determine that the number of lost RTP packets in each lost entire frame is int(V_lostPackets/V_lostFrames), and the number of lost RTP packets in a frame to which the latter RTP packet belongs is V_lostPackets%V_lostFrames.

[0232] Optionally, the processor 12 is further specifically configured to:

if it is determined according to the timestamps and marker bits of the two RTP packets that the two RTP packets belong to different frames, frames to which the two RTP packets belong are nonconsecutive, and the former RTP packet is not the last RTP packet in a frame to which the former RTP packet belongs, determine the number V_lostFrames of lost entire frames between the frames to which the two RTP packets belong according to a video frame rate, a clock rate of an RTP packet, and the timestamps of the two RTP packets; and

determine that the number of lost RTP packets in the frame to which the former RTP packet belongs is 1, the number of lost RTP packets in each lost entire frame is int((V_lostPackets – 1)/V_lostFrames), and the number of lost RTP packets in a frame to which the latter RTP packet belongs is (V_lostPackets – 1)%V_lostFrames.

[0233] For a specific implementation of this embodiment, refer to the frame size detection method provided by the foregoing embodiment of the present invention. In this embodiment of the present invention, if it is determined that a packet loss occurs between two received RTP packets, a payload of each lost RTP packet is estimated according to a payload of each received RTP packet, the total number of lost RTP packets between the two RTP packets is obtained according to sequence numbers of the two RTP packets, and then the number of lost RTP packets in each frame with a packet loss is estimated according to the total number V_lostPackets of lost RTP packets, and timestamps and marker bits of the two RTP packets, so that a size of each frame with the packet loss is obtained according to the number of lost RTP packets in each frame with the packet loss and a payload of each lost RTP packet. This provides an effective solution of detecting a size of a frame with a packet loss.

[0234] Finally, it should be noted that the foregoing embodiments are merely intended for describing the technical solutions of the present invention except limiting the present invention. Although the present invention is described in detail with reference to the foregoing embodiments, a person of ordinary skill in the art should understand that he may still make modifications to the technical solutions described in the foregoing embodiments or make equivalent replacements to some technical features thereof, without departing from ~~the spirit and~~ scope of the technical solutions of the embodiments of the present invention.

CLAIMS

What is claimed is:

1. A frame type detection method for a video stream, comprising:

obtaining a size of a current video frame, wherein the current video frame is located after the first video frame of the video stream;

obtaining a change feature value of the current video frame according to the size of the current video frame and a size of a previous firstvideo frame adjacent to the current video frame;

obtaining an I-frame threshold of the current video frame according to a video frame rate and a location of the current video frame; and

determining whether the previous firstvideo frame is an I frame according to the change feature value of the current video frame, a change feature value of the previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, the size of the previous first video frame, and a size of a previous second video frame adjacent to the previous first video frame.

2. The method according to claim 1, wherein the obtaining a size of a current video frame specifically comprises:

whenit is determined that a packet loss does not occur in the current video frame, obtaining a payload of each Real-time Transport Protocol RTP packet in the current video frame; and

accumulating the payload of each RTP packet in the current video frame to obtain the size of the current video frame.

3. The method according to claim 1, wherein the obtaining a size of a current video frame specifically comprises:

when it is determined that a packet loss occurs in the current video frame and the entire frame is not lost, obtaining a payload of each received RTP packet in the current video frame, and accumulating the payload of each received RTP packet in the current video frame to obtain a total size of the received RTP packets in the current video frame;

estimating a payload of each lost RTP packet and the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all the received RTP packets, and obtaining a total size of the lost RTP packets in the current video frame according to the payload of each lost RTP packet and the number of lost RTP packets in the current video frame; and

adding the total size of the received RTP packets in the current video frame and the total size of the lost RTP packets in the current video frame to obtain the size of the current video frame.

4. The method according to claim 3, wherein the estimating a payload of each lost RTP packet according to a previous adjacent RTP packet and a next adjacent RTP packet of a lost RTP packet in the current video frame among all received RTP packets specifically comprises:

obtaining a payload of the previous adjacent RTP packet and a payload of the next adjacent RTP packet; and

estimating the payload of each lost RTP packet according to the average value of the payload of the previous adjacent RTP packet and the payload of the next adjacent RTP packet.

5. The method according to claim 3, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

when it is determined according to timestamps of the previous adjacent RTP packet and the next adjacent RTP packet that both the previous adjacent RTP packet and the next adjacent RTP packet belong to the current video frame, or,

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the previous first video frame, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the previous first video frame, obtaining the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determining that the number of lost RTP packets in the current video frame is V_lostPackets.

6. The method according to claim 3, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, the next adjacent RTP packet belongs to a next video frame adjacent to the current video frame, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, obtaining the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determining that the number of lost RTP packets in the current video frame is int(V_lostPackets/2) + V_lostPackets%2.

7. The method according to claim 3, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that a video frame to which the previous adjacent RTP packet belongs and the current video frame are nonconsecutive, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, obtaining the number V_lostFrames of lost video frames between the previous adjacent RTP packet and the next adjacent RTP packet and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and sequence numbers and timestamps of the previous adjacent RTP packet and the next adjacent RTP packet; and

determining that the number of lost RTP packets in the current video frame is V_lostPackets%V_lostFrames.

8. The method according to claim 3, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, a video frame to which the next adjacent RTP packet belongs and the current video frame are nonconsecutive, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, determining that the number of lost RTP packets in the current video frame is 1.

9. The method according to claim 1, wherein the obtaining a size of a current video frame specifically comprises:

if it is determined that the entire current video frame is lost, estimating a payload of each lost RTP packet according to a previous adjacent RTP packet and a next adjacent RTP packet of the current video frame among all received RTP packets, obtaining the number V_lostFrames of lost video frames between a video frame to which the previous adjacent RTP packet belongs and a video frame to which the next adjacent RTP packet belongs and the total number V_lostPackets of lost

RTP packets according to a video frame rate, a clock rate of an RTP packet, and timestamps and sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet;

if it is determined according to a marker bit of the previous adjacent RTP packet that the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, determining that the number of RTP packets in the current video frame is int(V_lostPackets/V_lostFrames), if it is determined the previous adjacent RTP packet is not the last RTP packet, determining that the number of RTP packets in the current video frame is int((V_lostPackets – 1)/V_lostFrames); and

obtaining the size of the current video frame according to the number of RTP packets in the current video frame and a payload of each lost RTP packet.

10. The method according to any one of claims 1 to 9, wherein the obtaining a change feature value of the current video frame according to the size of the current video frame and a size of a previous first video frame adjacent to the current video frame specifically comprises:

using an absolute value of a difference value between the size of the current video frame and the size of the previous first video frame as the change feature value of the current video frame.

11. The method according to any one of claims 1 to 10, wherein the obtaining an I-frame threshold of the current video frame according to a video frame rate and a location of the current video frame specifically comprises:

obtaining the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame.

12. The method according to claim 11, wherein the obtaining the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame specifically comprises:

if the previous second video frame is the previous closest I frame, determining that the I-frame threshold of the current video frame is a product of a size of the previous closest I frame and a first constant, wherein a value range of the first constant is (0,1].

13. The method according to claim 11, wherein the obtaining the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame specifically comprises:

if the previous second video frame is not the previous closest I frame, determining whether the distance between the current video frame and the previous closest I frame is greater than the video frame rate, if greater than, determining a product of an I-frame threshold of the previous first video frame and a first scale factor as the I-frame threshold of the current video frame, and if not greater than, determining the product of the I-frame threshold of the previous first video frame and a

second scale factor as the I-frame threshold of the current video frame; wherein a value range of the first scale factor and the second scale factor is (0,1], and the first scale factor is greater than the second scale factor.

14. The method according to any one of claims 1 to 13, wherein the determining whether the previous first video frame is an I frame according to the change feature value of the current video frame, a change feature value of the previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, the size of the previous first video frame, and a size of a previous second video frame adjacent to the previous first video frame specifically comprises:

if a ratio of the size of the previous first video frame to the size of the previous second video frame or a ratio of the size of the previous first video frame to the size of the current video frame is greater than a second constant, the change feature value of the current video frame is greater than the I-frame threshold of the current video frame, and the change feature value of the previous first video frame is greater than the I-frame threshold of the current video frame, determining that the previous first video frame is an I frame, and otherwise determining that the previous first video frame is not an I frame.

15. The method according to claim 14, wherein the determining whether the previous first video frame is an I frame according to the change feature value of the current video frame, a change feature value of the previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, the size of the previous first video frame, and a size of a previous second video frame adjacent to the previous first video frame specifically further comprises:

if the current video frame is the second video frame of the video stream, determining that the previous first video frame of the current video frame is an I frame.

16. The method according to claim 14, wherein the second constant is determined according to a code rate, the video frame rate, and the location of the current video frame.

17. The method according to claim 14 or 15, after the determining that the previous first video frame is an I frame, further comprising:

calculating an average size of each I frame.

18. The method according to claim 17, wherein if the current video frame is the last video frame in the video stream, the method further comprises:

if a ratio of the size of the current video frame to the average size of each I frame is greater than a third constant, determining that the current video frame is an I frame, and otherwise determining that the current video frame is not an I frame, wherein the third constant is greater than 0.

19. The method according to any one of claims 1 to 18, before the obtaining a size of a current

video frame, further comprising:

obtaining a size of the first video frame;

determining that a change feature value of the first video frame is a product of the size of the first video frame and a fourth constant, wherein a value range of the fourth constant is (0,1]; and

determining that an I-frame threshold of the first video frame equals the change feature value of the first video frame.

20. A frame type detection apparatus for a video stream, comprising:

a frame size obtaining module, configured to obtain a size of a current video frame, wherein the current video frame is located after the first video frame of the video stream;

a feature extracting module, configured to obtain a change feature value of the current video frame according to the size of the current video frame and a size of a previous first video frame adjacent to the current video frame;

a threshold obtaining module, configured to obtain an I-frame threshold of the current video frame according to a video frame rate and a location of the current video frame; and

a type determining module, configured to determine whether the previous first video frame is an I frame according to the change feature value of the current video frame, a change feature value of the previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, the size of the previous first video frame, and a size of a previous second video frame adjacent to the previous first video frame.

21. The apparatus according to claim 20, wherein the frame size obtaining module is specifically configured to:

if it is determined that a packet loss does not occur in the current video frame, obtain a payload of each Real-time Transport Protocol RTP packet in the current video frame; and

accumulate the payload of each RTP packet in the current video frame to obtain the size of the current video frame.

22. The apparatus according to claim 20, wherein the frame size obtaining module specifically comprises:

a received size obtaining unit, configured to: if it is determined that a packet loss occurs in the current video frame and the entire frame is not lost, obtain a payload of each received RTP packet in the current video frame, and accumulate the payload of each received RTP packet in the current video frame to obtain a total size of the received RTP packets in the current video frame;

a lost size obtaining unit, configured to estimate a payload of each lost RTP packet and the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video

frame among all received RTP packets, and obtain a total size of the lost RTP packets in the current video frame according to a payload of each lost RTP packet and the number of lost RTP packets in the current video frame; and

a frame size obtaining unit, configured to add the total size of the received RTP packets and the total size of the lost RTP packets in the current video frame to obtain the size of the current video frame.

23. The apparatus according to claim 22, wherein the lost size obtaining unit is specifically configured to:

obtain a payload of the previous adjacent RTP packet and a payload of the next adjacent RTP packet; and

estimate the payload of each lost RTP packet according to the average value of the payload of the previous adjacent RTP packet and the payload of the next adjacent RTP packet.

24. The apparatus according to claim 22, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to timestamps of the previous adjacent RTP packet and the next adjacent RTP packet that both the previous adjacent RTP packet and the next adjacent RTP packet belong to the current video frame, or,

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the previous first video frame, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the previous first video frame, obtain the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determine that the number of lost RTP packets in the current video frame is V_lostPackets.

25. The apparatus according to claim 22, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, the next adjacent RTP packet belongs to a next video frame adjacent to the current video frame, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, obtain the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP

packet; and

determine that the number of lost RTP packets in the current video frame is int(V_lostPackets/2) + V_lostPackets%2.

26. The apparatus according to claim 22, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that a video frame to which the previous adjacent RTP packet belongs and the current video frame are nonconsecutive, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, obtain the number V_lostFrames of lost video frames between the previous adjacent RTP packet and the next adjacent RTP packet and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and sequence numbers and timestamps of the previous adjacent RTP packet and the next adjacent RTP packet; and

determine that the number of lost RTP packets in the current video frame is V_lostPackets%V_lostFrames.

27. The apparatus according to claim 22, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, a video frame to which the next adjacent RTP packet belongs and the current video frame are nonconsecutive, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, determine that the number of lost RTP packets in the current video frame is 1.

28. The apparatus according to claim 20, wherein the frame size obtaining module is specifically configured to:

if it is determined that the entire current video frame is lost, estimate a payload of each lost RTP packet according to a previous adjacent RTP packet and a next adjacent RTP packet of the current video frame among all received RTP packets, obtain the number V_lostFrames of lost video frames between a video frame to which the previous adjacent RTP packet belongs and a video frame to which the next adjacent RTP packet belongs and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and timestamps and sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet;

if it is determined according to a marker bit of the previous adjacent RTP packet that the

previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, determine that the number of RTP packets in the current video frame is int(V_lostPackets/V_lostFrames), and otherwise determine that the number of RTP packets in the current video frame is int((V_lostPackets – 1)/V_lostFrames); and

obtain the size of the current video frame according to the number of RTP packets in the current video frame and a payload of each lost RTP packet.

29. The apparatus according to any one of claim 20 to 28, wherein the feature extracting module is specifically configured to:

use an absolute value of a difference value between the size of the current video frame and the size of the previous first video frame as the change feature value of the current video frame.

30. The apparatus according to any one of claims 20 to 29, wherein the threshold obtaining module is specifically configured to:

obtain the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame.

31. The apparatus according to claim 30, wherein the threshold obtaining module is specifically configured to:

if the previous second video frame is the previous closest I frame, determine that the I-frame threshold of the current video frame is a product of a size of the previous closest I-frame and a first constant, wherein a value range of the first constant is (0,1].

32. The apparatus according to claim 30, wherein the threshold obtaining module is specifically configured to:

if the previous second video frame is not the previous closest I frame, determine whether the distance between the current video frame and the previous closest I frame is greater than the video frame rate, if greater than, determine a product of an I-frame threshold of the previous first video frame and a first scale factor as the I-frame threshold of the current video frame, and if not greater than, determine the product of the I-frame threshold of the previous first video frame and a second scale factor as the I-frame threshold of the current video frame; wherein a value range of the first scale factor and the second scale factor is both (0,1], and the first scale factor is greater than the second scale factor.

33. The apparatus according to any one of claims 20 to 32, wherein the type determining module is specifically configured to:

if a ratio of the size of the previous first video frame to the size of the previous second video frame or a ratio of the size of the previous first video frame to the size of the current video frame is greater than a second constant, the change feature value of the current video frame is greater than

the I-frame threshold of the current video frame, and the change feature value of the previous first video frame is greater than the I-frame threshold of the current video frame, determine that the previous first video frame is an I frame, and otherwise determine that the previous first video frame is not an I frame.

34. The apparatus according to claim 33, wherein the type determining module is specifically configured to:

if the current video frame is the second video frame of the video stream, determine that the previous first video frame is an I frame.

35. The apparatus according to claim 33, wherein the second constant is determined according to a code rate, the video frame rate, and the location of the current video frame.

36. The apparatus according to claim 33 or 34, further comprising:

an average value calculating module, configured to: after the type determining module determines that the previous first video frame is an I frame, calculate an average size of each I frame.

37. The apparatus according to claim 36, wherein if the current video frame is the last video frame in the video stream, the type determining module is further configured to:

if a ratio of the size of the current video frame to the average size of each I frame is greater than a third constant, determine that the current video frame is an I frame, and otherwise determine that the current video frame is not an I frame, wherein the third constant is greater than 0.

38. The apparatus according to any one of claims 20 to 37, wherein the frame size obtaining module is further configured to: obtain a size of the first video frame;

the feature extracting module is further configured to: determine that a change feature value of the first video frame is a product of the size of the first video frame and a fourth constant, wherein a value range of the fourth constant is (0,1]; and

the threshold obtaining module is further configured to determine that an I-frame threshold of the first video frame equals the change feature value of the first video frame.

39. A frame type detection method for a video stream, comprising:

obtaining a size of a current video frame, wherein the current video frame is located after the first video frame of the video stream;

obtaining a change feature value of the current video frame according to the size of the current video frame and sizes of at least two previous video frames;

obtaining an I-frame threshold of the current video frame according to a video frame rate and a location of the current video frame; and

determining, according to the change feature value of the current video frame, a change feature

value of a previous first video frame adjacent to the current video frame, the I-frame threshold of the current video frame, the size of the current video frame, and the sizes of the at least two previous video frames, whether the previous first video frame is an I frame.

40. The method according to claim 39, wherein the obtaining a size of a current video frame specifically comprises:

if it is determined that a packet loss does not occur in the current video frame, obtaining a payload of each Real-time Transport Protocol RTP packet in the current video frame; and

accumulating the payload of each RTP packet in the current video frame to obtain the size of the current video frame.

41. The method according to claim 39, wherein the obtaining a size of a current video frame specifically comprises:

if it is determined that a packet loss occurs in the current video frame and the entire frame is not lost, obtaining a payload of each received RTP packet in the current video frame, and accumulating the payload of each received RTP packet in the current video frame to obtain a total size of the received RTP packets in the current video frame;

estimating a payload of each lost RTP packet and the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets, and obtaining a total size of the lost RTP packets in the current video frame according to a payload of each lost RTP packet and the number of lost RTP packets in the current video frame; and

adding the total size of the received RTP packets and the total size of the lost RTP packets in the current video frame to obtain the size of the current video frame.

42. The method according to claim 41, wherein the estimating a payload of each lost RTP packet according to a previous adjacent RTP packet and a next adjacent RTP packet of a lost RTP packet in the current video frame among all received RTP packets specifically comprises:

obtaining a payload of the previous adjacent RTP packet and a payload of the next adjacent RTP packet; and

estimating the payload of each lost RTP packet according to the average value of the payload of the previous adjacent RTP packet and the payload of the next adjacent RTP packet.

43. The method according to claim 41, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

if it is determined according to timestamps of the previous adjacent RTP packet and the next

adjacent RTP packet that both the previous adjacent RTP packet and the next adjacent RTP packet belong to the current video frame, or,

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the previous first video frame, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the previous first video frame, obtaining the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determining that the number of lost RTP packets in the current video frame is V_lostPackets.

44. The method according to claim 41, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, the next adjacent RTP packet belongs to a next video frame adjacent to the current video frame, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, obtaining the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determining that the number of lost RTP packets in the current video frame is int(V_lostPackets/2) + V_lostPackets%2.

45. The method according to claim 41, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that a video frame to which the previous adjacent RTP packet belongs and the current video frame are nonconsecutive, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, obtaining the number V_lostFrames of lost video frames between the previous

adjacent RTP packet and the next adjacent RTP packet and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and sequence numbers and timestamps of the previous adjacent RTP packet and the next adjacent RTP packet; and

determining that the number of lost RTP packets in the current video frame is V_lostPackets%V_lostFrames.

46. The method according to claim 41, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, a video frame to which the next adjacent RTP packet belongs and the current video frame are nonconsecutive, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, determining that the number of lost RTP packets in the current video frame is 1.

47. The method according to claim 39, wherein the obtaining a size of a current video frame specifically comprises:

if it is determined that the entire current video frame is lost, estimating a payload of each lost RTP packet according to a previous adjacent RTP packet and a next adjacent RTP packet of the current video frame among all received RTP packets, obtaining the number V_lostFrames of lost video frames between a video frame to which the previous adjacent RTP packet belongs and a video frame to which the next adjacent RTP packet belongs and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and timestamps and sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet;

if it is determined according to a marker bit of the previous adjacent RTP packet that the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, determining that the number of RTP packets in the current video frame is int(V_lostPackets/V_lostFrames), and otherwise determining that the number of RTP packets in the current video frame is int((V_lostPackets – 1)/V_lostFrames); and

obtaining the size of the current video frame according to the number of RTP packets in the current video frame and a payload of each lost RTP packet.

48. The method according to any one of claims 39 to 47, wherein the obtaining a change feature value of the current video frame according to the size of the current video frame and sizes of at least two previous video frames specifically comprises:

using an absolute value of an average value of difference values between the size of the current video frame and the sizes of the at least two previous video frames or an average value of absolute values of difference values between the size of the current frame and the sizes of the at least two previous video frames as the change feature value of the current video frame.

49. The method according to any one of claims 39 to 48, wherein the obtaining an I-frame threshold of the current video frame according to a video frame rate and a location of the current video frame specifically comprises:

obtaining the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame.

50. The method according to claim 49, wherein the obtaining the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame, specifically comprises:

if a previous second video frame adjacent to the previous first video frame is the previous closest I frame, determining that the I-frame threshold of the current video frame is a product of a size of the previous closest I frame and a first constant, wherein a value range of the first constant is (0,1].

51. The method according to claim 49, wherein the obtaining the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I-frame specifically comprises:

if a previous second video frame adjacent to the previous first video frame is not the previous closest I frame, determining whether the distance between the current video frame and the previous closest I frame is greater than the video frame rate, if greater than, determining the product of an I-frame threshold of the previous first video frame and a first scale factor as the I-frame threshold of the current video frame, and if not greater than, determining the product of the I-frame threshold of the previous first video frame and a second scale factor as the I-frame threshold of the current video frame; wherein a value range of the first scale factor and the second scale factor is both (0,1], and the first scale factor is greater than the second scale factor.

52. The method according to any one of claims 39 to 51, wherein the determining, according to the change feature value of the current video frame, a change feature value of a previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, and sizes of the at least two previous video frames, whether the previous first video frame is an I frame specifically comprises:

if a ratio of the size of the previous first video frame to the size of the previous second video frame adjacent to the previous first video frame or a ratio of the size of the previous first video

frame to the size of the current video frame is greater than a second constant, and the change feature value of the current video frame is greater than the I-frame threshold of the current video frame, and the change feature value of the previous first video frame is greater than the I-frame threshold of the current video frame, determining that the previous first video frame is an I frame, and otherwise determining that the previous first video frame is not an I frame; or,

if a ratio of the size of the previous first video frame to the average value of sizes of at least two previous video frames before the previous first video frame or a ratio of the size of the previous first video frame to the size of the current video frame is greater than a second constant, the change feature value of the current video frame is greater than the I-frame threshold of the current video frame, and the change feature value of the previous first video frame is greater than the I-frame threshold of the current video frame, determining that the previous first video frame is an I frame, and otherwise determining that the previous first video frame is not an I frame.

53. The method according to claim 52, wherein the determining, according to the change feature value of the current video frame, a change feature value of a previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, and sizes of the at least two previous video frames, whether the previous first video frame is an I-frame specifically further comprises:

if the current video frame is the second video frame of the video stream, determining that the previous first video frame is an I frame.

54. The method according to claim 52, wherein the second constant is determined according to a code rate, the video frame rate, and the location of the current video frame.

55. The method according to claim 52 or 53, after the determining that the previous first video frame is an I frame, further comprising:

calculating an average size of each I frame.

56. The method according to claim 55, wherein if the current video frame is the last video frame in the video stream, the method further comprises:

if a ratio of the size of the current video frame to the average size of each I frame is greater than a third constant, determining that the current video frame is an I frame, and otherwise determining that the current video frame is not an I frame, wherein the third constant is greater than 0.

57. The method according to any one of claims 39 to 56, before the obtaining a size of a current video frame, further comprising:

obtaining a size of the first video frame;

determining that a change feature value of the first video frame is a product of the size of the

first video frame and a fourth constant, wherein a value range of the fourth constant is (0,1]; and

determining that an I-frame threshold of the first video frame equals the change feature value of the first video frame.

58. A frame type detection apparatus for a video stream, comprising:

a frame size obtaining module, configured to obtain a size of a current video frame, wherein the current video frame is located after the first video frame of the video stream;

a feature extracting module, configured to obtain a change feature value of the current video frame according to the size of the current video frame and sizes of at least two previous video frames;

a threshold obtaining module, configured to obtain an I-frame threshold of the current video frame according to a video frame rate and a location of the current video frame; and

a type determining module, configured to determine, according to the change feature value of the current video frame, a change feature value of a previous first video frame adjacent to the current video frame, the I-frame threshold of the current video frame, the size of the current video frame, and the sizes of the at least two previous video frames, whether the previous first video frame is an I frame.

59. The apparatus according to claim 58, wherein the frame size obtaining module is specifically configured to:

if it is determined that a packet loss does not occur in the current video frame, obtain a payload of each Real-time Transport Protocol RTP packet in the current video frame; and

accumulate the payload of each RTP packet in the current video frame to obtain the size of the current video frame.

60. The apparatus according to claim 58, wherein the frame size obtaining module specifically comprises:

a received size obtaining unit, configured to: if it is determined that a packet loss occurs in the current video frame and the entire frame is not lost, obtain a payload of each received RTP packet in the current video frame, and accumulate the payload of each received RTP packet in the current video frame to obtain the total size of the received RTP packets in the current video frame;

a lost size obtaining unit, configured to estimate a payload of each lost RTP packet and the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets, and obtain a total size of the lost RTP packets in the current video frame according to a payload of each lost RTP packet and the number of lost RTP packets in the current video frame; and

a frame size obtaining unit, configured to add the total size of the received RTP packets and the total size of the lost RTP packets in the current video frame to obtain the size of the current video frame.

61. The apparatus according to claim 60, wherein the lost size obtaining unit is specifically configured to:

obtain a payload of the previous adjacent RTP packet and a payload of the next adjacent RTP packet; and

estimate a payload of each lost RTP packet according to the average value of the payload of the previous adjacent RTP packet and the payload of the next adjacent RTP packet.

62. The apparatus according to claim 60, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to timestamps of the previous adjacent RTP packet and the next adjacent RTP packet that both the previous adjacent RTP packet and the next adjacent RTP packet belong to the current video frame, or,

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the previous first video frame, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the previous first video frame, obtain the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determine that the number of lost RTP packets in the current video frame is V_lostPackets.

63. The apparatus according to claim 60, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, the next adjacent RTP packet belongs to a next video frame adjacent to the current video frame, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, obtain the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determine that the number of lost RTP packets in the current video frame is int(V_lostPackets/2) + V_lostPackets%2.

64. The apparatus according to claim 60, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that a video frame to which the previous adjacent RTP packet belongs and the current video frame are nonconsecutive, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, obtain the number V_lostFrames of lost video frames between the previous adjacent RTP packet and the next adjacent RTP packet and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and sequence numbers and timestamps of the previous adjacent RTP packet and the next adjacent RTP packet; and

determine that the number of lost RTP packets in the current video frame is V_lostPackets%V_lostFrames.

65. The apparatus according to claim 60, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, a video frame to which the next adjacent RTP packet belongs and the current video frame are nonconsecutive, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, determine that the number of lost RTP packets in the current video frame is 1.

66. The apparatus according to claim 58, wherein the frame size obtaining module is specifically configured to:

if it is determined that the entire current video frame is lost, estimate a payload of each lost RTP packet according to a previous adjacent RTP packet and a next adjacent RTP packet of the current video frame among all received RTP packets, obtain the number V_lostFrames of lost video frames between a video frame to which the previous adjacent RTP packet belongs and a video frame to which the next adjacent RTP packet belongs and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and timestamps and sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet;

if it is determined according to a marker bit of the previous adjacent RTP packet that the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, determine that the number of RTP packets in the current video frame is int(V_lostPackets/V_lostFrames), and otherwise determine that the number of RTP packets in the

current video frame is int((V_lostPackets – 1)/V_lostFrames); and

obtain the size of the current video frame according to the number of RTP packets in the current video frame and a payload of each lost RTP packet.

67. The apparatus according to any one of claims 58 to 66, wherein the feature extracting module is specifically configured to:

use an absolute value of an average value of difference values between the size of the current video frame and the sizes of the at least two previous video frames or an average value of absolute values of difference values between the size of the current frame and the sizes of the at least two previous video frames as the change feature value of the current video frame.

68. The apparatus according to any one of claims 58 to 67, wherein the threshold obtaining module is specifically configured to:

obtain the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame.

69. The apparatus according to claim 68, wherein the threshold obtaining module is specifically configured to:

if a previous second video frame adjacent to the previous first video frame is the previous closest I frame, determine that the I-frame threshold of the current video frame is a product of a size of the previous closest I-frame and a first constant, wherein a value range of the first constant is (0,1].

70. The apparatus according to claim 68, wherein the threshold obtaining module is specifically configured to:

if a previous second video frame adjacent to the previous first video frame is not the previous closest I frame, determine whether the distance between the current video frame and the previous closest I-frame is greater than the video frame rate, if greater than, determine the product of an I-frame threshold of the previous first video frame and a first scale factor as the I-frame threshold of the current video frame, and if not greater than, determine the product of the I-frame threshold of the previous first video frame and a second scale factor as the I-frame threshold of the current video frame; wherein a value range of the first scale factor and the second scale factor is both (0,1], and the first scale factor is greater than the second scale factor.

71. The apparatus according to any one of claims 58 to 70, wherein the type determining module is specifically further configured to:

if a ratio of the size of the previous first video frame to the size of the previous second video frame adjacent to the previous first video frame or a ratio of the size of the previous first video frame to the size of the current video frame is greater than a second constant, the change feature

value of the current video frame is greater than the I-frame threshold of the current video frame, and the change feature value of the previous first video frame is greater than the I-frame threshold of the current video frame, determine that the previous first video frame is an I frame, and otherwise determine that the previous first video frame is not an I frame; or,

if a ratio of the size of the previous first video frame to the average value of sizes of at least two previous video frames before the previous first video frame or the ratio of the size of the previous first video frame to the size of the current video frame is greater than a second constant, the change feature value of the current video frame is greater than the I-frame threshold of the current video frame, and the change feature value of the previous first video frame is greater than the I-frame threshold of the current video frame, determine that the previous first video frame is an I frame, and otherwise determine that the previous first video frame is not an I frame.

72. The apparatus according to claim 71, wherein the type determining module is specifically configured to:

if the current video frame is the second video frame of the video stream, determine that the previous first video frame is an I frame.

73. The apparatus according to claim 71, wherein the second constant is determined according to a code rate, the video frame rate, and the location of the current video frame.

74. The apparatus according to claim 71 or 72, further comprising:

an average value calculating module, configured to: after the type determining module determines that the previous first video frame is an I frame, calculate an average size of each I frame.

75. The apparatus according to claim 74, wherein if the current video frame is the last video frame in the video stream, the type determining module is further configured to:

if a ratio of the size of the current video frame to the average size of each I frame is greater than a third constant, determine that the current video frame is an I frame, and otherwise determine that the current video frame is not an I frame, wherein the third constant is greater than 0.

76. The apparatus according to any one of claims 58 to 75, wherein the frame size obtaining module is further configured to: obtain a size of the first video frame;

the feature extracting module is further configured to: determine that a change feature value of the first video frame is a product of the size of the first video frame and a fourth constant, wherein a value range of the fourth constant is (0,1]; and

the threshold obtaining module is further configured to determine that an I-frame threshold of the first video frame equals the change feature value of the first video frame.

77. A frame size detection method, comprising:

if it is determined that a packet loss occurs between two received RTP packets, obtaining a payload of each received RTP packet, and estimating a payload of each lost RTP packet according to the payload of each received RTP packet;

obtaining the total number V_lostPackets of lost RTP packets between the two RTP packets according to sequence numbers of the two RTP packets;

estimating the number of lost RTP packets in each frame with a packet loss according to the total number V_lostPackets of lost RTP packets, and timestamps and marker bits of the two RTP packets; and

obtaining a size of each frame with the packet loss according to the number of lost RTP packets in each frame with the packet loss and the payload of each lost RTP packet.

78. The method according to claim 77, wherein the estimating a payload of each lost RTP packet according to the payload of each received RTP packet specifically comprises:

estimating the payload of each lost RTP packet according to an average value of the payloads of the two RTP packets; or

estimating the payload of each lost RTP packet according to an average value of payloads of a plurality of received RTP packets before a lost RTP packet.

79. The method according to claim 77 or 78, wherein the estimating the number of lost RTP packets in each frame with a packet loss according to the total number V_lostPackets of lost RTP packets, and timestamps and marker bits of the two RTP packets specifically comprises:

if it is determined according to the timestamps of the two RTP packets that the two RTP packets belong to a same frame, or, if it is determined according to the timestamps and marker bits of the two RTP packets that the two RTP packets separately belong to two consecutive frames and the former RTP packet is the last RTP packet in a frame to which the former RTP packet belongs, determining that the number of lost RTP packets in a frame to which the latter RTP packet belongs equals the total number V_lostPackets of lost RTP packets.

80. The method according to claim 77 or 78, wherein the estimating the number of lost RTP packets in each frame with a packet loss according to the total number V_lostPackets of lost RTP packets, and timestamps and marker bits of the two RTP packets specifically comprises:

if it is determined according to the timestamps and marker bits of the two RTP packets that the two RTP packets separately belong to two consecutive frames and the former RTP packet is not the last RTP packet in a frame to which the former RTP packet belongs, determining that the number of lost RTP packets in the frame to which the former RTP packet belongs is int(V_lostPackets/2) + V_lostPackets%2, and the number of lost RTP packets in a frame to which the latter RTP packet belongs is int(V_lostPackets/2).

81. The method according to claim 77 or 78, wherein the estimating the number of lost RTP packets in each frame with a packet loss according to the total number V_lostPackets of lost RTP packets, and timestamps and marker bits of the two RTP packets specifically comprises:

if it is determined according to the timestamps and marker bits of the two RTP packets that the two RTP packets belong to different frames, frames to which the two RTP packets belong are nonconsecutive, and the former RTP packet is the last RTP packet in a frame to which the former RTP packet belongs, obtaining the number V_lostFrames of lost entire frames between the frames to which the two RTP packets belong according to a video frame rate, a clock rate of an RTP packet, and the timestamps of the two RTP packets; and

determining that the number of lost RTP packets in each lost entire frame is int(V_lostPackets/V_lostFrames), and the number of lost RTP packets in a frame to which the latter RTP packet belongs is V_lostPackets%V_lostFrames.

82. The method according to claim 77 or 78, wherein the estimating the number of lost RTP packets in each frame with a packet loss according to the total number V_lostPackets of lost RTP packets, and timestamps and marker bits of the two RTP packets specifically comprises:

if it is determined according to the timestamps and marker bits of the two RTP packets that the two RTP packets belong to different frames, frames to which the two RTP packets belong are nonconsecutive, and the former RTP packet is not the last RTP packet in a frame to which the former RTP packet belongs, obtaining the number V_lostFrames of lost entire frames between the frames to which the two RTP packets belong according to a video frame rate, a clock rate of an RTP packet, and the timestamps of the two RTP packets; and

determining that the number of lost RTP packets in the frame to which the former RTP packet belongs is 1, the number of lost RTP packets in each lost entire frame is int((V_lostPackets – 1)/V_lostFrames), and the number of lost RTP packets in a frame to which the latter RTP packet belongs is (V_lostPackets – 1)%V_lostFrames.

83. A frame size detection apparatus, comprising:

a payload estimating module, configured to: if it is determined that a packet loss occurs between two received RTP packets, obtain a payload of each received RTP packet, and estimate a payload of each lost RTP packet according to the payload of each received RTP packet;

a total loss number obtaining module, configured to obtain the total number V_lostPackets of lost RTP packets between the two RTP packets according to sequence numbers of the two RTP packets;

an each loss number estimating module, configured to estimate the number of lost RTP packets in each frame with a packet loss according to the total number of lost RTP packets *V_lostPackets*,

and timestamps and marker bits of the two RTP packets; and

a frame size detecting module, configured to obtain a size of each frame with the packet loss according to the number of lost RTP packets in each frame with the packet loss and a payload of each lost RTP packet.

84. The apparatus according to claim 83, wherein the payload estimating module is specifically configured to:

estimate the payload of each lost RTP packet according to an average value of the payloads of the two RTP packets; or

estimate the payload of each lost RTP packet according to an average value of payloads of a plurality of received RTP packets before a lost RTP packet.

85. The apparatus according to claim 83 or 84, wherein the each loss number estimating module is specifically configured to:

if it is determined according to the timestamps of the two RTP packets that the two RTP packets belong to a same frame, or, if it is determined according to the timestamps and marker bits of the two RTP packets that the two RTP packets separately belong to two consecutive frames and the former RTP packet is the last RTP packet in a frame to which the former RTP packet belongs, determine that the number of lost RTP packets in a frame to which the latter RTP packet belongs equals the total number V_lostPackets of lost RTP packets.

86. The apparatus according to claim 83 or 84, wherein the each loss number estimating module is specifically configured to:

if it is determined according to the timestamps and marker bits of the two RTP packets that the two RTP packets separately belong to two consecutive frames and the former RTP packet is not the last RTP packet in a frame to which the former RTP packet belongs, determine that the number of lost RTP packets in the frame to which the former RTP packet belongs is int(V_lostPackets/2) + V_lostPackets%2, and the number of lost RTP packets in a frame to which the latter RTP packet belongs is int(V_lostPackets/2).

87. The apparatus according to claim 83 or 84, wherein the each loss number estimating module is specifically configured to:

if it is determined according to the timestamps and marker bits of the two RTP packets that the two RTP packets belong to different frames, frames to which the two RTP packets belong are nonconsecutive, and the former RTP packet is the last RTP packet in a frame to which the former RTP packet belongs, obtain the number V_lostFrames of lost entire frames between the frames to which the two RTP packets belong according to a video frame rate, a clock rate of an RTP packet, and the timestamps of the two RTP packets; and

determine that the number of lost RTP packets in each lost entire frame is int(V_lostPackets/V_lostFrames), and the number of lost RTP packets in a frame to which the latter RTP packet belongs is V_lostPackets%V_lostFrames.

88. The apparatus according to claim 83 or 84, wherein the each loss number estimating module is specifically configured to:

if it is determined according to the timestamps and marker bits of the two RTP packets that the two RTP packets belong to different frames, frames to which the two RTP packets belong are nonconsecutive, and the former RTP packet is not the last RTP packet in a frame to which the former RTP packet belongs, obtain the number V_lostFrames of lost entire frames between the frames to which the two RTP packets belong according to a video frame rate, a clock rate of an RTP packet, and the timestamps of the two RTP packets; and

determine that the number of lost RTP packets in the frame to which the former RTP packet belongs is 1, the number of lost RTP packets in each lost entire frame is int((V_lostPackets – 1)/V_lostFrames), and the number of lost RTP packets in a frame to which the latter RTP packet belongs is (V_lostPackets – 1)%V_lostFrames.

CLAIMS

1. A frame type detection method for a video stream, comprising:

obtaining a size of a current video frame, wherein the current video frame is located after the first video frame of the video stream;

obtaining a change feature value of the current video frame according to the size of the current video frame and a size of a previous firstvideo frame adjacent to the current video frame;

obtaining an I-frame threshold of the current video frame according to a video frame rate and a location of the current video frame; and

determining whether the previous firstvideo frame is an I frame according to the change feature value of the current video frame, a change feature value of the previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, the size of the previous first video frame, and a size of a previous second video frame adjacent to the previous first video frame.

2. The method according to claim 1, wherein the obtaining a size of a current video frame specifically comprises:

whenit is determined that a packet loss does not occur in the current video frame, obtaining a payload of each Real-time Transport Protocol RTP packet in the current video frame; and

accumulating the payload of each RTP packet in the current video frame to obtain the size of the current video frame.

3. The method according to claim 1, wherein the obtaining a size of a current video frame specifically comprises:

when it is determined that a packet loss occurs in the current video frame and the entire frame is not lost, obtaining a payload of each received RTP packet in the current video frame, and accumulating the payload of each received RTP packet in the current video frame to obtain a total size of the received RTP packets in the current video frame;

estimating a payload of each lost RTP packet and the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all the received RTP packets, and obtaining a total size of the lost RTP packets in the current video

frame according to the payload of each lost RTP packet and the number of lost RTP packets in the current video frame; and

adding the total size of the received RTP packets in the current video frame and the total size of the lost RTP packets in the current video frame to obtain the size of the current video frame.

4. The method according to claim 3, wherein the estimating a payload of each lost RTP packet according to a previous adjacent RTP packet and a next adjacent RTP packet of a lost RTP packet in the current video frame among all received RTP packets specifically comprises:

obtaining a payload of the previous adjacent RTP packet and a payload of the next adjacent RTP packet; and

estimating the payload of each lost RTP packet according to the average value of the payload of the previous adjacent RTP packet and the payload of the next adjacent RTP packet.

5. The method according to claim 3, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

when it is determined according to timestamps of the previous adjacent RTP packet and the next adjacent RTP packet that both the previous adjacent RTP packet and the next adjacent RTP packet belong to the current video frame, or,

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the previous first video frame, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the previous first video frame, obtaining the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determining that the number of lost RTP packets in the current video frame is V_lostPackets.

6. The method according to claim 3, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP

packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, the next adjacent RTP packet belongs to a next video frame adjacent to the current video frame, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, obtaining the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determining that the number of lost RTP packets in the current video frame is int(V_lostPackets/2) + V_lostPackets%2.

7. The method according to claim 3, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets specifically comprises:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that a video frame to which the previous adjacent RTP packet belongs and the current video frame are nonconsecutive, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, obtaining the number V_lostFrames of lost video frames between the previous adjacent RTP packet and the next adjacent RTP packet and the total number V_lostPackets of lost RTP packets according to the video frame rate, a clock rate of an RTP packet, and sequence numbers and timestamps of the previous adjacent RTP packet and the next adjacent RTP packet; and

determining that the number of lost RTP packets in the current video frame is V_lostPackets%V_lostFrames.

8. The method according to claim 3, wherein the estimating the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame

among all received RTP packets specifically comprises:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, a video frame to which the next adjacent RTP packet belongs and the current video frame are nonconsecutive, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, determining that the number of lost RTP packets in the current video frame is 1.

9. The method according to claim 1, wherein the obtaining a size of a current video frame specifically comprises:

if it is determined that the entire current video frame is lost, estimating a payload of each lost RTP packet according to a previous adjacent RTP packet and a next adjacent RTP packet of the current video frame among all received RTP packets, obtaining the number V_lostFrames of lost video frames between a video frame to which the previous adjacent RTP packet belongs and a video frame to which the next adjacent RTP packet belongs and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and timestamps and sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet;

if it is determined according to a marker bit of the previous adjacent RTP packet that the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, determining that the number of RTP packets in the current video frame is int(V_lostPackets/V_lostFrames), if it is determined the previous adjacent RTP packet is not the last RTP packet, determining that the number of RTP packets in the current video frame is int((V_lostPackets – 1)/V_lostFrames); and

obtaining the size of the current video frame according to the number of RTP packets in the current video frame and a payload of each lost RTP packet.

10. The method according to claim 1, wherein the obtaining a change feature value of the current video frame according to the size of the current video frame and a size of a previous first video frame adjacent to the current video frame specifically comprises:

using an absolute value of a difference value between the size of the current video frame and the size of the previous first video frame as the change feature value of the current video

frame.

11. The method according to claim 1, wherein the obtaining an I-frame threshold of the current video frame according to a video frame rate and a location of the current video frame specifically comprises:

obtaining the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame.

12. The method according to claim 11, wherein the obtaining the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame specifically comprises:

if the previous second video frame is the previous closest I frame, determining that the I-frame threshold of the current video frame is a product of a size of the previous closest I frame and a first constant, wherein a value range of the first constant is (0,1].

13. The method according to claim 11, wherein the obtaining the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame specifically comprises:

if the previous second video frame is not the previous closest I frame, determining whether the distance between the current video frame and the previous closest I frame is greater than the video frame rate, if greater than, determining a product of an I-frame threshold of the previous first video frame and a first scale factor as the I-frame threshold of the current video frame, and if not greater than, determining the product of the I-frame threshold of the previous first video frame and a second scale factor as the I-frame threshold of the current video frame; wherein a value range of the first scale factor and the second scale factor is (0,1], and the first scale factor is greater than the second scale factor.

14. The method according to claim 1, wherein the determining whether the previous first video frame is an I frame according to the change feature value of the current video frame, a change feature value of the previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, the size of the previous first video frame, and a size of a previous second video frame adjacent to the previous first video frame specifically comprises:

if a ratio of the size of the previous first video frame to the size of the previous second video frame or a ratio of the size of the previous first video frame to the size of the current

video frame is greater than a second constant, the change feature value of the current video frame is greater than the I-frame threshold of the current video frame, and the change feature value of the previous first video frame is greater than the I-frame threshold of the current video frame, determining that the previous first video frame is an I frame, and otherwise determining that the previous first video frame is not an I frame.

15. The method according to claim 14, wherein the determining whether the previous first video frame is an I frame according to the change feature value of the current video frame, a change feature value of the previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, the size of the previous first video frame, and a size of a previous second video frame adjacent to the previous first video frame specifically further comprises:

if the current video frame is the second video frame of the video stream, determining that the previous first video frame of the current video frame is an I frame.

16. The method according to claim 14, after the determining that the previous first video frame of the current video frame is an I frame, further comprising:

calculating an average size of I frames of the video stream.

17. The method according to claim 16, wherein if the current video frame is the last video frame in the video stream, the method further comprises:

if a ratio of the size of the current video frame to the average size of I frames of the video stream is greater than a third constant, determining that the current video frame is an I frame, and otherwise determining that the current video frame is not an I frame, wherein the third constant is greater than 0.

18. The method according to claim 1, before the obtaining a size of a current video frame, further comprising:

obtaining a size of the first video frame;

determining that a change feature value of the first video frame is a product of the size of the first video frame and a fourth constant, wherein a value range of the fourth constant is (0,1]; and

determining that an I-frame threshold of the first video frame equals the change feature value of the first video frame.

19. A frame type detection apparatus for a video stream, comprising:

a frame size obtaining module, configured to obtain a size of a current video frame, wherein the current video frame is located after the first video frame of the video stream;

a feature extracting module, configured to obtain a change feature value of the current video frame according to the size of the current video frame and a size of a previous first video frame adjacent to the current video frame;

a threshold obtaining module, configured to obtain an I-frame threshold of the current video frame according to a video frame rate and a location of the current video frame; and

a type determining module, configured to determine whether the previous first video frame is an I frame according to the change feature value of the current video frame, a change feature value of the previous first video frame, the I-frame threshold of the current video frame, the size of the current video frame, the size of the previous first video frame, and a size of a previous second video frame adjacent to the previous first video frame.

20. The apparatus according to claim 19, wherein the frame size obtaining module is specifically configured to:

if it is determined that a packet loss does not occur in the current video frame, obtain a payload of each Real-time Transport Protocol RTP packet in the current video frame; and

accumulate the payload of each RTP packet in the current video frame to obtain the size of the current video frame.

21. The apparatus according to claim 19, wherein the frame size obtaining module specifically comprises:

a received size obtaining unit, configured to: if it is determined that a packet loss occurs in the current video frame and the entire frame is not lost, obtain a payload of each received RTP packet in the current video frame, and accumulate the payload of each received RTP packet in the current video frame to obtain a total size of the received RTP packets in the current video frame;

a lost size obtaining unit, configured to estimate a payload of each lost RTP packet and the number of lost RTP packets in the current video frame according to a previous adjacent RTP packet of a lost RTP packet and a next adjacent RTP packet of the lost RTP packet in the current video frame among all received RTP packets, and obtain a total size of the lost RTP packets in the current video frame according to a payload of each lost RTP packet and the number of lost RTP packets in the current video frame; and

a frame size obtaining unit, configured to add the total size of the received RTP packets and the total size of the lost RTP packets in the current video frame to obtain the size of the current video frame.

22. The apparatus according to claim 21, wherein the lost size obtaining unit is specifically configured to:

obtain a payload of the previous adjacent RTP packet and a payload of the next adjacent RTP packet; and

estimate the payload of each lost RTP packet according to the average value of the payload of the previous adjacent RTP packet and the payload of the next adjacent RTP packet.

23. The apparatus according to claim 21, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to timestamps of the previous adjacent RTP packet and the next adjacent RTP packet that both the previous adjacent RTP packet and the next adjacent RTP packet belong to the current video frame, or,

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the previous first video frame, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the previous first video frame, obtain the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determine that the number of lost RTP packets in the current video frame is V_lostPackets.

24. The apparatus according to claim 21, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, the next adjacent RTP packet belongs to a next video frame adjacent to the current video frame, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, obtain

the total number V_lostPackets of lost RTP packets between the previous adjacent RTP packet and the next adjacent RTP packet according to sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet; and

determine that the number of lost RTP packets in the current video frame is int(V_lostPackets/2) + V_lostPackets%2.

25. The apparatus according to claim 21, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that a video frame to which the previous adjacent RTP packet belongs and the current video frame are nonconsecutive, the next adjacent RTP packet belongs to the current video frame, and the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, obtain the number V_lostFrames of lost video frames between the previous adjacent RTP packet and the next adjacent RTP packet and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and sequence numbers and timestamps of the previous adjacent RTP packet and the next adjacent RTP packet; and

determine that the number of lost RTP packets in the current video frame is V_lostPackets%V_lostFrames.

26. The apparatus according to claim 21, wherein the lost size obtaining unit is specifically further configured to:

if it is determined according to a marker bit of the previous adjacent RTP packet, a timestamp of the previous adjacent RTP packet, and a timestamp of the next adjacent RTP packet that the previous adjacent RTP packet belongs to the current video frame, a video frame to which the next adjacent RTP packet belongs and the current video frame are nonconsecutive, and the previous adjacent RTP packet is not the last RTP packet in the current video frame, determine that the number of lost RTP packets in the current video frame is 1.

27. The apparatus according to claim 19, wherein the frame size obtaining module is specifically configured to:

if it is determined that the entire current video frame is lost, estimate a payload of each

lost RTP packet according to a previous adjacent RTP packet and a next adjacent RTP packet of the current video frame among all received RTP packets, obtain the number V_lostFrames of lost video frames between a video frame to which the previous adjacent RTP packet belongs and a video frame to which the next adjacent RTP packet belongs and the total number V_lostPackets of lost RTP packets according to a video frame rate, a clock rate of an RTP packet, and timestamps and sequence numbers of the previous adjacent RTP packet and the next adjacent RTP packet;

if it is determined according to a marker bit of the previous adjacent RTP packet that the previous adjacent RTP packet is the last RTP packet in the video frame to which the previous adjacent RTP packet belongs, determine that the number of RTP packets in the current video frame is int(V_lostPackets/V_lostFrames), and otherwise determine that the number of RTP packets in the current video frame is int((V_lostPackets – 1)/V_lostFrames); and

obtain the size of the current video frame according to the number of RTP packets in the current video frame and a payload of each lost RTP packet.

28. The apparatus according to claim 19, wherein the feature extracting module is specifically configured to:

use an absolute value of a difference value between the size of the current video frame and the size of the previous first video frame as the change feature value of the current video frame.

29. The apparatus according to claim 19, wherein the threshold obtaining module is specifically configured to:

obtain the I-frame threshold of the current video frame according to the video frame rate and a distance between the current video frame and a previous closest I frame.

30. The apparatus according to claim 29, wherein the threshold obtaining module is specifically configured to:

if the previous second video frame is the previous closest I frame, determine that the I-frame threshold of the current video frame is a product of a size of the previous closest I-frame and a first constant, wherein a value range of the first constant is (0,1].

31. The apparatus according to claim 29, wherein the threshold obtaining module is specifically configured to:

if the previous second video frame is not the previous closest I frame, determine whether

the distance between the current video frame and the previous closest I frame is greater than the video frame rate, if greater than, determine a product of an I-frame threshold of the previous first video frame and a first scale factor as the I-frame threshold of the current video frame, and if not greater than, determine the product of the I-frame threshold of the previous first video frame and a second scale factor as the I-frame threshold of the current video frame; wherein a value range of the first scale factor and the second scale factor is both (0,1], and the first scale factor is greater than the second scale factor.

32. The apparatus according to claim 19, wherein the type determining module is specifically configured to:

if a ratio of the size of the previous first video frame to the size of the previous second video frame or a ratio of the size of the previous first video frame to the size of the current video frame is greater than a second constant, the change feature value of the current video frame is greater than the I-frame threshold of the current video frame, and the change feature value of the previous first video frame is greater than the I-frame threshold of the current video frame, determine that the previous first video frame is an I frame, and otherwise determine that the previous first video frame is not an I frame.

33. The apparatus according to claim 32, wherein the type determining module is specifically configured to:

if the current video frame is the second video frame of the video stream, determine that the previous first video frame is an I frame.

34. The apparatus according to claim 32, further comprising:

an average value calculating module, configured to: after the type determining module determines that the previous first video frame is an I frame, calculate an average size of I frames of the video stream.

35. The apparatus according to claim 34, wherein if the current video frame is the last video frame in the video stream, the type determining module is further configured to:

if a ratio of the size of the current video frame to the average size of I frames of the video stream is greater than a third constant, determine that the current video frame is an I frame, and otherwise determine that the current video frame is not an I frame, wherein the third constant is greater than 0.

36. The apparatus according to claim 19, wherein the frame size obtaining module is

further configured to: obtain a size of the first video frame;

the feature extracting module is further configured to: determine that a change feature value of the first video frame is a product of the size of the first video frame and a fourth constant, wherein a value range of the fourth constant is (0,1]; and

the threshold obtaining module is further configured to determine that an I-frame threshold of the first video frame equals the change feature value of the first video frame.