[0072] After the driving alert is triggered, first a reasonable reaction time (a preset time period) is provided for the driver for determining by himself. During this period of time, the driver may determine to change the driving state or turn off the alert (the alert can be turned off manually after the problem is solved), but when the driver does not adopt any measure while the variation trend of the detection result indicates that the danger level is continuously increasing, i.e., the danger level of the detection result increases as the time passes, and the vehicle needs to be automatically controlled to ensure driving safety.

[0073] In one or more optional embodiments, when the target object is a lane line, step 110 may include:

[0074] acquiring a video stream involving a drive road based on an image acquisition apparatus disposed on the vehicle;

[0075] detecting a lane line from at least one image frame of the video stream to obtain a detection result of the lane line; and

[0076] obtaining a detection result of departure from the lane line based on the detection result of the lane line and a relative position of the vehicle.

[0077] Since the lane line is disposed on a road surface, when acquiring the video stream, the video stream including the driving road needs to be acquired. Optionally, detection on the lane line in the image is performed by a deep neural network, for example, identifying the lane line in the image by an image identifying network to obtain the position of the lane line in the image; determining a relative position information between the vehicle and the lane line according to the positions of the lane lines in multiple continuous image frames; the relative position information may include, but not limited to: on the line, departure to the left, departure to the right, centering, etc.; in the embodiments of the present application, violations of the vehicle such as running on the line may be reduced by obtaining the lane line departure detection result.

[0078] Optionally, step 130 may include:

[0079] in response to the detection result of departure from a lane line meeting the preset driving alert condition, determining whether the speed of the vehicle exceeds a first speed threshold.

[0080] In this embodiment, a first speed threshold is set for the detection result of departure from a lane line. When the speed of the vehicle exceeds the first speed threshold, the driving alert can be triggered to prompt the driver to notice the condition of departure from the lane line so as to reduce violations of the vehicle.

[0081] Optionally, the preset driving alert condition includes that a distance between the vehicle and the lane line reaching a preset range.

[00140] acquiring a video stream involving the traffic sign based on an image acquisition device disposed on the vehicle; classifying the traffic signs in the at least one image frame of the video stream to obtain a classification result of the traffic sign; and

[00141] obtaining a detection result of the traffic sign according to the classification result of the traffic sign.

[00142] During the driving process, the vehicle would encounter various traffic signs, and different traffic signs have different meanings; a traffic sign must be obeyed while driving the vehicle. Therefore, in this embodiment, acquiring the video stream including the traffic sign by the image acquisition apparatus; identifying images in the video stream to obtain the type of the traffic sign; the driving operation that currently can be executed by the vehicle is determined according to the type of the traffic sign, so as to further improve safety of the intelligent driving.

[00143] Optionally, step 130 may include:

[00144] Determining whether the speed of the vehicle exceeds a third speed threshold in response to the detection result of the traffic sign meeting the preset driving alert condition,

[00145] In this embodiment, a third speed threshold is set for the traffic sign detection result; when the speed of the vehicle exceeds the third speed threshold, the driving alert can be triggered to prompt the driver to notice the type of the traffic sign so as to reduce violation operations of the vehicle.

[00146] A traffic sign must be obeyed while driving the vehicle; traffic signs, as a part of the traffic rules, are disposed on fixed positions; when the traffic sign can be observed by the vehicle, the state of the vehicle needs to be adjusted in time to obey the traffic sign. The embodiment of the present application improves driving safety by using the intelligent driving assistance to prompt the driver and/or to automatically control to reduce incorrect operations due to the driver not observing the traffic sign. For example, when the vehicle does not obey the prohibitory sign, prompting the driver of a serious violation, and requiring further safety actions.

[00147] Optionally, the value range of the third speed threshold is greater than 60 km per hour.

[00148] Generally the traffic sign can be acquired at a long distance, and if the third speed threshold is set too small, frequent alerts will interfere with the driver, which may cause the driver's repugnance and affect the normal driving. Therefore, in the embodiment of the present application, the third speed threshold is set to be greater than 60 km/h, which can reduce the occurrence of violation operations of the vehicle without frequent alerts.

[00194] a driving state obtaining unit, configured to, in response to the triggering of the driving alert, obtain a driving state of the vehicle during a preset time period ; and

[00195] a result control unit, configured to, in response to that after the preset time expires, the driving state of the vehicle does not match a default driving state corresponding to the detection result, generate a driving control instruction for the vehicle according to the default driving state corresponding to the detection result.

[00196] The embodiments of the present application provide assisted driving control in which the vehicle is mainly controlled by the driver. After the driving alert is triggered, a period of time can be reserved for the driver to adopt a measure. If the driver still does not adjust the driving state after a reasonable period of time of alerting, it means that the danger level has increased significantly, and the assisted driving mode can be switched into an automatic driving mode to take over the control right of the vehicle, so as to automatically control the vehicle to adopt a safe measure.

[00197] In one or more optional embodiments, the apparatus of this embodiment further includes:

[00198] a result variation unit, configured to obtain a variation trend of the detection result over the preset time period in response to the triggering of the driving alert; and

[00199] a danger control unit, configured to generate a driving control instruction of the vehicle according to the default driving state corresponding to the detection result in response to the variation trend of the detection result indicating that a danger level being kept or rising

[00200] and the duration of the alert exceeds a preset threshold.

[00201] After the driving alert is triggered, first a reasonable reaction time (a preset time period) is provided for the driver for determining by himself. During this period of time, the driver may determine to change the driving state or turn off the alert (the alert can be turned off manually after the problem is solved), but when the driver does not adopt any measure while the variation trend of the detection result indicates that the danger level is continuously increasing, i.e., the danger level of the detection result increases as the time passes, and the vehicle needs to be automatically controlled the vehicle to ensure driving safety.

[00202] In one or more optional embodiments, when the target object is a lane line, the environment detection unit 21 is configured to acquire a video stream involving a drive road based on an image acquisition apparatus disposed on the vehicle; detect the lane line detection in at least one image frame of the video stream to obtain a detection result of the lane line; and obtain a detection result of departure from a lane line according to a lane line detection result and relative position information of the vehicle

[00229] Optionally, the first preset time is in a range of 1.5~5 seconds, and/or the second preset time is in a range of 1~2 seconds, and/or the third preset time is less than or equal to 1 second.

[00230] In one or more optional embodiments, when the target object is a traffic sign, the environment detection unit 21 is configured to acquire a video stream involving a traffic sign based on an image acquisition device disposed on the vehicle; classify the traffic signs in at least one image frame of the video stream to obtain a classification result of the traffic sign; and obtain a detection result of the traffic sign according to the classification result of the traffic sign.

[00231] During the driving process, the vehicle may encounter various traffic signs, and different traffic signs have different meanings; a traffic sign must be obeyed while driving the vehicle. Therefore, in this embodiment, the video stream including the traffic sign is obtained by the image acquisition apparatus; identity the images in the video stream to obtain the type of the traffic sign; the driving operation that currently can be executed by the vehicle is determined according to the type of the traffic sign, so as to further improve safety of the intelligent driving.

[00232] Optionally, the speed determining unit 23 is configured to determine whether the speed of the vehicle exceeds a third speed threshold in response to the detection result of the traffic sign meeting the preset driving alert condition.

[00233] Optionally, the value range of the third speed threshold is greater than 60 km per hour.

[00234] Optionally, the result control unit is configured to execute at least one of the following operations:

[00235] in response to that the traffic sign is a speed limit sign and that the driving state of the vehicle does not match the default driving state corresponding to the speed limit sign, generating an instruction for controlling the speed of the vehicle to increase or decrease to a speed corresponding to the traffic sign;

[00236] in response to that the traffic sign is a prohibition sign and that a the driving state of the vehicle does not match the default driving state corresponding to the prohibition sign, generating an instruction for controlling the vehicle not to perform an operation prohibited by the traffic sign;

[00237] in response to that the traffic sign is a warning sign and that the driving state of the vehicle does not match the default driving state corresponding to the warning sign, generating an instruction for controlling the vehicle to change the driving state;

[00238] in response to that the traffic sign is an indication sign and the driving state of the vehicle does not match the default driving state corresponding to the indication sign,

WHAT IS CLAIMED IS:

1. An intelligent driving control method, comprising:

detecting a driving environment of a vehicle to obtain a detection result of at least one type of target objects in the driving environment;

determining whether the detection result meets a preset driving alert condition;

in response to the detection result meeting the preset driving alert condition, determining whether a speed of the vehicle exceeds a speed threshold; and

in response to the speed exceeding the speed threshold, triggering a driving alert according to the detection result; wherein

when the detection result in the driving environment comprises a detection result of multiple types of target objects that respectively correspond to at least two different speed thresholds, a lower speed threshold of the at least two different speed thresholds is set as the speed threshold corresponding to a current driving environment.

2. The method according to claim 1, wherein the speed threshold is defaulted, or the speed threshold is set according to a received instruction; and/or

for the at least one type of target objects, speed thresholds respectively corresponding to different types of the target objects are same or different; and/or, preset driving alert conditions respectively corresponding to the different types of the target objects are same or different; and/or, driving alert modes respectively corresponding to the different types of the target objects are same or different; and/or,

the at least one type of target objects comprise at least one of: lane lines, traffic signs, traffic lights, pedestrians, motor vehicles, non-motor vehicles, animals, dangerous objects, or fixed obstacles; and/or,

a mode of the driving alert comprises at least one of: an auditory alert mode, a visual alert mode, a tactile alert mode, or an olfactory alert mode; and/or,

the detection result in the driving environment comprises one or more of: a detection result of deviation from a lane line, a traffic sign detection result, a traffic light state detection result, and a detection result of a distance from a first object; and the first object comprises at least one of: a pedestrian, a motor vehicle, a non-motor vehicle, an animal, a dangerous object, or a fixed obstacle.

3. The method according to claim 1, further comprising:

in response to the triggering of the driving alert, obtaining a driving state of the vehicle during a preset time period; and

in response to that, after the preset time period expires, the driving state of the vehicle does not match a default driving state corresponding to the detection result, generating a driving control instruction for the vehicle according to the default driving state corresponding to the detection result; and/or,

in response to the triggering of the driving alert, obtaining a variation trend of the detection result over a preset time period; and

in response to that the variation trend of the detection result indicates a danger level being kept or rising and that a duration of the alert exceeds a preset threshold, generating a driving control instruction for the vehicle according to the default driving state corresponding to the detection result.

4. The method according to claim 3, wherein, when the target object is a lane line, the detecting of the driving environment of the vehicle to obtain the detection result of the at least one type of target objects in the driving environment comprises:

acquiring a video stream involving a driving road based on an image acquisition apparatus disposed on the vehicle;

detecting the lane line from at least one image frame of the video stream to obtain a detection result of the lane line; and

obtaining a detection result of deviation from the lane line based on the detection result of the lane line and a relative position of the vehicle.

5. The method according to claim 4, wherein, when the target object is an first object, the detecting of the driving environment of the vehicle to obtain the detection result of the at least one type of target objects in the driving environment comprises:

acquiring a video stream involving the first object based on an image acquisition apparatus disposed on the vehicle;

detecting the first object from at least one image frame of the video stream to obtain a detection result of the first object; and

obtaining a detection result of a distance from the first object based on the detection

result of the first object and a relative position of the vehicle.

6. The method according to claim 5, wherein, when the target object is a traffic sign, the detecting of the driving environment of the vehicle to obtain the detection result of the at least one type of target objects in the driving environment comprises:

acquiring a video stream involving the traffic sign based on an image acquisition device disposed on the vehicle;

classifying the traffic sign in at least one image frame of the video stream to obtain a classification result of the traffic sign; and

obtaining a detection result of the traffic sign according to the classification result of the traffic sign.

7. The method according to claim 6, wherein, when the target object is a traffic light, the detecting of the driving environment of the vehicle to obtain the detection result of the at least one type of target objects in the driving environment comprises:

acquiring a video stream involving the traffic light based on an image acquisition apparatus disposed on the vehicle; and

performing traffic light state detection on at least one image frame of the video stream to obtain a traffic light state detection result.

8. The method according to claim 7, wherein the determining of whether the speed of the vehicle exceeds the speed threshold comprises:

in response to the detection result of deviation from the lane line meeting the preset driving alert condition, determining whether the speed of the vehicle exceeds a first speed threshold;

and/or,

the obtaining of the variation trend of the detection result over the preset time period comprises:

in response to the triggering of the driving alert, obtaining a variation trend of deviation of the vehicle from the lane line over the preset time period, and

the generating of the driving control instruction for the vehicle according to the default driving state corresponding to the detection result comprises:

in response to that the variation trend of the deviation of the vehicle from the lane line indicates a level of the deviation from the lane line rising and that the duration of the alert exceeds the preset threshold, issuing a prompt information for turning on a turn signal light and/or controlling the vehicle to turn on a corresponding turn signal light according to the default driving state corresponding to the detection result of the deviation from the lane line;

and/or,

the obtaining of the variation trend of the detection result over the preset time period comprises:

in response to the triggering of the driving alert, obtaining a variation range of a distance between the vehicle and the lane line, and

the generating of the driving control instruction for the vehicle according to the default driving state corresponding to the detection result comprises:

in response to that the variation range exceeds a safe distance range during a period corresponding to the preset threshold for the duration of the alert, controlling the vehicle so that the distance between the vehicle and the lane line is kept within the safe distance range.

9. The method according to claim 8, wherein the preset driving alert condition comprises that a distance between the vehicle and the lane line is within a preset range; and/or,

the first speed threshold is greater than 35 kilometers per hour; and/or,

the first speed threshold is in a range of 60~80 kilometers per hour.

10. The method according to claim 8, wherein the issuing of the prompt information for turning on the turn signal light and/or the controlling of the vehicle to turn on the corresponding turn signal light according to the default driving state corresponding to the detection result of the deviation from the lane line comprises:

in response to that the variation trend of the deviation of the vehicle from the lane line indicates the level of the deviation from the lane line rising and that the duration of the alert exceeds the preset threshold,

determining, based on at least one of the traffic sign detection result, the traffic light state detection result, or the detection result of the distance from the first object, to issue the prompt information for turning on the turn signal light and/or to control the vehicle to turn on the corresponding turn signal light.

11. The method according to claim 8, wherein the obtaining of the driving state of the vehicle during the preset time period comprises:

in response to the triggering of the driving alert, obtaining a turn signal light state of the vehicle, and

the generating of the driving control instruction for the vehicle according to the default driving state corresponding to the detection result comprises:

in response to that, after the preset time period expires, the turn signal light state matches the default driving state corresponding to the detection result, not issuing the prompt information and/or control information; and/or

in response to that, after the preset time period expires, the turn signal light state does not match the default driving state corresponding to the detection result, issuing the prompt information and/or control information;

and/or,

the default driving state corresponding to the detection result is determined based on the relative position and a type of the lane line; and

the type of the lane line comprises at least one of white dotted line, white solid line, yellow dotted line, yellow solid line, double white dotted lines, double yellow solid lines, yellow dotted and solid lines, or double white solid lines;

and/or,

the determining of whether the speed of the vehicle exceeds the speed threshold comprises:

in response to the detection result of the distance from the first object meeting the preset driving alert condition, determining whether the speed of the vehicle exceeds a second speed threshold.

12. The method according to claim 8, wherein, for different types of the first objects, the second speed threshold has different value ranges or a same value range; and/or,

when the first object is a motor vehicle, the second speed threshold is in a range of 20~200 kilometers per hour; and/or,

when the first object is a pedestrian, the second speed threshold is in a range of 20~40 kilometers per hour; and/or,

the default driving state corresponding to the detection result of the first object is determined based on a time-to-collision of the vehicle with respect to the first object; and

the time-to-collision is determined based on the distance from the first object and a relative speed of the vehicle with respect to the first object.

13. The method according to claim 12, wherein the obtaining of the variation trend of the detection result over the preset time period comprises:

in response to the triggering of the driving alert, determining whether the time-to-collision meets, within the preset time period, at least one of following conditions: the time-to-collision is less than a first preset time, the time-to-collision is less than a second preset time, or the time-to-collision is less than a third preset time; and

the generating of the driving control instruction for the vehicle according to the default driving state corresponding to the detection result comprises:

in response to that a variation trend of the detection result of the first object indicates the time-to-collision reducing and that the duration of the alert exceeds the preset threshold, generating a preset anti-collision instruction according to the default driving state corresponding to the detection result, wherein the preset anti-collision instruction comprises at least one of: an instruction for prompting a driver to reduce the speed, an instruction for controlling the vehicle to reduce the speed, or an instruction for controlling a part or all of braking and/or turning functions of the vehicle.

14. The method according to claim 13, wherein the generating of the preset anti-collision instruction according to the default driving state corresponding to the detection result comprises:

in response to the time-to-collision being less than the first preset time and the duration of the alert exceeding the preset threshold, issuing alert information to prompt the driver to reduce the speed and/or to turn; and/or

in response to the time-to-collision being less than the second preset time and the duration of the alert exceeding the preset threshold, issuing the alert information to prompt the driver to

reduce the speed and/or to turn, and controlling a part of braking and/or turning functions of the vehicle; and/or

in response to the time-to-collision being less than the third preset time and the duration of the alert exceeding the preset threshold, controlling the vehicle to brake and/or to turn.

15. The method according to claim 14, wherein respective value ranges of the first preset time, the second preset time, and the third preset time have an intersection therebetween or have no intersection therebetween; and/or,

the first preset time is in a range of 1.5~5 seconds, and/or the second preset time is in a range of 1~2 seconds, and/or the third preset time is less than or equal to 1 second.

16. The method according to claim 15, wherein the determining of whether the speed of the vehicle exceeds the speed threshold comprises:

in response to the detection result of the traffic sign meeting the preset driving alert condition, determining whether the speed of the vehicle exceeds a third speed threshold;

and/or,

the determining of whether the speed of the vehicle exceeds the speed threshold comprises:

in response to the traffic light state detection result meeting the preset driving alert condition, determining whether the speed of the vehicle exceeds a fourth speed threshold;

and/or,

the generating of the driving control instruction for the vehicle according to the default driving state corresponding to the detection result comprises:

in response to that, after the preset time period expires, the driving state of the vehicle does not match the default driving state corresponding to the traffic light state detection result, generating an instruction for controlling the vehicle to turn on a turn signal light, slow down, brake, and/or turn.

17. The method according to claim 16, wherein the third speed threshold is greater than 60 kilometers per hour; and/or,

the generating of the driving control instruction for the vehicle according to the default driving state corresponding to the detection result comprises at least one of:

in response to that the traffic sign is a speed limit sign and that the driving state of the vehicle does not match the default driving state corresponding to the speed limit sign, generating an instruction for controlling the speed of the vehicle to increase or decrease to a speed corresponding to the traffic sign;

in response to that the traffic sign is a prohibition sign and that the driving state of the vehicle does not match the default driving state corresponding to the prohibition sign, issuing an instruction for controlling the vehicle not to perform an operation prohibited by the traffic sign;

in response to that the traffic sign is a warning sign and that the driving state of the vehicle does not match the default driving state corresponding to the warning sign, generating an instruction for controlling the vehicle to change the driving state;

in response to that the traffic sign is an indication sign and that the driving state of the vehicle does not match the default driving state corresponding to the indication sign, generating an instruction for controlling the vehicle to perform driving control according to indication of the traffic sign;

in response to that the traffic sign is a road sign and/or a tourist region sign and that the driving state of the vehicle does not match the default driving state corresponding to the road sign and/or the tourist region sign, generating an instruction for controlling the vehicle to drive towards a road according to the vehicle's destination; or

in response to that the traffic sign is a road construction safety sign and that the driving state of the vehicle does not match the default driving state corresponding to the road construction safety sign, generating an instruction for controlling the vehicle to perform one or more operations of slowing down, braking, detouring, retaining the driving state, turning, turning on a turn signal light, or turning on a brake light according to indication of the traffic sign.

18. The method according to claim 17, wherein the preset driving alert condition comprises that a current driving state of the vehicle does not conform to the traffic light state detection result; and/or,

the fourth speed threshold is greater than 40 kilometers per hour.

19. An electronic device, comprising: a memory storing executable instructions; and a processor, configured to communicate with the memory to execute the executable instructions to implement operations comprising:

detecting a driving environment of a vehicle to obtain a detection result of at least one type of target objects in the driving environment;

determining whether the detection result meets a preset driving alert condition;

in response to the detection result meeting the preset driving alert condition, determining whether a speed of the vehicle exceeds a speed threshold; and

in response to the speed exceeding the speed threshold, triggering a driving alert according to the detection result; wherein

when the detection result in the driving environment comprises a detection result of multiple types of target objects that respectively correspond to at least two different speed thresholds, a lower speed threshold of the at least two different speed thresholds is set as the speed threshold corresponding to a current driving environment.

20. A non-transitory computer-readable storage medium, having a computer program stored thereon, wherein when the program is executed by a processor, the processor is caused to perform operations comprising:

detecting a driving environment of a vehicle to obtain a detection result of at least one type of target objects in the driving environment;

determining whether the detection result meets a preset driving alert condition;

in response to the detection result meeting the preset driving alert condition, determining whether a speed of the vehicle exceeds a speed threshold; and

in response to the speed exceeding the speed threshold, triggering a driving alert according to the detection result; wherein

when the detection result in the driving environment comprises a detection result of multiple types of target objects that respectively correspond to at least two different speed thresholds, a lower speed threshold of the at least two different speed thresholds is set as the speed threshold corresponding to a current driving environment.