CLAIMS

1. A passenger state analysis method, comprising:

obtaining a video stream of a rear seat area in a vehicle;

performing face detection and body detection on at least one image frame in the video stream;

determining state information of a passenger in the rear seat area according to a result of the face detection and body detection; and

in response to the fact that the state information of the passenger satisfies a predetermined condition, outputting prompt information to a driver area or a specified device in the vehicle,

wherein the determining state information of the passenger in the rear seat area according to the result of the face detection and body detection comprises:

determining whether the passenger is in an abnormal state according to the result of the face detection and body detection; and determining whether the passenger makes a dangerous action according to the result of the face detection and body detection; and

the in response to the fact that the state information of the passenger satisfies the predetermined condition, outputting the prompt information to the driver area or the specified device in the vehicle comprises: in response to the fact that the passenger is in the abnormal state, the passenger makes the dangerous action, the passenger is in the abnormal state for a preset period of time, or the passenger is in the dangerous action state for a preset period of time, outputting the prompt information to the driver area or the specified device in the vehicle,

wherein the abnormal state comprises at least one of: irritability, choking, coughing, or pain;

wherein the dangerous action comprises at least one of: opening a door, holding a

device, unfastening a seat belt, extending a part of a body out of a window, leaving a specified area, or smoking;

wherein the passenger comprises at least one of: an adult or a child;

wherein the result of the face detection and body detection comprises at least one of: whether there is a face, whether there is a body, eyes open, eyes closed, expression, age, mouth open, mouth closed, or body movements.

2. The method according to claim 1, wherein the passenger comprises the child;

the rear seat area comprises a child seat area;

the result of the face detection and body detection comprises at least one of: whether there is a face or whether there is a body;

the determining the state information of the passenger in the rear seat area according to the result of the face detection and body detection comprises: determining whether the child is located on the child seat according to the result of the face detection and body detection; and

the in response to the fact that the state information of the passenger satisfies the predetermined condition, outputting the prompt information to the driver area or the specified device in the vehicle comprises: in response to the fact that the child leaves the child seat or a childless state on the child seat exceeds a preset period of time, outputting the prompt information to the driver area or the specified device in the vehicle.

3. The method according to any one of claims 1 to 2, wherein the passenger comprises the child;

the determining state information of the passenger in the rear seat area according to the result of the face detection and body detection comprises: determining whether the child is crying according to the result of the face detection and body detection; and

the in response to the fact that the state information of the passenger satisfies the predetermined condition, outputting the prompt information to the driver area or the specified device in the vehicle comprises: in response to the fact that the child is crying or the child is in a crying state for a preset period of time, outputting the prompt information to the driver area or the specified device in the vehicle.

4. The method according to any one of claims 1 to 2, wherein the passenger comprises the child;

the result of the face detection and body detection comprises eyes open and eyes closed;

the determining state information of the passenger in the rear seat area according to the result of the face detection and body detection comprises: determining whether the child is asleep or awake according to a state statistical analysis result of the child's eyes open and/or closed within a predetermined time window; and

the in response to the fact that the state information of the passenger satisfies the predetermined condition, outputting the prompt information to the driver area or the specified device in the vehicle comprises: in response to the child being asleep, being asleep for a predetermined period of time, being awake, or being awake for a predetermined period of time, outputting the prompt information to the driver area or the specified device in the vehicle.

5. The method according to any one of claims 1 to 4, wherein the result of the face detection and body detection comprises: a classification result of whether the passenger is a child;

the performing face detection and body detection on at least one image frame in the video stream comprises:

extracting at least one of a face feature or body feature of the at least one image frame in the video stream; and

performing classification processing of whether the passenger is a child based on the extracted feature.

6. The method according to any one of claims 1 to 5, wherein the performing face detection and body detection on at least one image frame in the video stream comprises: performing, by a feature extraction branch of a neural network, at least one of face feature extraction or body feature extraction on the at least one image frame in the video stream; and

determining, by at least one detection branch connected to the feature extraction branch in the neural network, the result of the face detection and body detection based on at least one of a face feature or a body feature extracted by the feature extraction branch.

7. The method according to any one of claims 1 to 5, wherein the performing face detection and body detection on at least one image frame in the video stream comprises: performing, by the feature extraction branch of the neural network, at least one of face feature extraction or body feature extraction on the at least one image frame in the video stream; and

respectively determining, by a classification branch and at least one detection branch connected to the feature extraction branch in the neural network, whether a person in the image is a child, and the result of the face detection and body detection based on at least one of the face feature or the body feature extracted by the feature extraction branch.

8. The method according to any one of claims 1 to 5, wherein the performing face detection and body detection on at least one image frame in the video stream comprises: performing, by the feature extraction branch of the neural network, face feature extraction on the at least one image frame in the video stream;

determining, by the classification branch connected to the feature extraction branch in the neural network, whether the person in the image is a child based on the face feature extracted by the feature extraction branch; or

determining, by an identification branch connected to the feature extraction branch in the neural network, the age of the passenger in the image, and determining the passenger whose age is less than or equal to a preset age as a child.

9. The method according to claim 7 or 8, wherein the classification branch that determines whether the person in the image is a child is pre-trained based on child annotation data that distinguishes gender.

10. The method according to any one of claims 7 to 9, before the performing face detection and body detection on at least one image frame in the video stream, further comprising:

training the neural network by using a sample image, wherein the sample image has child annotation information;

wherein the child annotation information indicates whether the person in the sample image is a child; in response to the fact that the age or estimated age of the person in the sample image is greater than the age or estimated age of a person in a reference image, the child annotation information of the sample image indicates a non-child; and in response to the age or estimated age of the person in the sample image is less than or equal to the age or estimated age of the person in the reference image, the child annotation information of the sample image indicates a child.

11. The method according to claim 10, wherein the reference image comprises a boy reference image and a girl reference image.

12. The method according to any one of claims 1 to 11, wherein the obtaining the video stream of the rear seat area in the vehicle comprises:

collecting to obtain the video stream of the rear seat area based on at least one camera disposed inside the vehicle.

13. The method according to any one of claims 1 to 12, wherein the in response to the fact that the state information of the passenger satisfies the predetermined condition, outputting the prompt information to the driver area or the specified device in the vehicle comprises:

in response to the fact that the state information of the passenger satisfies the predetermined condition, outputting the prompt information to at least one of a device within the driver's line of sight range or a preset device.

14. The method according to claim 12 or 13, further comprising:

displaying, by the at least one of the device within the driver's line of sight range or the preset device, at least one of the following information: at least one image frame of the obtained video stream or the result of the face detection and body detection.

15. The method according to any one of claims 1 to 14, before the obtaining the video stream of the rear seat area in the vehicle, further comprising:

receiving, by a mobile application terminal or a vehicle-mounted device, a monitoring instruction; and

the obtaining the video stream of the rear seat area in the vehicle comprises:

obtaining the video stream of the rear seat area in the vehicle according to the monitoring instruction.

16. A passenger state analysis apparatus, comprising:

a video collection unit, configured to obtain a video stream of a rear seat area in a vehicle;

an image detection unit, configured to perform face detection and body detection on at least one image frame in the video stream;

a state determining unit, configured to determine state information of a passenger in the rear seat area according to a result of the face detection and body detection; and

an information prompt unit, configured to: in response to the fact that the state information of the passenger satisfies a predetermined condition, output prompt information to a driver area or a specified device in the vehicle,

wherein the state determining unit is further configured to:

determine whether the passenger is in an abnormal state according to the result of the face detection and body detection; and determine whether the passenger makes a dangerous action according to the result of the face detection and body detection; and

in response to the passenger being in the abnormal state, the passenger making the dangerous action, the passenger being in the abnormal state for a preset period of time, or the passenger being in a dangerous action state for a preset period of time, output the prompt information to the driver area or the specified device in the vehicle,

wherein the abnormal state comprises at least one of: irritability, choking, coughing, or pain;

wherein the dangerous action comprises at least one of: opening a door, holding a device, unfastening a seat belt, extending a part of a body out of a window, leaving a specified area, or smoking;

wherein the passenger comprises at least one of: an adult or a child;

wherein the result of the face detection and body detection comprises at least one of:

whether there is a face, whether there is a body, eyes open, eyes closed, expression, age, mouth open, mouth closed, or body movements.

17. An electronic device, comprising the passenger state analysis apparatus according to claim 18; or

the electronic device comprises: a memory, configured to store an executable instruction; and a processor, configured to communicate with the memory to execute the executable instructions so as to complete operations of the passenger state analysis method according to any one of claims 1 to 15.

18. A computer program product, comprising computer-readable codes, wherein when the computer-readable codes are run on a device, a processor in the device executes instructions for implementing the passenger state analysis method according to any one of claims 1 to 15.