

WHAT IS CLAIMED IS:

- 1                   1.       A decoder-side motion vector refinement method, the method comprising:  
2                   determining a target integer motion vector displacement by comparing integer  
3 distance costs corresponding to candidate integer motion vector displacements with respect to an  
4 initial motion vector;  
5                   determining a sub-pixel motion vector displacement by performing calculation on  
6 the integer distance costs; and  
7                   determining a refined motion vector based on the target integer motion vector  
8 displacement, the sub-pixel motion vector displacement and the initial motion vector.
  
- 1                   2.       The method of claim 1, wherein the sub-pixel motion vector displacement  
2 is determined by the following equations:  
3                    $x0 = (E(-1, 0) - E(1, 0)) / (2 \times (E(-1, 0) + E(1, 0) - 2 \times E(0, 0)))$ , and  
4                    $y0 = (E(0, -1) - E(0, 1)) / (2 \times (E(0, -1) + E(0, 1) - 2 \times E(0, 0)))$ ;  
5                   where x0 and y0 are coordinates associated with the sub-pixel motion vector  
6 displacement with respect to a center (0, 0), and E(-1, 0), E(1, 0), E(0, 0), E(0, -1) and E(0, 1) are  
7 the integer distance costs corresponding to candidate integer motion vector displacements (-1, 0),  
8 (1, 0), (0, 0), (0, -1) and (0, 1) with respect to the initial motion vector, respectively.
  
- 1                   3.       The method of claim 2, wherein x0 is determined by performing at least  
2 one of shift, comparison, and increment operation on E (-1, 0), E(1, 0) and E(0, 0).
  
- 1                   4.       The method of claim 2, wherein y0 is determined by performing at least  
2 one of shift, comparison, and increment operation on E(0, -1), E(0, 1) and E(0, 0).
  
- 1                   5.       The method of claim 1, wherein the sub-pixel motion vector displacement  
2 is bounded between -0.5 and +0.5 pixel.
  
- 1                   6.       The method of claim 1, further comprising, before determining the sub-  
2 pixel motion vector displacement:  
3                   determining whether a predetermined motion vector displacement comprises the  
4 target integer motion vector displacement;

5                   in the event that the predetermined motion vector displacement comprises the  
6 target integer motion vector displacement:  
7                   determining the sub-pixel motion vector displacement by performing calculation  
8 on the integer distance costs.

1                   7.       The method of claim 6, further comprising:  
2                   in the event that the predetermined motion vector displacement does not  
3 comprises the target integer motion vector displacement:  
4                   calculating a refined motion vector based on the target integer motion vector  
5 displacement and the initial motion vector.

1                   8.       The method of claim 1, wherein determining the target integer motion  
2 vector displacement comprising:  
3                   calculating an integer distance cost for each candidate integer motion vector  
4 displacement; and  
5                   selecting a candidate integer motion vector displacement corresponding to a  
6 lowest integer distance cost as the target integer motion vector displacement.

1                   9.       The method of claim 1, wherein the target integer motion vector  
2 displacement comprises a first motion vector displacement corresponding to a reference picture  
3 list L0, and a second motion vector displacement corresponding to a reference picture list L1, the  
4 method further comprising:  
5                   determining the first motion vector displacement by comparing integer costs  
6 corresponding to candidate integer motion vector displacements corresponding to the reference  
7 picture list L0; and  
8                   determining the second motion vector displacement by negating the first motion  
9 vector displacement.

1                   10.     An apparatus comprising:  
2                   an input for receiving encoded video data;  
3                   an entropy decoding unit configured to decode the received encoded video data to  
4 obtain decoded data; and  
5                   one or more processors coupled to the entropy decoding unit and configured to:

6                   determine a target integer motion vector displacement by comparing integer  
 7 distance costs corresponding to candidate integer motion vector displacements with respect to an  
 8 initial motion vector according to the decoded data;  
 9                   determine a sub-pixel motion vector displacement by performing calculation on  
 10 the integer distance costs; and  
 11                   determine a refined motion vector based on the target integer motion vector  
 12 displacement, the sub-pixel motion vector displacement and the initial motion vector.

1                   11.    The apparatus of claim 10, wherein the sub-pixel motion vector  
 2 displacement is determined by the following equations:  
 3                    $x_0 = (E(-1, 0) - E(1, 0)) / (2 \times (E(-1, 0) + E(1, 0) - 2 \times E(0, 0)))$ , and  
 4                    $y_0 = (E(0, -1) - E(0, 1)) / (2 \times (E(0, -1) + E(0, 1) - 2 \times E(0, 0)))$ ;  
 5                   where  $x_0$  and  $y_0$  are coordinates associated with the sub-pixel motion vector  
 6 displacement with respect to a center (0, 0), and  $E(-1, 0)$ ,  $E(1, 0)$ ,  $E(0, 0)$ ,  $E(0, -1)$  and  $E(0, 1)$  are  
 7 the integer distance costs corresponding to candidate integer motion vector displacements (-1, 0),  
 8 (1, 0), (0, 0), (0, -1) and (0, 1) with respect to the initial motion vector, respectively.

1                   12.    The apparatus of claim 11, wherein  $x_0$  is determined by performing at  
 2 least one of shift, comparison, and increment operation on  $E(-1, 0)$ ,  $E(1, 0)$  and  $E(0, 0)$ .

1                   13.    The apparatus of claim 11, wherein  $y_0$  is determined by performing at  
 2 least one of shift, comparison, and increment operation on  $E(0, -1)$ ,  $E(0, 1)$  and  $E(0, 0)$ .

1                   14.    The apparatus of claim 10, wherein the sub-pixel motion vector  
 2 displacement is bounded between -0.5 and +0.5 pixel.

1                   15.    The apparatus of claim 10, wherein the one or more processors are further  
 2 configured to, before determining the sub-pixel motion vector displacement:

3                   determine whether a predetermined motion vector displacement comprises the  
 4 target integer motion vector displacement;

5                   in the event that the predetermined motion vector displacement comprises the  
 6 target integer motion vector displacement:

7                   determine the sub-pixel motion vector displacement by performing calculation on  
8 the integer costs.

1                   16.     The apparatus of claim 15, wherein the one or more processors are further  
2 configured to:

3                   in the event that the predetermined motion vector displacement does not  
4 comprises the target integer motion vector displacement:

5                   calculate a refined motion vector based on the target integer motion vector  
6 displacement and the initial motion vector.

1                   17.     The apparatus of claim 10, wherein the one or more processors determine  
2 the target integer motion vector displacement by:

3                   calculating an integer distance cost for each candidate integer motion vector  
4 displacement; and

5                   selecting a candidate integer motion vector displacement corresponding to a  
6 lowest integer distance cost as the target integer motion vector displacement.

1                   18.     The apparatus of claim 10, wherein the target integer motion vector  
2 displacement comprises a first motion vector displacement corresponding to a reference picture  
3 list L0, and a second motion vector displacement corresponding to a reference picture list L1, the  
4 one or more processors are configured to:

5                   determine the first motion vector displacement by comparing integer costs  
6 corresponding to candidate integer motion vector displacements corresponding to the reference  
7 picture list L0; and

8                   determine the second motion vector displacement by negating the first motion  
9 vector displacement.

10                  19.     A computer-readable medium storing instructions which, when executed  
11 on a processor, perform the steps of a method according to any of claim 1-9.

1

1