apparatus, a video encoding device, and a video decoding device, to determine a reference picture index of a picture block according to a derivation method during encoding or decoding without transmitting the reference picture index of the picture block in a bitstream, so that transmission resources can be saved, and coding compression efficiency can be improved to some extent.

[0006] To achieve the foregoing objective, the following technical solutions are used in the embodiments of this application.

[0007] According to a first aspect, the present invention provides a bi-directional inter prediction method. The method includes:

determining a reference picture index i_1 of a first reference picture list as a first reference picture index that corresponds to a current block and that is of the first reference picture list, where a picture order count POC (picture order count) corresponding to the reference picture index i_1 is less than a POC of a current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_1 from the POC of the current picture is less than a difference obtained by subtracting a POC corresponding to a reference picture index i_x from the POC of the current picture, the reference picture index i_x is any reference picture index other than the reference picture index i_1 in reference picture indices of the first reference picture list, and the POC corresponding to the reference picture index i_x is less than the POC of the current picture;

determining a reference picture index i_2 of a second reference picture list as a second reference picture index that corresponds to the current block and that is of the second reference picture list, where a POC corresponding to the reference picture index i_2 is greater than the POC of the current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_2 from the POC of the current picture is greater than a difference obtained by subtracting a POC corresponding to a reference picture index i_y from the POC of the current picture, the reference picture index i_y is any reference picture index other than the reference picture index i_2 in the reference picture indices of the second reference picture list, and the POC corresponding to the reference picture index i_y is greater than the POC of the current picture; and

predicting the current block based on the first reference picture index and the second reference picture index, where the current picture includes the current block.

[0008] It should be understood that the reference picture index in the present invention may also be briefly referred to as an index.

[0009] According to a second aspect, the present invention provides a bi-directional inter

prediction method. The method includes:

when a first group of conditions is satisfied, determining a reference picture index i_1 of a first reference picture list as a first reference picture index that corresponds to a current block and that is of the first reference picture list, where the first group of conditions includes at least the following condition 1 and condition 2:

condition 1: a POC corresponding to the reference picture index i_1 is less than a POC of a current picture; and

condition 2: a difference obtained by subtracting the POC corresponding to the reference picture index i_1 from the POC of the current picture is less than a difference obtained by subtracting a POC corresponding to a reference picture index i_x from the POC of the current picture, the reference picture index i_x is any reference picture index other than the reference picture index i_1 in reference picture indices of the first reference picture list, and the POC corresponding to the reference picture index i_x is less than the POC of the current picture;

when a second group of conditions is satisfied, determining a reference picture index i_2 of a second reference picture list as a second reference picture index that corresponds to the current block and that is of the second reference picture list, where the second group of conditions includes at least the following condition 11 and condition 12:

condition 11: a POC corresponding to the reference picture index i_2 is greater than the POC of the current picture; and

condition 12: a difference obtained by subtracting the POC corresponding to the reference picture index i_2 from the POC of the current picture is greater than a difference obtained by subtracting a POC corresponding to a reference picture index i_y from the POC of the current picture, the reference picture index i_y is any reference picture index other than the reference picture index i_2 in the reference picture indices of the second reference picture list, and the POC corresponding to the reference picture index i_y is greater than the POC of the current picture; and

predicting the current block based on the first reference picture index and the second reference picture index, where the current picture includes the current block.

[0010] It should be understood that, in the embodiments of the present invention, in addition to the condition 1 and the condition 2, the first group of conditions may further include another condition, and in addition to the condition 11 and the condition 12, the second group of conditions may further include another condition. These conditions include but are not limited to an optional

execution condition in the prior art or an optional execution condition in standard evolution, and are not exhaustively enumerated in the embodiments of the present invention.

[0011] According to a third aspect, the present invention provides a bi-directional inter prediction method. The method includes:

allowing to determine a reference picture index i_1 of a first reference picture list as a first reference picture index that corresponds to a current block and that is of the first reference picture list, where a POC corresponding to the reference picture index i_1 is less than a POC of a current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_1 from the POC of the current picture is less than a difference obtained by subtracting a POC corresponding to a reference picture index i_x from the POC of the current picture, the reference picture index i_x is any reference picture index other than the reference picture index i_1 in reference picture indices of the first reference picture list, and the POC corresponding to the reference picture index i_x is less than the POC of the current picture;

allowing to determine a reference picture index i_2 of a second reference picture list as a second reference picture index that corresponds to the current block and that is of the second reference picture list, where a POC corresponding to the reference picture index i_2 is greater than the POC of the current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_2 from the POC of the current picture is greater than a difference obtained by subtracting a POC corresponding to a reference picture index i_y from the POC of the current picture, the reference picture index i_y is any reference picture index other than the reference picture index i_2 in the reference picture indices of the second reference picture list, and the POC corresponding to the reference picture index i_y is greater than the POC of the current picture; and

predicting the current block based on the first reference picture index and the second reference picture index when the reference picture index i_1 is determined as the first reference picture index that corresponds to the current block and that is of the first reference picture list and the reference picture index i_2 is determined as the second reference picture index that corresponds to the current block and that is of the second reference picture list, where the current picture includes the current block.

[0012] According to the first aspect, the second aspect, or the third aspect of the present invention, in a possible design, the first reference picture list may correspond to a first direction, and the second reference picture list may correspond to a second direction. The first direction and

corresponding to a reference picture index i_y from the POC of the current picture, the reference picture index i_y is any reference picture index other than the reference picture index i_2 in the reference picture indices of the second reference picture list, and the POC corresponding to the reference picture index i_y is greater than the POC of the current picture; and

an inter prediction processing unit, configured to predict the current block based on the first reference picture index and the second reference picture index, where the current picture includes the current block.

[0035] According to the fourth aspect, in a possible design, the apparatus further includes an obtaining unit, configured to obtain a first identifier, where a value of the first identifier is a first preset value, and when the value of the first identifier is the first preset value, the first identifier is used to indicate to determine the reference picture index i_1 of the first reference picture list as the first reference picture index that corresponds to the current block and that is of the first reference picture list, and determine the reference picture index i_2 of the second reference picture list as the second reference picture index that corresponds to the current block and that is of the second reference picture list.

[0036] According to the fourth aspect, in a possible design, when the first identifier is the first preset value, the first identifier is further used to indicate to determine a second motion vector difference of the current block based on a first motion vector difference of the current block; the obtaining unit is further configured to obtain the first motion vector difference of the current block; and the determining unit is further configured to obtain the second motion vector difference of the current block based on the first motion vector difference according to the following formula:

$$\text{mvd_lY} = -\text{mvd_lX}.$$

[0037] Herein, mvd_lY represents the second motion vector difference, mvd_lX represents the first motion vector difference, one of the first motion vector difference and the second motion vector difference belongs to motion information corresponding to the first reference picture list, and the other one of the first motion vector difference and the second motion vector difference belongs to motion information corresponding to the second reference picture list.

[0038] According to the fourth aspect, in a possible design, the obtaining unit is specifically configured to obtain a first predicted motion vector and a second predicted motion vector; the determining unit is configured to: determine a first motion vector based on the first predicted motion vector and the first motion vector difference, and determine a second motion vector based

pictures in L1).

[00321] For L0, 2, 4, and 5 are all less than 7, but 5 is closer to 7 than 2 and 4. An index of a reference picture corresponding to 5 in L0 is 2 (that is, the third element in the list). Therefore, $i_1 = 2$.

[00322] S502: Determine the reference picture index i_2 of the second reference picture list as the second reference picture index that corresponds to the current block and that is of the second reference picture list, where a POC corresponding to the reference picture index i_2 is greater than the POC of the current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_2 from the POC of the current picture is greater than a difference obtained by subtracting a POC corresponding to a reference picture index i_y from the POC of the current picture, the reference picture index i_y is any reference picture index other than the reference picture index i_2 in the reference picture indices of the second reference picture list, and the POC corresponding to the reference picture index i_y is greater than the POC of the current picture. To be specific, the POC corresponding to the reference picture index i_2 is a POC, closest to the POC of the current picture, in all POCs that are in the second reference picture list and that are greater than the POC of the current picture.

[00323] The reference picture lists in S501 are still used as an example.

[00324] Example A:

[00325] For L1, 9, 10, and 11 are all greater than 8, but 9 is closer to 8 than 10 and 11. An index of a reference picture corresponding to 9 in L1 is 0 (that is, the first element in the list). Therefore, $i_2 = 0$.

[00326] Example B:

[00327] For L0, 9, 10, and 12 are all greater than 7, but 9 is closer to 7 than 10 and 12. An index of a reference picture corresponding to 9 in L0 is 0 (that is, the first element in the list). Therefore, $i_2 = 0$.

[00328] Example C:

[00329] The POC of the current picture in which the current block is located is 7, and the current picture has two reference picture lists: L0 {2, 4, 5, 8} (where 2, 4, 5, and 8 may represent POCs of reference pictures in L0) and L1 {6, 9, 10} (where 6, 9, and 10 may represent POCs of reference pictures in L1).

[00330] For L1, 9 and 10 are both greater than 7, but 9 is closer to 7 than 10. An index of a

apparatus in performing S402, S403, and the like in the foregoing embodiment, and/or another process of the technology described in this specification.

[00349] All related content of the steps in the foregoing method embodiments may be cited in function descriptions of corresponding function modules, and details are not described herein again.

[00350] Certainly, the bi-directional inter prediction apparatus provided in this embodiment of this application includes but is not limited to the foregoing modules. For example, the bi-directional inter prediction apparatus may further include a storage unit 52.

[00351] The storage unit 52 may be configured to store program code and data of the bi-directional inter prediction apparatus.

[00352] Corresponding to the method in FIG. 5A, in an optional example, the present invention may further provide a bi-directional inter prediction apparatus 5000. Referring to FIG. 5C, the apparatus includes:

a determining unit 5002, configured to determine a reference picture index i_1 of a first reference picture list as a first reference picture index that corresponds to a current block and that is of the first reference picture list, where a POC corresponding to the reference picture index i_1 is less than a POC of a current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_1 from the POC of the current picture is less than a difference obtained by subtracting a POC corresponding to a reference picture index i_x from the POC of the current picture, the reference picture index i_x is any reference picture index other than the reference picture index i_1 in reference picture indices of the first reference picture list, and the POC corresponding to the reference picture index i_x is less than the POC of the current picture, where

the determining unit 5002 is further configured to determine a reference picture index i_2 of a second reference picture list as a second reference picture index that corresponds to the current block and that is of the second reference picture list, where a POC corresponding to the reference picture index i_2 is greater than the POC of the current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_2 from the POC of the current picture is greater than a difference obtained by subtracting a POC corresponding to a reference picture index i_y from the POC of the current picture, the reference picture index i_y is any reference picture index other than the reference picture index i_2 in the reference picture indices of the second reference picture list, and the POC corresponding to the reference picture index i_y is greater than

CLAIMS

What is claimed is:

1. A bi-directional inter prediction method, wherein the method comprises:

determining a reference picture index i_1 of a first reference picture list as a first reference picture index that corresponds to a current block and that is of the first reference picture list, wherein a picture order count, POC corresponding to the reference picture index i_1 is less than a POC of a current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_1 from the POC of the current picture is less than a difference obtained by subtracting a POC corresponding to a reference picture index i_x from the POC of the current picture, the reference picture index i_x is any reference picture index other than the reference picture index i_1 in reference picture indices of the first reference picture list, and the POC corresponding to the reference picture index i_x is less than the POC of the current picture;

determining a reference picture index i_2 of a second reference picture list as a second reference picture index that corresponds to the current block and that is of the second reference picture list, wherein a POC corresponding to the reference picture index i_2 is greater than the POC of the current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_2 from the POC of the current picture is greater than a difference obtained by subtracting a POC corresponding to a reference picture index i_y from the POC of the current picture, the reference picture index i_y is any reference picture index other than the reference picture index i_2 in the reference picture indices of the second reference picture list, and the POC corresponding to the reference picture index i_y is greater than the POC of the current picture; and

predicting the current block based on the first reference picture index and the second reference picture index, wherein the current picture comprises the current block.

2. The method according to claim 1, the method further comprises:

obtaining a first identifier, wherein a value of the first identifier is a first preset value, wherein when the value of the first identifier is the first preset value, the first identifier is used to indicate to determine the reference picture index i_1 of the first reference picture list as the first reference picture index that corresponds to the current block and that is of the first reference picture list, and determine the reference picture index i_2 of the second reference picture list as the second

reference picture index that corresponds to the current block and that is of the second reference picture list.

3. The method according to claim 2, wherein when the first identifier is the first preset value, the first identifier is further used to indicate to determine a second motion vector difference of the current block based on a first motion vector difference of the current block, and the method further comprises:

obtaining the first motion vector difference of the current block; and

obtaining the second motion vector difference of the current block based on the first motion vector difference according to the following formula:

$mvd_lY = -mvd_lX$, wherein

mvd_lY represents the second motion vector difference, mvd_lX represents the first motion vector difference, one of the first motion vector difference and the second motion vector difference corresponds to the first reference picture list, and the other one of the first motion vector difference and the second motion vector difference corresponds to the second reference picture list.

4. The method according to claim 3, wherein the method further comprises:

obtaining a first predicted motion vector and a second predicted motion vector;

determining a first motion vector based on the first predicted motion vector and the first motion vector difference; and

determining a second motion vector based on the second predicted motion vector and the second motion vector difference; and

the predicting the current block based on the first reference picture index and the second reference picture index comprises: predicting the current block based on the first reference picture index, the second reference picture index, the first reference picture list, the second reference picture list, the first motion vector, and the second motion vector.

5. A bi-directional inter prediction apparatus, wherein the apparatus comprises:

a determining unit, configured to: determine a reference picture index i_1 of a first reference picture list as a first reference picture index that corresponds to a current block and that is of the first reference picture list, wherein a POC corresponding to the reference picture index i_1 is less

than a POC of a current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_1 from the POC of the current picture is less than a difference obtained by subtracting a POC corresponding to a reference picture index i_x from the POC of the current picture, the reference picture index i_x is any reference picture index other than the reference picture index i_1 in reference picture indices of the first reference picture list, and the POC corresponding to the reference picture index i_x is less than the POC of the current picture; and

determine a reference picture index i_2 of a second reference picture list as a second reference picture index that corresponds to the current block and that is of the second reference picture list, wherein a POC corresponding to the reference picture index i_2 is greater than the POC of the current picture, a difference obtained by subtracting the POC corresponding to the reference picture index i_2 from the POC of the current picture is greater than a difference obtained by subtracting a POC corresponding to a reference picture index i_y from the POC of the current picture, the reference picture index i_y is any reference picture index other than the reference picture index i_2 in the reference picture indices of the second reference picture list, and the POC corresponding to the reference picture index i_y is greater than the POC of the current picture; and

an inter prediction processing unit, configured to predict the current block based on the first reference picture index and the second reference picture index, wherein the current picture comprises the current block.

6. The apparatus according to claim 5, the apparatus further comprises:

an obtaining unit, configured to obtain a first identifier, wherein a value of the first identifier is a first preset value, wherein

when the value of the first identifier is the first preset value, the first identifier is used to indicate to determine the reference picture index i_1 of the first reference picture list as the first reference picture index that corresponds to the current block and that is of the first reference picture list, and determine the reference picture index i_2 of the second reference picture list as the second reference picture index that corresponds to the current block and that is of the second reference picture list.

7. The apparatus according to claim 6, wherein when the first identifier is the first preset value, the first identifier is further used to indicate to determine a second motion vector difference of the

current block based on a first motion vector difference of the current block, and the obtaining unit is further configured to:

obtain the first motion vector difference of the current block; and

the determining unit is further configured to obtain the second motion vector difference of the current block based on the first motion vector difference according to the following formula:

$mvd_lY = -mvd_lX$, wherein

mvd_lY represents the second motion vector difference, mvd_lX represents the first motion vector difference, one of the first motion vector difference and the second motion vector difference corresponds to the first reference picture list, and the other one of the first motion vector difference and the second motion vector difference corresponds to the second reference picture list.

8. The apparatus according to claim 7, wherein the obtaining unit is further configured to:

obtain a first predicted motion vector and a second predicted motion vector;

the determining unit is further specifically configured to:

determine a first motion vector based on the first predicted motion vector and the first motion vector difference; and

determine a second motion vector based on the second predicted motion vector and the second motion vector difference; and

the inter prediction processing unit is specifically configured to predict the current block based on the first reference picture index, the second reference picture index, the first reference picture list, the second reference picture list, the first motion vector, and the second motion vector.

9. A video encoding device, comprising:

an inter prediction module, configured to perform the method according to any one of claims 1 to 4; and

a reconstruction module, configured to reconstruct a current block based on a predicted sample value obtained by the inter prediction module.

10. A video decoding device, comprising:

an inter prediction module, configured to perform the method according to any one of claims 1 to 4; and

a reconstruction module, configured to reconstruct a current block based on a predicted sample value obtained by the inter prediction module.

11. A video encoding device, comprising a non-volatile memory and a processor that are coupled to each other, wherein the processor invokes program code stored in the memory, to perform the method according to any one of claims 1 to 4.

12. A video decoding device, comprising a non-volatile memory and a processor that are coupled to each other, wherein the processor invokes program code stored in the memory, to perform the method according to any one of claims 1 to 4.

13. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program, and when the computer program is run on a processor, the method according to any one of claims 1 to 4 is implemented.

14. A terminal, wherein the terminal comprises one or more processors, a memory, and a communications interface; and

the memory and the communications interface are connected to the one or more processors, the terminal communicates with another device through the communications interface, the memory is configured to store computer program code, the computer program code comprises an instruction, and when the one or more processors execute the instruction, the terminal performs the bi-directional inter prediction method according to any one of claims 1 to 4.

15. A non-transitory storage medium comprising a bitstream encoded or decoded by the method to any one of claims 1 to 4.