

CLAIMS

1. A method for coding an image of a video sequence, wherein the image comprises a current image block, the method comprises:

obtaining initial motion information of the current image block;

5 obtaining sample values of at least two candidate reference image blocks corresponding to the current image block according to the initial motion information;

constraining a bit-depth of sample values of each candidate reference image block to a predefined bit-depth;

10 obtaining refined motion information based on constrained sample values of at least two constrained candidate reference image blocks; and

determining a prediction image block of the current image block according to the refined motion information.

2. The method according to claim 1, wherein the constraining a bit-depth of sample values of each candidate reference image block to a predefined bit-depth comprises:

15 performing a right shift by an amount of $(b-d)$ on the bit-depth of sample values of each candidate reference image block, wherein b is the bit-depth of the sample values of the each candidate reference image block, d is the predefined bit-depth, and b is greater than d .

3. The method according to claim 1 or 2, wherein the obtaining initial motion information of a current image block comprises:

20 using a first cost function to determine motion information with the least cost from a merge candidate list as the initial motion information, wherein the merge candidate list comprises motion information of adjacent blocks of the current image block.

4. The method according to claim 1 or 2, wherein the obtaining initial motion information of a current image block comprises:

25 determining motion information identified by a merge index from a merge candidate list as the initial motion information, wherein the merge candidate list comprises motion information of adjacent blocks of the current image block.

5. The method according to any one of claims 1-4, wherein the obtaining sample values of at least two candidate reference image blocks corresponding to the current image block comprises:

determining a position of a candidate reference image block according to the initial motion information and a position of the current image block;

determining whether sample values of the candidate reference image block are available based on the position of the candidate reference image block, if the sample values of the candidate reference image block are unavailable, performing an interpolation operation to obtain the sample values of the candidate reference image block.

6. The method according to any one of claims 1-5, wherein the obtaining refined motion information based on constrained sample values of the at least two constrained candidate reference image blocks comprises:

using a second cost function to determine a position of a constrained candidate reference image block with the least cost;

obtaining the refined motion information according to the position of the constrained candidate reference image block with the least cost.

7. The method according to claim 6, wherein the second cost function indicates a difference between a constrained candidate reference image block and a template of the current image block, wherein the template is obtained based on the initial motion information and a position of the current image block and a bit-depth of sample values of the template is constrained to the predefined bit-depth.

8. The method according to claim 7, wherein the cost is calculated as:

$$\text{cost} = \sum_{i=0}^{H-1} \sum_{j=0}^{W-1} |(I0(i, j) - \text{MIN}((1 \ll d) - 1, (I1(i, j) + (m0 - m1))))|, \text{ if } m0 > m1$$

$$\text{cost} = \sum_{i=0}^{H-1} \sum_{j=0}^{W-1} |(\text{MIN}((1 \ll d) - 1, (I0(i, j) + (m1 - m0))) - I1(i, j))|, \text{ otherwise}$$

wherein H is a height of the current image block, W is a width of the current image block, $I0(i, j)$ is a sample value at a position (i, j) of a constrained candidate reference image block, $I1(i, j)$ is a sample value at the position (i, j) of the template, $m0$ is a mean of sample values of the constrained candidate reference image block, $m1$ is a mean of sample values of the template, d is the predefined bit-depth.

9. The method according to claim 7 or 8, wherein the at least two constrained candidate reference image blocks comprises a set of first constrained candidate reference image blocks and a set of second constrained candidate reference image blocks;

wherein the initial motion information comprises first initial motion information and second initial motion information, the method further comprises:

obtaining a first initial reference image block based on the first initial motion information and a position of the current image block;

obtaining a second initial reference image block based on the second initial motion information and the position of the current image block;

calculating a weighted combination of the first initial reference image block and the second initial reference image block as the template;

wherein the using a second cost function to determine a position of a constrained candidate reference image block with the least cost comprises:

calculating differences between the template and each first constrained candidate reference image block and determining a first position of a first constrained reference image block with the smallest difference;

calculating differences between the template and each second constrained candidate reference image block and determining a second position of a second constrained reference image block with the smallest difference;

wherein the obtaining the refined motion information according to a position of the constrained candidate reference image block comprises:

obtaining the refined motion information according to the first position and the second position.

10. The method according to claim 6, wherein the at least two constrained candidate reference image blocks comprises a set of first constrained candidate reference image blocks and a set of second constrained candidate reference image blocks, and the second cost function indicates a difference between a first constrained candidate reference image block and a second constrained candidate reference image block.

11. The method according to claim 10, wherein the cost is calculated as:

$$\text{cost} = \sum_{i=0}^{H-1} \sum_{j=0}^{W-1} |(I0(i, j) - \text{MIN}((1 \ll d) - 1, (I1(i, j) + (m0 - m1))))|, \text{ if } m0 > m1$$

$$\text{cost} = \sum_{i=0}^{H-1} \sum_{j=0}^{W-1} |(\text{MIN}((1 \ll d) - 1, (I0(i, j) + (m1 - m0)))) - I1(i, j)|, \text{ otherwise}$$

wherein H is a height of the current image block, W is a width of the current image block,

$I0(i, j)$ is a sample value at a position (i, j) of a first constrained candidate reference image block, $I1(i, j)$ is a sample value at the position (i, j) of a second constrained candidate reference image block, $m0$ is a mean of sample values of the first constrained candidate reference image block, $m1$ is a mean of sample values of the second constrained candidate reference image block, d is the predefined bit-depth.

12. The method according to any one of claims 1-11, wherein the refined motion information comprises a refined motion vector of the current image block;

wherein the determining a prediction image block of the current image block according to the refined motion information comprises:

determining the prediction image block of the current image block according to the refined motion vector and a reference image, wherein the reference image is a predefined image or obtained based on a predefined algorithm.

13. The method according to any one of claims 1-11, wherein the refined motion information comprises a refined motion vector of the current image block and indication of a reference image;

wherein the determining a prediction image block of the current image block according to the refined motion information comprises:

determining the prediction image block of the current image block according to the refined motion vector and the indication of the reference image.

14. The method according to claim 3, wherein the first cost function is one of a sum of absolute difference (SAD), a mean-removed sum of absolute difference (MR-SAD) or a sum of squared differences (SSD).

15. The method according to any one of claims 6-11, wherein the second cost function is one of a sum of absolute difference (SAD), a mean-removed sum of absolute difference (MR-SAD) or a sum of squared differences (SSD).

16. The method according to any one of claims 1-15, wherein the constrained candidate reference image block refers to the candidate reference image block with constrained sample values.

17. An apparatus for coding an image of a video sequence, wherein the image comprises a current image block, the apparatus comprises:

an obtaining module, configured to obtain initial motion information of the current image block;

the obtaining module is further configured to obtain sample values of at least two candidate reference image blocks corresponding to the current image block according to the initial motion information;

a constraining module, configured to constrain a bit-depth of sample values of each candidate reference image block to a predefined bit-depth;

the obtaining module is further configured to obtain refined motion information based on constrained sample values of at least two constrained candidate reference image blocks; and

a determining module, configured to determine a prediction image block of the current image block according to the refined motion information.

18. The apparatus according to claim 17, wherein the constraining module is specifically configured to:

perform a right shift by an amount of $(b-d)$ on the bit-depth of sample values of each candidate reference image block, wherein b is the bit-depth of the sample values of the each candidate reference image block, d is the predefined bit-depth, and b is greater than d .

19. The apparatus according to claim 17 or 18, wherein the obtaining module is specifically configured to:

use a first cost function to determine motion information with the least cost from a merge candidate list as the initial motion information, wherein the merge candidate list comprises motion information of adjacent blocks of the current image block.

20. The apparatus according to claim 17 or 18, wherein the obtaining module is specifically configured to:

determine motion information identified by a merge index from a merge candidate list as the initial motion information, wherein the merge candidate list comprises motion information of adjacent blocks of the current image block.

21. The apparatus according to any one of claims 17-20, wherein the obtaining module is specifically configured to:

determine a position of a candidate reference image block according to the initial motion information and a position of the current image block;

determine whether sample values of the candidate reference image block are available based on the position of the candidate reference image block, if sample values of the candidate reference image block are unavailable, performing an interpolation operation to obtain the sample values of the candidate reference image block.

22. The apparatus according to any one of claims 17-21, wherein the obtaining module is specifically configured to:

use a second cost function to determine a position of a constrained candidate reference image block with the least cost;

obtain the refined motion information according to the position of the constrained candidate reference image block with the least cost.

23. The apparatus according to claim 22, wherein the second cost function indicates a difference between a constrained candidate reference image block and a template of the current image block, wherein the template is obtained based on the initial motion information and a position of the current image block and a bit-depth of sample values of the template is constrained to the predefined bit-depth.

24. The apparatus according to claim 23, wherein the cost is calculated as:

$$\text{cost} = \sum_{i=0}^{H-1} \sum_{j=0}^{W-1} |(I0(i, j) - \text{MIN}((1 \ll d) - 1, (I1(i, j) + (m0 - m1))))|, \text{ if } m0 > m1$$

$$\text{cost} = \sum_{i=0}^{H-1} \sum_{j=0}^{W-1} |(\text{MIN}((1 \ll d) - 1, (I0(i, j) + (m1 - m0))) - I1(i, j))|, \text{ otherwise}$$

wherein H is a height of the current image block, W is a width of the current image block, $I0(i, j)$ is a sample value at a position (i, j) of a constrained candidate reference image block, $I1(i, j)$ is a sample value at the position (i, j) of the template, $m0$ is a mean of sample values

of the constrained candidate reference image block, $m1$ is a mean of sample values of the template, d is the predefined bit-depth.

25. The apparatus according to claim 23 or 24, wherein the at least two constrained candidate reference image blocks comprises a set of first constrained candidate reference image blocks and a set of second constrained candidate reference image blocks;

wherein the obtaining module is specifically configured to:

obtain a first initial reference image block based on the first initial motion information and a position of the current image block;

obtain a second initial reference image block based on the second initial motion information and the position of the current image block;

calculate a weighted combination of the first initial reference image block and the second initial reference image block as the template;

calculate differences between the template and each first constrained candidate reference image block and determine a first position of a first constrained reference image block with the smallest difference;

calculate differences between the template and each second constrained candidate reference image block and determine a second position of a second constrained reference image block with the smallest difference;

wherein the determining module is specifically configured to:

obtain the refined motion information according to the first position and the second position.

26. The apparatus according to claim 22, wherein the at least two constrained candidate reference image blocks comprises a set of first constrained candidate reference image blocks and a set of second constrained candidate reference image blocks, and the second cost function indicates a difference between a first constrained candidate reference image block and a second constrained candidate reference image block.

27. The apparatus according to claim 26, wherein the cost is calculated as:

$$\text{cost} = \sum_{i=0}^{H-1} \sum_{j=0}^{W-1} |(I0(i,j) - \text{MIN}((1 \ll d) - 1, (I1(i,j) + (m0 - m1))))|, \text{ if } m0 > m1$$

$$\text{cost} = \sum_{i=0}^{H-1} \sum_{j=0}^{W-1} |(\text{MIN}((1 \ll d) - 1, (I0(i,j) + (m1 - m0)))) - I1(i,j)|, \text{ otherwise}$$

wherein H is a height of the current image block, W is a width of the current image block, $I_0(i, j)$ is a sample value at a position (i, j) of a first constrained candidate reference image block, $I_1(i, j)$ is a sample value at the position (i, j) of a second constrained candidate reference image block, m_0 is a mean of sample values of the first constrained candidate reference image block, m_1 is a mean of sample values of the second constrained candidate reference image block, d is the predefined bit-depth.

28. The apparatus according to any one of claims 17-27, wherein the refined motion information comprises a refined motion vector of the current image block;

wherein the determining module is specifically configured to:

determine the prediction image block of the current image block according to the refined motion vector and a reference image, wherein the reference image is a predefined image or obtained based on a predefined algorithm.

29. The apparatus according to any one of claims 17-27, wherein the initial motion information comprises a refined motion vector of the current image block and indication of a reference image;

wherein the determining module is specifically configured to:

determine the prediction image block of the current image block according to the refined motion vector and the indication of the reference image.

30. An encoder, comprising an apparatus for coding an image of a video sequence according to any one of claims 17-29.

31. A decoder, comprising an apparatus for coding an image of a video sequence according to any one of claims 17-29.

32. A terminal device, comprising an encoder according to claim 30 and a decoder according to claim 31.

CLAIMS

1. A method for coding an image of a video sequence, wherein the image comprises a current image block, the method comprises:

obtaining initial motion information of the current image block; wherein, the initial motion information comprising a first initial motion vector corresponding to a first reference image and a second initial motion vector corresponding to a second reference image;

obtaining constrained sample values of at least two reference image blocks corresponding to the current image block according to the initial motion information; wherein, the at least two reference image blocks comprising a first reference image block and a second reference image block, and the first reference image block corresponds to the first reference image, and the second reference image block corresponds to the second reference image;

the constrained sample values is obtained by constraining a bit-depth of sample values of each reference image block to a predefined bit-depth; wherein, the constraining the bit-depth of sample values of each reference image block to the predefined bit-depth comprising: constraining a bit-depth of sample values of the first reference image block to the predefined bit-depth and constraining a bit-depth of sample values of the second reference image block to the predefined bit-depth;

obtaining refined motion information based on the constrained sample values of at least two reference image blocks; wherein, the constrained sample values of at least two constrained reference image blocks comprising: constrained sample values of the first reference image blocks and constrained sample values of the second reference image blocks; and

determining a prediction image block of the current image block according to the refined motion information.

2. The method according to claim 1, wherein the constraining a bit-depth of sample values of each reference image block to a predefined bit-depth comprises:

performing a right shift by an amount of $(b-d)$ on the bit-depth of the sample values of each reference image block, wherein b is the bit-depth of the sample values of the each reference image block, d is the predefined bit-depth, and b is greater than d .

3. The method according to claim 1 or 2, wherein the obtaining initial motion information of a current image block comprises:

using a first cost function to determine motion information with the least cost from a merge list as the initial motion information, wherein the merge list comprises motion information of adjacent blocks of the current image block.

4. The method according to claim 1 or 2, wherein the obtaining initial motion information of a current image block comprises:

determining motion information identified by a merge index from a merge list as the initial motion information, wherein the merge list comprises motion information of adjacent blocks of the current image block.

5. The method according to any one of claims 1-4, wherein the obtaining sample values of at least two reference image blocks corresponding to the current image block comprises:

determining a position of a reference image block according to the initial motion information and a position of the current image block;

determining whether sample values of the reference image block are available based on the position of the reference image block, if the sample values of the reference image block are unavailable, performing an interpolation operation to obtain the sample values of the reference image block.

6. The method according to any one of claims 1-5, wherein the obtaining refined motion information based on constrained sample values of the at least two constrained reference image blocks comprises:

using a second cost function to determine a position of a reference image block with the least cost;

obtaining the refined motion information according to the position of the reference image block with the least cost.

7. The method according to claim 6, wherein the second cost function indicates a difference between a reference image block and a template of the current image block, wherein the template is obtained based on the initial motion information and a position of the current image block and a bit-depth of sample values of the template is constrained to the predefined bit-depth.

8. The method according to claim 7, wherein the at least two reference image blocks comprises a set of first reference image blocks and a set of second reference image blocks;

wherein the initial motion information comprises first initial motion information and second initial motion information, the method further comprises:

obtaining a first initial reference image block based on the first initial motion information and a position of the current image block;

obtaining a second initial reference image block based on the second initial motion information and the position of the current image block;

calculating a weighted combination of the first initial reference image block and the second initial reference image block as the template;

wherein the using a second cost function to determine a position of a reference image block with the least cost comprises:

calculating differences between the template and each first reference image block and determining a first position of a first constrained reference image block with the smallest difference;

calculating differences between the template and each second reference image block and determining a second position of a second constrained reference image block with the smallest difference;

wherein the obtaining the refined motion information according to a position of the reference image block comprises:

obtaining the refined motion information according to the first position and the second position.

9. The method according to claim 6, wherein the at least two reference image blocks comprises a set of first reference image blocks and a set of second reference image blocks, and the second cost function indicates a difference between a first reference image block and a second reference image block.

10. The method according to any one of claims 1-9, wherein the refined motion information comprises a refined motion vector of the current image block;

wherein the determining a prediction image block of the current image block according to the refined motion information comprises:

determining the prediction image block of the current image block according to the refined motion vector and a reference image, wherein the reference image is a predefined image or obtained based on a predefined algorithm.

11. The method according to any one of claims 1-9, wherein the refined motion information comprises a refined motion vector of the current image block and indication of a reference image;

wherein the determining a prediction image block of the current image block according to the refined motion information comprises:

determining the prediction image block of the current image block according to the refined motion vector and the indication of the reference image.

12. The method according to claim 3, wherein the first cost function is one of a sum of absolute difference (SAD), a mean-removed sum of absolute difference (MR-SAD) or a sum of squared differences (SSD).

13. The method according to any one of claims 6-9, wherein the second cost function is one of a sum of absolute difference (SAD), a mean-removed sum of absolute difference (MR-SAD) or a sum of squared differences (SSD).

14. The method according to any one of claims 1-13, wherein the reference image block refers to the reference image block with constrained sample values.

15. An apparatus for coding an image of a video sequence, wherein the image comprises a current image block, the apparatus comprises:

an obtaining module, configured to obtain initial motion information of the current image block; wherein, the initial motion information comprising a first initial motion vector corresponding to a first reference image and a second initial motion vector corresponding to a second reference image;

the obtaining module is further configured to obtain constrained sample values of at least two reference image blocks corresponding to the current image block according to the initial motion information; wherein, the at least two reference image blocks comprising a first reference image block and a second reference image block, and the first reference image block corresponds to the first reference image, and the second reference image block corresponds to the second reference image;

the constrained sample values is obtained by constraining a bit-depth of sample values of each reference image block to a predefined bit-depth; wherein, the constraining the bit-depth of sample values of each reference image block to the predefined bit-depth comprising: constraining a bit-depth of sample values of the first reference image block to the predefined bit-depth and constraining a bit-depth of sample values of the second reference image block to the predefined bit-depth;

the obtaining module is further configured to obtain refined motion information based on the constrained sample values of at least two reference image blocks; wherein, the constrained sample values of at least two constrained reference image blocks comprising: constrained sample values of the first reference image blocks and constrained sample values of the second reference image blocks; and

a determining module, configured to determine a prediction image block of the current image block according to the refined motion information.

16. The apparatus according to claim 15, wherein the obtaining module is configured to:

perform a right shift by an amount of $(b-d)$ on the bit-depth of the sample values of each reference image block, wherein b is the bit-depth of the sample values of the each reference image block, d is the predefined bit-depth, and b is greater than d .

17. A non-transitory computer-readable storage medium storing programming for execution by a processing circuitry, wherein the programming, when executed by the processing circuitry, configures the processing circuitry to carry out the method according to any one of claims 1-14.

18. A computer program for causing one or more processor to perform the method according to any one of claims 1-14.

19. A coder, comprising:
one or more processors; and
a non-transitory computer-readable storage medium coupled to the processors and storing programming for execution by the processors, wherein the programming, when executed by the processors, configures the decoder to carry out the method according to any one of claims 1-14.

20. A coding device, comprising circuitry configured to perform the method according to any one of claims 1-14.