CLAIMS

1. A method of decoding video data, the method comprising: receiving, by a video decoder, signaling information indicating merge mode is used for a portion of a current frame; based on merge mode being used, determining, by the video decoder, signaling information indicating refining of motion information should be performed by the video decoder for the portion of the current frame; decoding the portion of the current frame by: constructing, by a the video decoder implemented in processing circuitry, a candidate list of motion vector information for the portion of the current frame; receiving, by the video decoder, signaling information indicating starting first motion vector information of the candidate list of motion vector information, the starting first motion vector information indicating a first initial position in a first reference frame and starting second motion vector information indicating a motion trajectory extending between the first initial position of the first reference frame through the portion of the current frame to a second initial position of a second reference frame; refining, by the video decoder, based on one or more of bilateral matching or template matching, the starting first motion vector information to determine refined first motion vector information indicating a refined position in the first reference frame that is within a search range from the first initial position, and the starting second motion vector information to determine refined second motion vector information indicating a refined position in the second reference frame that is within a search range from the second initial position, wherein refining the starting first motion vector information comprises refining the motion trajectory and starting second motion vector information is based on a matching difference between the first initial position and the second initial position; generating, by the video decoder, a predictive block based on the refined first and second motion vector information; and decoding, by the video decoder, the portion of the current frame based on the predictive block.

2. The method of claim 1, wherein refining the starting first motion vector information and the starting second motion vector information comprises: determining, by the video decoder, a motion vector precision for the refined motion vector information that represents a precision of a refined motion vector indicated by the refined motion vector information.

3. A method of decoding video data, the method comprising: constructing, by a video decoder implemented in processing circuitry, a candidate list of motion vector information for a portion of a current frame, wherein the portion of the current frame is a current block of the current frame and wherein constructing the candidate list of motion vector information comprises:

calculating $mvd_{th} = 4 \ll mv_{precision}$ when $(W \cdot H < 64) ==> mvd_{th} = 4 \ll (mv_{precision} - 2)$ and $mvd_{th} = 4 \ll (mv_{precision} - 1)$ when $(W \cdot H < 256)$,

wherein $mv_{precision}$ represents the motion vector precision, W is a width of the current block, and H a height of the current block; receiving, by the video decoder, signaling information indicating starting motion vector information of the candidate list of motion vector information, the starting motion vector information indicating an initial position in a reference frame; refining, by the video decoder, based on one or more of bilateral matching or template matching, the starting

motion vector information to determine refined motion vector information indicating a refined position in the reference frame that is within a search range from the initial position; generating, by the video decoder, a predictive block based on the refined motion vector information; and decoding, by the video decoder, the current frame based on the predictive block.

4. The method of claim 1, wherein constructing the candidate list of motion vector information comprises: in response to determining that the portion of the current frame corresponds to a B-slice and a uni-predicted motion vector information is to be included in the candidate list of motion vector information, adding a bi-predicted motion vector information to the candidate list of motion vector information corresponding to the uni-predicted motion vector.

5. A method of decoding video data, the method comprising: constructing, by a video decoder implemented in processing circuitry, a candidate list of motion vector information for a portion of a current frame, wherein constructing the candidate list of motion vector information comprises: in response to determining that the portion of the current frame corresponds to a B-slice and uni-predicted motion vector information is to be included in the candidate list of motion vector information, adding bi-predicted motion vector information to the candidate list of motion vector information corresponding to the uni-predicted motion vector, wherein the uni-predicted motion vector information indicates a first motion vector and wherein adding the bi-predicted motion vector information to the candidate list of motion vector information comprises generating the bi-predicted motion vector information to indicate the first motion vector and a second motion vector corresponding to the first motion vector with an opposite sign; receiving, by the video decoder, signaling information indicating starting motion vector information of the candidate list of motion vector information, the starting motion vector information indicating an initial position in a reference frame; refining, by the video decoder, based on one or more of bilateral matching or template matching, the starting motion vector information to determine refined motion vector information indicating a refined position in the reference frame that is within a search range from the initial position; generating, by the video decoder, a predictive block based on the refined motion vector information; and decoding, by the video decoder, the current frame based on the predictive block.

6. A method of decoding video data, the method comprising: constructing, by a video decoder implemented in processing circuitry, a candidate list of motion vector information for a portion of a current frame, wherein constructing the candidate list of motion vector information comprises: in response to determining that the portion of the current frame corresponds to a B-slice and uni-predicted motion vector information is to be included in the candidate list of motion vector information, adding bi-predicted motion vector information to the candidate list of motion vector information corresponding to the uni-predicted motion vector; wherein the uni-predicted motion vector information indicates a first motion vector (MV0) for a first reference frame; wherein the bi-predicted motion vector information indicates the first motion vector and a second motion vector (MV1) for a second reference frame; and wherein adding the bi-predicted motion vector information comprises calculating

$$MV1 = \frac{POC0}{POC1} MV0,$$

wherein POC0 represents a temporal distance from the first reference frame to the current frame and POC1 represents a temporal distance from the second reference frame to the current frame; receiving, by the video decoder, signaling information indicating starting motion vector information of the candidate list of motion vector information, the starting motion vector information indicating an initial position in a reference frame; refining, by the video decoder, based on one or more of bilateral matching or template matching, the starting motion vector information to determine refined motion vector information indicating a refined position in the reference frame that is within a search range from the initial position; generating, by the video decoder, a predictive block based on the refined motion vector information; and decoding, by the video decoder, the current frame based on the predictive block.

7. The method of claim 1, wherein the starting first motion vector information and the starting second motion vector information indicates a motion trajectory extending between the first initial position of the first reference frame through the portion of the current frame to the second initial position of the second reference frame and refining the starting first motion vector information and the starting second motion vector information, and refining the motion vector trajectory comprises: modifying a first motion vector of the motion vector trajectory that specifies the first initial position by a motion vector refinement; and modifying a second motion vector of the motion vector trajectory that specifies the second initial position by the motion vector refinement with an opposite sign.

8. The method of claim 1, wherein refining the motion vector trajectory comprises: scaling the motion trajectory based on a temporal distance between the current frame and the first reference frame and a temporal distance between the current frame and the second reference frame.

9. The method of claim 1, wherein refining the motion vector trajectory comprises: refining a first motion vector of the motion vector trajectory that specifies the first initial position based on the matching difference between the first initial position and the second initial position to generate a first refined motion vector; and refining a second motion vector of the motion vector trajectory that specifies the second initial position based on the first refined motion vector.

10. The method of claim 1, wherein refining the motion trajectory comprises: determining the matching difference between the first initial position and the second initial position based a metric, wherein the metric comprises one or more of a Sum of Absolute Difference (SAD), a Mean-Removed SAD (MR-SAD), a Sum of Squared Difference (SSD), Normalized Cross-Correlation (NCC), or a Structural Similarity Index (SSIM).

11. The method of claim 10, wherein refining the motion trajectory comprises: selecting the metric from a plurality of metrics based on a size of the current block.

12. The method of claim 10, wherein refining the motion trajectory comprises: selecting the

metric as MR-SAD, NCC, or SSIM when the size of the current block exceeds a block size threshold; and selecting the metric as SAD or SSE when the size of the current block does not exceed a block size threshold.

13. The method of claim 1, wherein the portion of the current frame corresponds to a current block of the current frame, a current coding unit for the current frame, or a plurality of coding units for the current frame.

14. A device for decoding video data, the device comprising: a memory configured to store the video data; and processing circuitry configured to: receive signaling information indicating merge mode is used for a portion of a current frame, based on merge mode being used, determine signaling information indicating refining of motion information should be performed by the processing circuitry for the portion of the current frame, decode the portion of the current frame by: construct a candidate list of motion vector information for the portion of the current frame; receive signaling information indicating starting first motion vector information of the candidate list of motion vector information, the starting first motion vector information indicating a first initial position in a first reference frame and starting second motion vector information indicating second initial position of a second reference frame; refine, based on one or more of bilateral matching or template matching, the starting first motion vector information to determine refined first motion vector information indicating a refined position in the first reference frame that is within a search range from the first initial position, and the starting second motion vector information to determine refined second motion vector information indicating a refined position in the second reference frame that is within a search range from the second initial position, wherein, to refine the starting first motion vector information and starting second motion vector information is based on a matching difference between the first initial position and the second initial position; generate a predictive block based on the refined first and second motion vector information; and decode the portion of the current frame based on the predictive block.

15. The device of claim 14, wherein to refine the starting first motion vector information and the starting second motion vector information, the processing circuitry is configured to: determine a motion vector precision for the refined motion vector information that represents a precision of a refined motion vector indicated by the refined motion vector information.

16. A device for decoding video data, the device comprising: a memory configured to store the video data; and processing circuitry configured to: construct a candidate list of motion vector information for a portion of a current frame, wherein the portion of the current frame is a current block of the current frame and wherein, to construct the candidate list of motion vector information, the processing circuitry is configured to:

calculate $mvd_{th} = 4 \ll mv_{precision}$ when $(W \cdot H < 64) ==> \ mvd_{th} = 4 \ll \left(mv_{precision} - 2\right)$ and $mvd_{th} = 4 \ll (mv_{precision} - 1)$ when $(W \cdot H < 256)$,

wherein $mv_{precision}$ represents the motion vector precision, *W* is a width of the current block, and *H* a height of the current block; receive signaling information indicating starting motion vector

information of the candidate list of motion vector information, the starting motion vector information indicating an initial position in a reference frame; refine, based on one or more of bilateral matching or template matching, the starting motion vector information to determine refined motion vector information indicating a refined position in the reference frame that is within a search range from the initial position; generate a predictive block based on the refined motion vector information; and decode the current frame based on the predictive block.

17. The device of claim 14, wherein, to construct the candidate list of motion vector information, the processing circuitry is configured to: in response to determining that the portion of the current frame corresponds to a B-slice and a uni-predicted motion vector information is to be included in the candidate list of motion vector information, add a bi-predicted motion vector information to the candidate list of motion vector information corresponding to the uni-predicted motion vector.

18. A device for decoding video data, the device comprising: a memory configured to store the video data; and processing circuitry configured to: construct a candidate list of motion vector information for a portion of a current frame, wherein, to construct the candidate list of motion vector information, the processing circuitry is configured to: in response to determining that the portion of the current frame corresponds to a B-slice and a uni-predicted motion vector information is to be included in the candidate list of motion vector information, add a bi-predicted motion vector information to the candidate list of motion vector information corresponding to the uni-predicted motion vector, wherein the uni-predicted motion vector information indicates a first motion vector and wherein, to add the bi-predicted motion vector information to the candidate list of motion vector information, the processing circuitry is configured to generate the bi-predicted motion vector information to indicate the first motion vector and a second motion vector corresponding to the first motion vector with an opposite sign; receive signaling information indicating starting motion vector information of the candidate list of motion vector information, the starting motion vector information indicating an initial position in a reference frame; refine, based on one or more of bilateral matching or template matching, the starting motion vector information to determine refined motion vector information indicating a refined position in the reference frame that is within a search range from the initial position; generate a predictive block based on the refined motion vector information; and decode the current frame based on the predictive block.

19. A device for decoding video data, the device comprising: a memory configured to store the video data; and processing circuitry configured to: construct a candidate list of motion vector information for a portion of a current frame, wherein, to construct the candidate list of motion vector information, the processing circuitry is configured to: in response to determining that the portion of the current frame corresponds to a B-slice and a uni-predicted motion vector information is to be included in the candidate list of motion vector information, add a bi-predicted motion vector information to the candidate list of motion vector information corresponding to the uni-predicted motion vector, wherein the uni-predicted motion vector information indicates a first motion vector (MV0) for a first reference frame; wherein the bi-

predicted motion vector information indicates the first motion vector and a second motion vector (MV1) for a second reference frame; and wherein, to add the bi-predicted motion vector information, the processing circuitry is configured to calculate

$MV1 = \frac{POC0}{POC1} MV0$,

wherein POC0 represents a temporal distance from the first reference frame to the current frame and POC1 represents a temporal distance from the second reference frame to the current frame; receive signaling information indicating starting motion vector information of the candidate list of motion vector information, the starting motion vector information indicating an initial position in a reference frame; refine, based on one or more of bilateral matching or template matching, the starting motion vector information to determine refined motion vector information indicating a refined position in the reference frame that is within a search range from the initial position; generate a predictive block based on the refined motion vector information; and decode the current frame based on the predictive block.

20. The device of claim 14, wherein the starting first motion vector information and the starting second motion vector information indicates a motion trajectory extending between the first initial position of the first reference frame through the portion of the current frame to the second initial position of the second reference frame and information, and to refine the motion vector trajectory, the processing circuitry is configured to: modify a first motion vector of the motion vector trajectory that specifies the first initial position by a motion vector refinement; and modify a second motion vector of the motion vector trajectory that specifies the second initial position by the motion vector refinement with an opposite sign.

21. The device of claim 20, wherein, to refine the motion vector trajectory, the processing circuitry is configured to: scale the motion trajectory based on a temporal distance between the current frame and the first reference frame and a temporal distance between the current frame and the second reference frame.

22. The device of claim 20, wherein, to refine the motion vector trajectory, the processing circuitry is configured to: refine a first motion vector of the motion vector trajectory that specifies the first initial position based on the matching difference between the first initial position and the second initial position to generate a first refined motion vector; and refine a second motion vector of the motion vector trajectory that specifies the second initial position based on the first refined motion vector.

23. The device of claim 20, wherein, to refine the motion trajectory, the processing circuitry is configured to: determine the matching difference between the first initial position and the second initial position based a metric, wherein the metric comprises one or more of a Sum of Absolute Difference (SAD), a Mean-Removed SAD (MR-SAD), a Sum of Squared Difference (SSD), Normalized Cross-Correlation (NCC), or a Structural Similarity Index (SSIM).

24. The device of claim 23, wherein, to refine the motion trajectory, the processing circuitry is

configured to: select the metric from a plurality of metrics based on a size of the current block.

25. The device of claim 23, wherein, to refine the motion trajectory, the processing circuitry is configured to: select the metric as MR-SAD, NCC, or SSIM when the size of the current block exceeds a block size threshold; and select the metric as SAD or SSE when the size of the current block does not exceed a block size threshold.

26. The device of claim 14, wherein the portion of the current frame corresponds to a current block of the current frame, a current coding unit for the current frame, or a plurality of coding units for the current frame.

27. The device of claim 14, wherein the device comprises a wireless communication device, further comprising a receiver configured to receive encoded video data.

28. The device of claim 27, wherein the wireless communication device comprises a telephone handset and wherein the receiver is configured to demodulate, according to a wireless communication standard, a signal comprising the encoded video data.

29. A method of encoding video data, the method comprising: constructing, by a video encoder implemented in processing circuitry, a candidate list of motion vector information for a portion of a current frame; selecting, by the video encoder, starting first motion vector information of the candidate list of motion vector information, the starting first motion vector information indicating a first initial position in a first reference frame and a starting second motion vector information indicating a second initial position of a second reference frame; refining, by the video encoder, based on one or more of bilateral matching or template matching, the starting first motion vector information to determine refined first motion vector information indicating a refined position in the first reference frame that is within a search range from the first initial position, and the starting second motion vector information to determine refined second motion vector information indicating a refined position in the second reference frame that is within a search rang from the second initial position, wherein refining the starting first motion vector information and starting second motion vector information is based on a matching difference between the first initial position and the second initial position; generating, by the video encoder, a predictive block based on the refined first and second motion vector information; generating, by the video encoder, residual sample values for the portion of the current block of video data based on the predictive block; and outputting, by the video encoder, an indication of the residual sample values and signaling information indicating the starting motion vector information of the candidate list of motion vector information.

30. A device for encoding video data, the device comprising: a memory configured to store the video data; and processing circuitry configured to: construct a candidate list of motion vector information for a portion of a current frame; select starting first motion vector information of the candidate list of motion vector information, the starting first motion vector information indicating a first initial position in a first reference frame and starting second motion vector

information indicating a second initial position of a second reference frame; refine, based on one or more of bilateral matching or template matching, the starting first motion vector information to determine refined first motion vector information indicating a first refined position in the reference frame that is within a search range from the first initial position, and the starting second motion vector information to determine refined second motion vector information indicating a refined position in the second reference frame that is within a search range from the second initial position, wherein, the processing circuitry is configured to refine the starting first motion vector information and starting second motion vector information based on a matching difference between the first initial position and the second initial position; generate a predictive block based on the refined first and second motion vector information; generate residual sample values for the current block of video data based on the predictive block; and output an indication of the residual sample values and signaling information indicating the starting motion vector information of the candidate list of motion vector information.

31. The device of claim 30, wherein the device comprises a wireless communication device, further comprising a transmitter configured to transmit encoded video data.

32. The device of claim 31, wherein the wireless communication device comprises a telephone handset and wherein the transmitter is configured to modulate, according to a wireless communication standard, a signal comprising the encoded video data.