign in the first sample image is known, the traffic sign comprises a first traffic sign and a second traffic sign, and the size of the first traffic sign is different from that of the second traffic sign.

12. The method according to claim 11, wherein the performing, by a discriminator, adversarial training on the feature extraction network based on a first sample image comprises:

inputting the first sample image into the feature extraction network to obtain a first sample image feature;

obtaining, by the discriminator, a discrimination result based on the first sample image feature, the discrimination result being used for representing the authenticity that the first sample image comprises the first traffic sign; and

alternately adjusting, based on the discrimination result and the known size of the traffic sign in the first sample image, parameters of the discriminator and the feature extraction network.

13. The method according to claim 8 or 9, wherein the performing feature extraction on the image to obtain an image feature corresponding to the image comprises:

inputting the second sample image into the convolutional neural network to obtain a prediction image feature, the second sample image comprising a labeling image feature;

adjusting, based on the prediction image feature and the labeling image feature, the parameter of the convolutional neural network;

performing, by the convolutional neural network, feature extraction on the image; and

determining, based on at least two features output by at least two convolutional layers in the convolutional neural network, the image feature corresponding to the image.

14. The method according to claim 13, wherein the determining, based on at least two features output by at least two convolutional layers in the convolutional neural network, the image feature corresponding to the image comprises:

processing at least one of the at least two feature maps output by the at least two convolutional layers so that the at least two feature maps have a same size; and

performing bitwise addition on the at least two feature maps having the same size to determine the image feature corresponding to the image.

15. The method according to any one of claims 8 to 14, wherein the obtaining, based on the image, at least one candidate region corresponding to the at least one traffic sign comprising traffic signs comprises:

obtaining at least one frame of the image comprising traffic signs from a video, and performing region detection on the image to obtain the at least one candidate region corresponding to the at least one traffic sign.

16. The method according to claim 15, wherein before the obtaining, based on the image, at least one candidate region corresponding to the at least one traffic sign comprising traffic signs, the method further comprises:

performing keypoint recognition on at least one frame of the image in the video, and determining a traffic sign keypoint corresponding to the traffic sign in the at least one frame of the image; and

tracking the traffic sign keypoint to obtain a keypoint region of the at least one frame of the image in the video;

after the obtaining, based on the image, the at least one candidate region corresponding to the at least one traffic sign, the method further comprises at least one of the following:

in response to an overlapping ratio of the candidate region to the keypoint region being greater than or equal to a set ratio, using the candidate region as a traffic sign candidate region

corresponding to the traffic sign; or

in response to the overlapping ratio of the candidate region to the keypoint region being less than the set ratio, using the keypoint region as the traffic sign candidate region corresponding to the traffic sign.

17. The method according to claim 16, wherein the tracking the traffic sign keypoint to obtain a keypoint region of the at least one frame of the image in the video comprises:

based on a distance between the traffic sign keypoints in two consecutive frames of the image in the video;

determining, based on a minimum value of the distance between the traffic sign keypoints, the position of a same traffic sign keypoint in the two consecutive frames of the image;

realizing, according to the position of the same traffic sign keypoint in the two consecutive frames of the image, the tracking of the traffic sign keypoint in the video; and

obtaining a keypoint region of the at least one frame of the image in the video.

18. An electronic device, comprising: a memory, configured to store executable instructions; and

a processor, configured to communicate with the memory to execute the executable instructions to complete operations of the method for traffic sign detection according to any one of claims 1 to 17.

19. A computer storage medium, configured to store computer readable instructions, wherein when the instructions are executed, operations of the method for traffic sign detection according to any one of claims 1 to 17 are executed.

20. A computer program product, comprising computer readable codes, wherein when the computer readable codes run in a device, a processor in the device executes instructions for implementing the method for traffic sign detection according to any one of claims 1 to 17.