CLAIMS

What is claimed is:

1. A decoding method, comprising:

when it is determined to use a bidirectional optical flow mode for a current block, performing motion compensation based on the bidirectional optical flow mode on the current block, wherein when the bidirectional optical flow mode is used for the current block, conditions which the current block meets at the same time at least comprise: switch control information indicates that it is allowed to use the bidirectional optical flow mode for the current block; a sub-block motion information mode is not used for the current block, a CIIP mode is not used for the current block, and an SMVD mode is not used for the current block; bidirectional prediction is used for the current block, and two reference frames corresponding to the current block come from different directions, and the two reference frames corresponding to the current block are at a same distance from a current slice; bidirectional prediction is used for the current block, and weighting weights of the two reference frames corresponding to the current block are the same; a width value, a height value, and an area value of the current block are all within a limited range;

wherein, the current block comprises one or more sub-blocks, performing motion compensation based on the bidirectional optical flow mode on the current block comprises:

for each sub-block of the one or more sub-blocks included in the current block, determining a target prediction value of the sub-block; and determining a prediction value of the current block based on target prediction values of all sub-blocks included in the current block;

wherein, determining a target prediction value of the sub-block comprises: determining a first original prediction value and a second original prediction value of the

sub-block; determining a horizontal velocity of the sub-block based on the first original prediction value and the second original prediction value; determining a vertical velocity of the sub-block based on the first original prediction value and the second original prediction value; acquiring a prediction compensation value of the sub-block based on the horizontal velocity and the vertical velocity; acquiring the target prediction value of the sub-block based on the first original prediction value, the second original prediction value and the prediction compensation value.

2. The method of claim 1, wherein, determining a target prediction value of the sub-block comprises:

determining a first original prediction value and a second original prediction value of the sub-block; determining a target prediction value of each 4x4 block in the sub-block based on the first original prediction value and the second original prediction value of the sub-block; determining the target prediction value of the sub-block based on the target prediction value of each 4x4 block in the sub-block.

3. The method of claim 2, wherein, determining the target prediction value of the 4x4 block based on the first original prediction value and the second original prediction value of the sub-block comprises:

for each 4x4 block in the sub-block, determining a horizontal velocity of the 4x4 block based on the first original prediction value and the second original prediction value; determining a vertical velocity of the 4x4 block based on the first original prediction value and the second original prediction value; acquiring a prediction compensation value of the 4x4 block based on the horizontal velocity and the vertical velocity of the 4x4 block; acquiring the target prediction value of the 4x4 block based on the first original prediction

value, the second original prediction value and the prediction compensation value of the 4x4 block.

4. The method of claim 1, wherein, motion information of the current block comprises a first motion vector and a first reference frame index, a second motion vector and a second reference frame index; determining the first original prediction value and the second original prediction value of the sub-block comprises: determining the first original prediction value of the sub-block based on the first motion vector and the first reference frame index, determining the second original prediction value of the sub-block based on the second motion vector and the second reference frame index.

5. The method of claim 4, wherein, determining the first original prediction value of the sub-block based on the first motion vector and the first reference frame index, determining the second original prediction value of the sub-block based on the second motion vector and the second reference frame index, comprises: determining a first reference block from a first reference frame corresponding to the first reference frame index based on the first motion vector, and determining the first original prediction value based on a prediction value of the first reference block; determining a second reference block from a second reference frame corresponding to the second reference frame index based on the second motion vector, and determining the second original prediction value based on a prediction value of the second reference block;

wherein, the prediction value of the first reference block comprises a prediction value of a central area of the first reference block and a prediction value of an edge area of the first reference block, the prediction value of the central area of the first reference block is obtained by performing interpolation on a pixel value of a pixel in the first reference

frame, and the prediction value of the edge area of the first reference block is obtained by copying a pixel value of a pixel in the first reference frame; the prediction value of the second reference block comprises a prediction value of a central area of the second reference block and a prediction value of an edge area of the second reference block, the prediction value of the central area of the second reference block is obtained by performing interpolation on a pixel value of a pixel in the second reference frame, and the prediction value of the edge area of the second reference block is obtained by copying a pixel value of a pixel in the second reference frame.

6. The method of claim 5, wherein, the edge area of the first reference block is an area with 1 row and 1 column at upper, lower, left, and right portions respectively, except the central area, the prediction value of the edge area of the first reference block is obtained by copying an integer pixel value of a pixel adjacent to the edge area of the first reference block in the first reference frame; the edge area of the second reference block is an area with 1 row and 1 column at upper, lower, left, and right portions respectively, except the central area, the prediction value of the edge area of the second reference block is obtained by copying an integer pixel value of a pixel adjacent to the edge area of the second reference block in the second reference frame.

7. The method of claim 1, wherein, when the current block comprises 1 sub-block, the sub-block is the current block itself; when the current block comprises multiple sub-blocks, motion information of the multiple sub-blocks is the same as that of the current block.

8. The method of claim 3, wherein,

determining a horizontal velocity of the 4x4 block based on the first original prediction value and the second original prediction value comprises:

determining a first prediction value and a second prediction value of the 4x4 block based on the first original prediction value and the second original prediction value, determining the horizontal velocity of the 4x4 block based on the first prediction value and the second prediction value of the 4x4 block;

determining a vertical velocity of the 4x4 block based on the first original prediction value and the second original prediction value comprises: determining the vertical velocity of the 4x4 block based on the first prediction value and the second prediction value of the 4x4 block;

acquiring the target prediction value of the 4x4 block based on the first original prediction value, the second original prediction value and the prediction compensation value of the 4x4 block comprises: acquiring the target prediction value of the 4x4 block based on the first prediction value of the 4x4 block, the second prediction value of the 4x4 block, and the prediction compensation value of the 4x4 block.

9. The method of claim 8, wherein, determining a first prediction value and a second prediction value of the 4x4 block based on the first original prediction value and the second original prediction value comprises:

determining a 6x6 block corresponding to the 4x4 block in the first reference block, acquiring a prediction value of the 6x6 block based on the first original prediction value of the first reference block, and determining the prediction value of the 6x6 block as the first prediction value of the 4x4 block;

determining a 6x6 block corresponding to the 4x4 block in the second reference block, acquiring a prediction value of the 6x6 block based on the second original prediction value of the second reference block, and determining the prediction value of the 6x6 block as the second prediction value of the 4x4 block.

10. The method of claim 3, wherein, determining a horizontal velocity and a vertical velocity of the 4x4 block based on the first original prediction value and the second original prediction value comprises:

determining an autocorrelation coefficient S1 of a horizontal gradient sum of the 4x4 block, a cross-correlation coefficient S2 between the horizontal gradient sum and a vertical gradient sum of the 4x4 block, a cross-correlation coefficient S3 between a difference of time domain prediction values and the horizontal gradient sum of the 4x4 block, an autocorrelation coefficient S5 of the vertical gradient sum of the 4x4 block, a cross-correlation coefficient S6 between the difference of time domain prediction values and the vertical gradient sum of the 4x4 block based on the first original prediction value and the second original prediction value;

determining the horizontal velocity and the vertical velocity of the 4x4 block based on the S1, S2, S3, S5, and S6;

wherein, determining the S1, S2, S3, S5, and S6 of the 4x4 block based on the first original prediction value and the second original prediction value comprises:

determining the horizontal gradient sum of the 4x4 block, the vertical gradient sum of the 4x4 block, the difference of time domain prediction values of the 4x4 block based on the first original prediction value and the second original prediction value;

determining the S1, S2, S3, S5, and S6 of the 4x4 block based on the horizontal gradient sum, the vertical gradient sum, the difference of time domain prediction values.

11. The method of claim 3, wherein,

determining a horizontal velocity of the 4x4 block based on the first original prediction value and the second original prediction value comprises:

determining an autocorrelation coefficient S1 of a horizontal gradient sum of the 4x4 block, a cross-correlation coefficient S3 between a difference of time domain prediction values and the horizontal gradient sum of the 4x4 block based on the first original prediction value and the second original prediction value; determining the horizontal velocity of the 4x4 block based on the S1, a velocity threshold, the S3; wherein the velocity threshold is M powers of 2, and M is a positive integer;

determining a vertical velocity of the 4x4 block based on the first original prediction value and the second original prediction value comprises:

determining a cross-correlation coefficient S2 between the horizontal gradient sum and a vertical gradient sum of the 4x4 block, an autocorrelation coefficient S5 of the vertical gradient sum of the 4x4 block, a cross-correlation coefficient S6 between the difference of time domain prediction values and the vertical gradient sum of the 4x4 block based on the first original prediction value and the second original prediction value; determining the vertical velocity of the 4x4 block based on the S2, the S5, the S6, a velocity threshold, and the horizontal velocity of the 4x4 block; wherein the velocity threshold is M powers of 2, and M is a positive integer;

wherein, acquiring a prediction compensation value of the 4x4 block based on the horizontal velocity and the vertical velocity of the 4x4 block comprises:

determining a horizontal gradient of the 4x4 block and a vertical gradient of the 4x4 block based on the first original prediction value, the second original prediction value, and the number of right shifts of the gradient; and acquiring the prediction compensation value of the 4x4 block based on the horizontal velocity of the 4x4 block, the vertical velocity of the 4x4 block, the horizontal gradient of the 4x4 block, and the vertical gradient of the 4x4 block.

12. The method of claim 1, further comprising:

for each sub-block of the one or more sub-blocks included in the current block, determining whether a current sub-block meets a specific condition, if the current sub-block meets the specific condition, jumping out of a process of performing prediction compensation on the sub-block based on bidirectional optical flow, wherein, the process of performing prediction compensation on the sub-block based on bidirectional optical flow comprises: for the sub-block, determining the first original prediction value and the second original prediction value of the sub-block; determining a target prediction value of each 4x4 block in the sub-block based on the first original prediction value and the second original prediction value of the sub-block, determining the target prediction value of the sub-block based on the target prediction value of each 4x4 block in the sub-block.

13. The method of claim 12, wherein,

determining whether to jump out of the process of performing prediction compensation on the sub-block based on the bidirectional optical flow according to a relationship between a SAD value of the sub-block and a sub-block threshold; wherein, the SAD value of the sub-block is a sum of absolute difference of a vertical two-times down-sampled prediction value of the first prediction block and a vertical two-times down-

sampled prediction value of the second prediction block; wherein, the first prediction block is a prediction block corresponding to a sub-block acquired from the first reference frame according to a first motion vector of the current block, and the second prediction block is a prediction block corresponding to a sub-block acquired from the second reference frame according to a second motion vector of the current block.

14. The method of claim 1, wherein,

for conditions that bidirectional prediction is used for the current block, two reference frames corresponding to the current block come from different directions, and the two reference frames corresponding to the current block are at a same distance from a current slice, if a display sequence number of the current slice is POC, and the display sequence numbers of the two reference frames corresponding to the current block are POC0 and POC1 respectively, when (POC-POC0)* (POC-POC1)<0, it is considered that the two reference frames come from different directions, and when a value of (POC-POC0) equal to a value of (POC1-POC), it is considered that the distances between the two reference frames and the current slice are the same;

wherein, the weighting weights of the two reference frames corresponding to the current block being the same comprises that it is allowed to use a frame-level weighted prediction method for the current slice and two weighting weights of the current slice are exactly the same; and that it is allowed to use a block-level weighted prediction method Bi-prediction with CU based weighting for the current block and the two weighting weights of the current block are exactly the same;

wherein, the sub-block motion information mode being not used for the current block comprises that an Affine mode is not used for the current block and an subblock-

based temporal motion vector prediction mode is not used for the current block; wherein the Affine mode is a mode using an affine motion model, and the subblock-based temporal motion vector prediction mode is a mode for acquiring motion information of an entire block in time domain;

wherein, the width value, the height value, and the area value of the current block being all within a limited range, comprises that the width value of the current block is greater than or equal to 8, the height value of the current block is greater than or equal to 8, and a product of the width value and the height value of the current block is greater than or equal to 128.

15. A decoding apparatus, which is configured to implement the method according to any one of claims 1 to 14.

16. A video decoding device, comprising a processor and a machine-readable storage medium, wherein the machine-readable storage medium stores thereon machine executable instructions that can be executed by the processor;

the processor is configured to execute the machine executable instructions to implement the method according to any one of claims 1 to 14.

17. An electronic device, comprising a processor; and

a memory for storing processor executable instructions;

wherein, the processor is configured to implement the decoding method according to any one of claims 1 to 14.

18. A non-transitory storage medium, wherein the non-transitory storage medium stores thereon instructions which, when executed by a processor, cause the processor to implement the method according to any one of claims 1 to 14.

19. A decoding method, comprising:

when it is determined to use a bidirectional optical flow mode for a current block, performing motion compensation based on the bidirectional optical flow mode on the current block, wherein when the bidirectional optical flow mode is used for the current block, conditions which the current block meets at least comprise: a CIIP mode is forbidden to be used for the current block, and an SMVD mode is forbidden to be used for the current block;

wherein, the current block comprises one or more sub-blocks, performing motion compensation based on the bidirectional optical flow mode on the current block comprises:

for each sub-block of the one or more sub-blocks included in the current block, determining a target prediction value of the sub-block; and determining a prediction value of the current block based on target prediction values of all sub-blocks included in the current block;

wherein, determining a target prediction value of the sub-block comprises: determining a first original prediction value and a second original prediction value of the sub-block; determining a horizontal velocity of the sub-block based on the first original prediction value and the second original prediction value; determining a vertical velocity of the sub-block based on the first original prediction value and the second original prediction value; acquiring a prediction compensation value of the sub-block based on the horizontal velocity and the vertical velocity; acquiring the target prediction value of the sub-block based on the first original prediction value, the second original prediction value and the prediction compensation value.