CLAIMS

What is claimed is:

1. A decoding method, comprising:

when a current block enables a motion vector refinement mode, determining prediction values of sub-blocks of the current block, and determining a prediction value of the current block according to the prediction values of sub-blocks of the current block, wherein for each sub-block of the current block, determining a prediction value of a sub-block comprises:

obtaining motion information of the current block comprising a first original motion vector and a first reference frame, a second original motion vector and a second reference frame;

determining a first reference block corresponding to the sub-block according to the first original motion vector of the current block, and determining a second reference block corresponding to the sub-block according to the second original motion vector of the current block;

obtaining an optimal motion vector according to pixel values of the first reference block and pixel values of the second reference block, wherein obtaining an optimal motion vector comprises:

taking an initial motion vector as a center, selecting motion vectors from the motion vectors containing the initial motion vector and motion vectors surrounding the initial motion vector, and determining the selected motion vectors as candidate motion vectors; wherein the initial motion vector is the first original motion vector or the second original motion vector; obtaining a cost value corresponding to the initial motion vector and cost values corresponding to the candidate motion vectors according to the pixel values of the first reference block and the pixel values of the second reference block; selecting a motion vector

from the initial motion vector and the candidate motion vectors as the optimal motion vector according to the cost value corresponding to the initial motion vector and the cost values corresponding to the candidate motion vectors;

adjusting the first original motion vector and the second original motion vector according to the optimal motion vector to obtain a first target motion vector corresponding to the first original motion vector and a second target motion vector corresponding to the second original motion vector;

determining the prediction value of the sub-block according to the first target motion vector and the second target motion vector; wherein determining the prediction value of the sub-block according to the first target motion vector and the second target motion vector comprises: determining a third reference block corresponding to the sub-block according to the first target motion vector, and determining a fourth reference block corresponding to the sub-block according to second target motion vector; weighting pixel values of the third reference block and pixel values of the fourth reference block to obtain the prediction value of the sub-block;~~.~~

~~2. The method of claim 1,~~ wherein,

taking an initial motion vector as a center, selecting motion vectors from the motion vectors containing the initial motion vector and the motion vectors surrounding the initial motion vector, and determining the selected motion vectors as candidate motion vectors, comprises: taking the initial motion vector as a center, searching 25 motion vectors containing the initial motion vector at a search range of 2, and determining the 25 motion vectors as candidate motion vectors; wherein a searching sequence of the 25 motion vectors is as follows: {Mv(-2,-2), Mv(-1,-2), Mv(0,-2), Mv(1,-2), Mv(2,-2), Mv(-2,-1), Mv(-1,-1), Mv(0,-1), Mv(1,-1), Mv(2,-1), Mv(-2, 0), Mv(-1, 0), Mv(0, 0), Mv(1, 0), Mv(2, 0), Mv(-2, 1), Mv(-1, 1), Mv(0, 1), Mv(1, 1), Mv(2, 1), Mv(-2, 2), Mv(-1, 2), Mv(0, 2), Mv(1, 2), Mv(2, 2)}.

~~3~~2. The method of claim 1, wherein,

obtaining a cost value corresponding to the initial motion vector and cost values corresponding to the candidate motion vectors according to the pixel values of the first reference block and the pixel values of the second reference block comprises:

obtaining cost values corresponding to the candidate motion vectors comprises: determining first sub-reference blocks corresponding to the candidate motion vectors based on the first reference block, and determining second sub-reference blocks corresponding to the candidate motion vectors based on the second reference block; calculating a sum of absolute differences of pixel point sample values in the first sub-reference blocks and the second sub-reference blocks by using a down-sampling operation performed vertically by 2 times; determining the cost values corresponding to the candidate motion vectors according to the obtained sum of absolute differences;

obtaining a cost value corresponding to the initial motion vector comprises: determining a first sub-reference block corresponding to the initial motion vector based on the first reference block, and determining a second sub-reference block corresponding to the initial motion vector based on the second reference block; calculating a sum of absolute differences of pixel point sample values in the first sub-reference block and the second sub-reference block by using a down-sampling operation performed vertically by 2 times; determining the cost value corresponding to the initial motion vector according to the obtained sum of absolute differences.

~~4~~3. The method of claim 1, wherein,

adjusting the first original motion vector and the second original motion vector according to the optimal motion vector to obtain a first target motion vector corresponding to the first original motion vector and a second target motion vector corresponding to the second original motion vector comprises:

determining a first integer-pixel motion vector adjustment value and a second integer-

pixel motion vector adjustment value according to the optimal motion vector; adjusting the first original motion vector according to the first integer-pixel motion vector adjustment value to obtain the first target motion vector corresponding to the first original motion vector; and adjusting the second original motion vector according to the second integer-pixel motion vector adjustment value to obtain the second target motion vector corresponding to the second original motion vector.

~~5~~4. The method of claim 3~~4~~, wherein,

determining a first integer-pixel motion vector adjustment value and a second integer-pixel motion vector adjustment value according to the optimal motion vector comprises:

determining the first integer-pixel motion vector adjustment value according to the optimal motion vector, wherein the first integer-pixel motion vector adjustment value is equal to the difference between the optimal motion vector and the initial motion vector;

determining the second integer-pixel motion vector adjustment value according to the first integer-pixel motion vector adjustment value; wherein the second integer-pixel motion vector adjustment value and the first integer-pixel motion vector adjustment value are opposite numbers to each other.

~~6~~5. The method of claim 3~~4~~, wherein,

adjusting the first original motion vector according to the first integer-pixel motion vector adjustment value to obtain the first target motion vector corresponding to the first original motion vector, and adjusting the second original motion vector according to the second integer-pixel motion vector adjustment value to obtain the second target motion vector corresponding to the second original motion vector comprises:

the first target motion vector is equal to the sum of the first original motion vector and the first integer-pixel motion vector adjustment value; the second target motion vector is equal to the sum of the second original motion vector and the second integer-pixel motion vector adjustment value.

~~7~~6. The method of claim 1, wherein,

adjusting the first original motion vector and the second original motion vector according to the optimal motion vector to obtain a first target motion vector corresponding to the first original motion vector and a second target motion vector corresponding to the second original motion vector comprises:

determining a first integer-pixel motion vector adjustment value, a first sub-pixel motion vector adjustment value, a second integer-pixel motion vector adjustment value and a second sub-pixel motion vector adjustment value according to the optimal motion vector; adjusting the first original motion vector according to the first integer-pixel motion vector adjustment value and the first sub-pixel motion vector adjustment value to obtain the first target motion vector of the sub-block; and adjusting the second original motion vector according to the second integer-pixel motion vector adjustment value and the second sub-pixel motion vector adjustment value to obtain the second target motion vector of the sub-block.

~~8~~7. The method of claim 1, wherein,

adjusting the first original motion vector and the second original motion vector according to the optimal motion vector to obtain a first target motion vector corresponding to the first original motion vector and a second target motion vector corresponding to the second original motion vector comprises:

determining a first integer-pixel motion vector adjustment value and a first sub-pixel motion vector adjustment value according to the optimal motion vector; obtaining an optimal offset motion vector according to the first integer-pixel motion vector adjustment value and the first sub-pixel motion vector adjustment value;

adjusting the first original motion vector based on the optimal offset motion vector to obtain the first target motion vector; adjusting the second original motion vector based on an opposite number of the optimal offset motion vector to obtain the second target motion vector.

~~9~~8. The method of claim 6~~7~~ or 7~~8~~, wherein,

determining a first integer-pixel motion vector adjustment value and a first sub-pixel motion vector adjustment value according to the optimal motion vector comprises:

determining the first integer-pixel motion vector adjustment value according to the optimal motion vector, wherein the first integer-pixel motion vector adjustment value is equal to the difference between the optimal motion vector and the initial motion vector;

determining the first sub-pixel motion vector adjustment value according to a cost value corresponding to the optimal motion vector and cost values corresponding to edge motion vectors corresponding to the optimal motion vector.

~~10~~9. The method of claim ~~8~~9, wherein, determining the first sub-pixel motion vector adjustment value according to a cost value corresponding to the optimal motion vector and cost values corresponding to edge motion vectors corresponding to the optimal motion vector comprises:

sequentially determining cost values of 5 integer-pixel motion vectors which take the optimal motion vector as a center; wherein the 5 integer-pixel motion vectors are 5 edge motion vectors obtained by shifting horizontally to the left, horizontally to the right, vertically upward and vertically downward respectively when taking the optimal motion vector as a center.

~~11~~10. The method of claim ~~6~~7, wherein, the first target motion vector is equal to the sum of the first original motion vector, the first integer-pixel motion vector adjustment value and the first sub-pixel motion vector adjustment value; the second target motion vector is equal to the sum of the second original motion vector, the second integer-pixel motion vector adjustment value and the second sub-pixel motion vector adjustment value; wherein, the second integer-pixel motion vector adjustment value and the first integer-pixel motion vector adjustment value are opposite numbers to each other; the second sub-pixel motion vector adjustment value and the first sub-pixel motion vector adjustment value are opposite numbers to each other.

~~12~~11. The method of claim 1, wherein,

the optimal motion vector is a motion vector having a smallest cost value selected from the original motion vector and the candidate motion vectors.

1~~2~~3. The method of claim 1, wherein, when the current block comprises one sub-block, the sub-block is the current block itself.

1~~3~~4. The method of claim 1, wherein, the first reference block and the second reference block are luminance prediction blocks determined based on a luminance component.

1~~4~~5. An encoding method, comprising:

when a current block enables a motion vector refinement mode, determining prediction values of sub-blocks of the current block, and determining a prediction value of the current block according to the prediction values of sub-blocks of the current block, wherein for each sub-block of the current block, determining a prediction value of a sub-block comprises:

obtaining motion information of the current block comprising a first original motion vector and a first reference frame, a second original motion vector and a second reference frame;

determining a first reference block corresponding to the sub-block according to the first original motion vector of the current block, and determining a second reference block corresponding to the sub-block according to the second original motion vector of the current block;

obtaining an optimal motion vector according to pixel values of the first reference block and pixel values of the second reference block, wherein obtaining optimal motion vector comprises:

taking an initial motion vector as a center, selecting motion vectors from the motion vectors containing the initial motion vector and the motion vectors surrounding the initial motion vector, and determining the selected motion vectors as candidate motion

vectors; wherein the initial motion vector is the first original motion vector or the second original motion vector; obtaining a cost value corresponding to the initial motion vector and cost values corresponding to the candidate motion vectors according to the pixel values of the first reference block and the pixel values of the second reference block; selecting a motion vector from the initial motion vector and the candidate motion vectors as the optimal motion vector according to the cost value corresponding to the initial motion vector and the cost values corresponding to the candidate motion vectors;

adjusting the first original motion vector and the second original motion vector according to the optimal motion vector to obtain a first target motion vector corresponding to the first original motion vector and a second target motion vector corresponding to the second original motion vector;

determining the prediction value of the sub-block according to the first target motion vector and the second target motion vector; wherein determining the prediction value of the sub-block according to the first target motion vector and the second target motion vector comprises: determining a third reference block corresponding to the sub-block according to the first target motion vector, and determining a fourth reference block corresponding to the sub-block according to second target motion vector; weighting pixel values of the third reference block and pixel values of the fourth reference block to obtain the prediction value of the sub-block;

wherein, taking an initial motion vector as a center, selecting motion vectors from the motion vectors containing the initial motion vector and the motion vectors surrounding the initial motion vector, and determining the selected motion vectors as candidate motion vectors, comprises: taking the initial motion vector as a center, searching 25 motion vectors containing the initial motion vector at a search range of 2, and determining the 25 motion vectors as candidate motion vectors; wherein a searching sequence of the 25 motion vectors is as follows: {Mv(-2,-2), Mv(-1,-2), Mv(0,-2), Mv(1,-2), Mv(2,-2), Mv(-2,-1), Mv(-1,-1), Mv(0,-1), Mv(1,-1), Mv(2,-1), Mv(-2, 0), Mv(-1, 0), Mv(0, 0), Mv(1, 0), Mv(2,

0)，Mv(-2, 1)，Mv(-1, 1)，Mv(0, 1)，Mv(1, 1)，Mv(2, 1)，Mv(-2, 2)，Mv(-1, 2)，Mv(0, 2)，Mv(1, 2)，Mv(2, 2)}.

156. A decoding apparatus, comprising: a processor and a machine-readable storage medium, wherein the machine-readable storage medium has stored thereon machine-executable instructions executable by the processor; the processor is used to execute machine-executable instructions so as to implement the method of any one of claims 1-134.

167. An encoding apparatus, comprising: a processor and a machine-readable storage medium, wherein the machine-readable storage medium has stored thereon machine-executable instructions executable by the processor; the processor is used to execute machine-executable instructions so as to implement the following steps:

when a current block enables a motion vector refinement mode, determining prediction values of sub-blocks of the current block, and determining a prediction value of the current block according to the prediction values of sub-blocks of the current block, wherein for each sub-block of the current block, determining a prediction value of a sub-block comprises:

obtaining motion information of the current block comprising a first original motion vector and a first reference frame, a second original motion vector and a second reference frame;

determining a first reference block corresponding to the sub-block according to the first original motion vector of the current block, and determining a second reference block corresponding to the sub-block according to the second original motion vector of the current block;

obtaining an optimal motion vector according to pixel values of the first reference block and pixel values of the second reference block, wherein obtaining an optimal motion vector comprises:

taking an initial motion vector as a center, selecting motion vectors from the motion vectors containing the initial motion vector and the motion vectors surrounding the initial

motion vector, and determining the selected motion vectors as candidate motion vectors; wherein the initial motion vector is the first original motion vector or the second original motion vector; obtaining a cost value corresponding to the initial motion vector and cost values corresponding to the candidate motion vectors according to the pixel values of the first reference block and the pixel values of the second reference block; selecting a motion vector from the initial motion vector and the candidate motion vectors as the optimal motion vector according to the cost value corresponding to the initial motion vector and the cost values corresponding to the candidate motion vectors;

adjusting the first original motion vector and the second original motion vector according to the optimal motion vector to obtain a first target motion vector corresponding to the first original motion vector and a second target motion vector corresponding to the second original motion vector;

determining the prediction value of the sub-block according to the first target motion vector and the second target motion vector; wherein determining the prediction value of the sub-block according to the first target motion vector and the second target motion vector comprises: determining a third reference block corresponding to the sub-block according to the first target motion vector, and determining a fourth reference block corresponding to the sub-block according to second target motion vector; weighting pixel values of the third reference block and pixel values of the fourth reference block to obtain the prediction value of the sub-block;

wherein, taking an initial motion vector as a center, selecting motion vectors from the motion vectors containing the initial motion vector and the motion vectors surrounding the initial motion vector, and determining the selected motion vectors as candidate motion vectors, comprises: taking the initial motion vector as a center, searching 25 motion vectors containing the initial motion vector at a search range of 2, and determining the 25 motion vectors as candidate motion vectors; wherein a searching sequence of the 25 motion vectors is as follows: {Mv(-2,-2), Mv(-1,-2), Mv(0,-2), Mv(1,-2), Mv(2,-2), Mv(-2,-1), Mv(-

1,-1)，Mv(0,-1)，Mv(1,-1)，Mv(2,-1)，Mv(-2, 0)，Mv(-1, 0)，Mv(0, 0)，Mv(1, 0)，Mv(2, 0)，Mv(-2, 1)，Mv(-1, 1)，Mv(0, 1)，Mv(1, 1)，Mv(2, 1)，Mv(-2, 2)，Mv(-1, 2)，Mv(0, 2)，Mv(1, 2)，Mv(2, 2)}.

178. A decoder, wherein the decoder is configured to implement the method of any one of claims 1-134.

189. An encoder, wherein the encoder is configured to implement the following steps:

when a current block enables a motion vector refinement mode, determining prediction values of sub-blocks of the current block, and determining a prediction value of the current block according to the prediction values of sub-blocks of the current block, wherein for each sub-block of the current block, determining a prediction value of a sub-block comprises:

obtaining motion information of the current block comprising a first original motion vector and a first reference frame, a second original motion vector and a second reference frame;

determining a first reference block corresponding to the sub-block according to the first original motion vector of the current block, and determining a second reference block corresponding to the sub-block according to the second original motion vector of the current block;

obtaining an optimal motion vector according to pixel values of the first reference block and pixel values of the second reference block, wherein obtaining an optimal motion vector comprises:

taking an initial motion vector as a center, selecting motion vectors from the motion vectors containing the initial motion vector and the motion vectors surrounding the initial motion vector, and determining the selected motion vectors as candidate motion vectors; wherein the initial motion vector is the first original motion vector or the second original motion vector; obtaining a cost value corresponding to the initial motion vector and cost values corresponding to the candidate motion vectors according to the pixel values of

the first reference block and the pixel values of the second reference block; selecting a motion vector from the initial motion vector and the candidate motion vectors as the optimal motion vector according to the cost value corresponding to the initial motion vector and the cost values corresponding to the candidate motion vectors;

adjusting the first original motion vector and the second original motion vector according to the optimal motion vector to obtain a first target motion vector corresponding to the first original motion vector and a second target motion vector corresponding to the second original motion vector;

determining the prediction value of the sub-block according to the first target motion vector and the second target motion vector; wherein determining the prediction value of the sub-block according to the first target motion vector and the second target motion vector comprises: determining a third reference block corresponding to the sub-block according to the first target motion vector, and determining a fourth reference block corresponding to the sub-block according to second target motion vector; weighting pixel values of the third reference block and pixel values of the fourth reference block to obtain the prediction value of the sub-block;

wherein, taking an initial motion vector as a center, selecting motion vectors from the motion vectors containing the initial motion vector and the motion vectors surrounding the initial motion vector, and determining the selected motion vectors as candidate motion vectors, comprises: taking the initial motion vector as a center, searching 25 motion vectors containing the initial motion vector at a search range of 2, and determining the 25 motion vectors as candidate motion vectors; wherein a searching sequence of the 25 motion vectors is as follows: {Mv(-2,-2), Mv(-1,-2), Mv(0,-2), Mv(1,-2), Mv(2,-2), Mv(-2,-1), Mv(-1,-1), Mv(0,-1), Mv(1,-1), Mv(2,-1), Mv(-2, 0), Mv(-1, 0), Mv(0, 0), Mv(1, 0), Mv(2, 0), Mv(-2, 1), Mv(-1, 1), Mv(0, 1), Mv(1, 1), Mv(2, 1), Mv(-2, 2), Mv(-1, 2), Mv(0, 2), Mv(1, 2), Mv(2, 2)}.

~~20~~19. A non-transitory machine-readable storage medium, comprising machine-executable instructions executable by a processor stored thereon; the processor is used to execute the machine-executable instructions to implement the method of any one of claims 1-13~~4~~.