CLAIMS

1. A method of coding video data, the method comprising:

determining that a first codeword representing a selected transform scheme of a set of transform candidates of a multiple transform selection (MTS) scheme for a current block of video data has a value indicating that a discrete cosine transform 2 (DCT-2) primary transform is to be applied to the current block;

coding a second codeword representing a secondary transform from a set of available secondary transforms to be applied to the current block when the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block; and

applying the DCT-2 primary transform and the secondary transform during coding of residual data for the current block.

2. The method of claim 1, wherein the set of transform candidates includes:

1) a horizontal identity transform and a vertical identity transform;

2) a discrete cosine transform (DCT)-2 horizontal transform and a DCT-2 vertical transform;

3) a discrete sine transform (DST)-7 horizontal transform and a DST-7 vertical transform;

4) a DCT-8 horizontal transform and the DST-7 vertical transform;

5) the DST-7 horizontal transform and a DST-8 vertical transform;

6) a first non-separable transform; and

7) a second non-separable transform.

3. The method of claim 1, wherein the set of transform candidates includes:

1) a horizontal identity transform and a vertical identity transform;

2) a discrete cosine transform (DCT)-2 horizontal transform and a DCT-2 vertical transform;

3) a discrete sine transform (DST)-7 horizontal transform and a DST-7 vertical transform;

4) a DCT-8 horizontal transform and the DST-7 vertical transform;

5) the DST-7 horizontal transform and a DST-8 vertical transform; and

6) the secondary transform of the set of available secondary transforms.

4. The method of claim 1, wherein the set of transform candidates excludes a combination

of a discrete cosine transform (DCT)-8 horizontal transform and a DCT-8 vertical transform.

5. The method of claim 1, wherein codewords associated with the transform candidates comprise Huffman codes.

6. The method of claim 1, wherein determining that the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block comprises determining that the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block according to at least one of a prediction mode or a size of the current block.

7. The method of claim 6, further comprising selecting the MTS scheme from a set of MTS schemes each including at least one of different sets of transform candidates or different binarizations for the transform candidates according to at least one of the prediction mode or the size of the current block.

8. The method of claim 6, further comprising selecting the MTS scheme according to whether the prediction mode is an intra-prediction mode or an inter-prediction mode.

9. The method of claim 6, further comprising selecting the MTS scheme from a set of MTS schemes according to at least one of a shape of the current block or a size of the current block.

10. The method of claim 9, wherein the set of MTS schemes includes a first MTS scheme having a first number of transform candidates for a first size of blocks and a second MTS scheme having a second number of transform candidates for a second size of blocks, the second number being larger than the first number and the second size being larger than the first size.

11. The method of claim 6, wherein the size of the current block is defined according to at least one of a width of the current block or a height of the current block.

12. The method of claim 6, wherein a shape of the current block is defined as square or rectangular.

13. The method of claim 1, wherein the set of transform candidates includes one or more separable transform candidates and one or more non-separable transform candidates.

14. The method of claim 1, wherein the second codeword comprises a value for a low-frequency non-separable transform (LFNST) syntax element.

15. The method of claim 14, wherein the first codeword comprises an MTS syntax element.

16. The method of claim 1,

wherein coding the second codeword comprises decoding the second codeword; and

wherein applying the DCT-2 primary transform and the secondary transform comprises:

applying the secondary transform to decoded transform coefficients to produce intermediate transform coefficients; and

applying the DCT-2 primary transform to the intermediate transform coefficients to produce a residual block for the current block.

17. The method of claim 1,

wherein coding the second codeword comprises encoding the second codeword; and

wherein applying the DCT-2 primary transform and the secondary transform comprises:

applying the DCT-2 primary transform to a residual block for the current block to generate intermediate transform coefficients; and

applying the secondary transform to the intermediate transform coefficients.

18. A device for coding video data, the device comprising:

a memory configured to store video data; and

one or more processors implemented in circuitry and configured to:

determine that a first codeword representing a selected transform scheme of a set of transform candidates of a multiple transform selection (MTS) scheme for a current block of the video data has a value indicating that a discrete cosine transform 2 (DCT-2) primary transform is to be applied to the current block;

code a second codeword representing a secondary transform from a set of available secondary transforms to be applied to the current block when the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block; and

apply the DCT-2 primary transform and the secondary transform during coding of residual data for the current block.

19. The device of claim 18, wherein the set of transform candidates includes:

1) a horizontal identity transform and a vertical identity transform;

2) a discrete cosine transform (DCT)-2 horizontal transform and a DCT-2 vertical transform;

3) a discrete sine transform (DST)-7 horizontal transform and a DST-7 vertical transform;

4) a DCT-8 horizontal transform and the DST-7 vertical transform;

5) the DST-7 horizontal transform and a DST-8 vertical transform;

6) a first non-separable transform; and

7) a second non-separable transform.

20. The device of claim 18, wherein the set of transform candidates includes:

1) a horizontal identity transform and a vertical identity transform;

2) a discrete cosine transform (DCT)-2 horizontal transform and a DCT-2 vertical transform;

3) a discrete sine transform (DST)-7 horizontal transform and a DST-7 vertical transform;

4) a DCT-8 horizontal transform and the DST-7 vertical transform;

5) the DST-7 horizontal transform and a DST-8 vertical transform; and

6) the secondary transform of the set of available secondary transforms.

21. The device of claim 18, wherein the set of transform candidates excludes a combination of a discrete cosine transform (DCT)-8 horizontal transform and a DCT-8 vertical transform.

22. The device of claim 18, wherein the one or more processors are configured to determine that the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block according to at least one of a prediction mode or a size of the current block.

23. The device of claim 18 wherein the second codeword comprises a value for a low-frequency non-separable transform (LFNST) syntax element.

24. The device of claim 23, wherein the first codeword comprises an MTS syntax element.

25. The device of claim 18, wherein the device comprises a video decoder, and wherein the one or more processors are configured to:

decode the second codeword;

apply the secondary transform to decoded transform coefficients to produce intermediate transform coefficients; and

apply the DCT-2 primary transform to the intermediate transform coefficients to produce a residual block for the current block.

26. The device of claim 18, wherein the device comprises a video encoder, and wherein the one or more processors are configured to:

encode the second codeword;

apply the DCT-2 primary transform to a residual block for the current block to generate intermediate transform coefficients; and

apply the secondary transform to the intermediate transform coefficients.

27. The device of claim 18, further comprising a display configured to display decoded video data.

28. The device of claim 18, wherein the device comprises one or more of a camera, a computer, a mobile device, a broadcast receiver device, or a set-top box.

29. The device of claim 18, wherein the device comprises at least one of:

an integrated circuit;

a microprocessor; or

a wireless communication device.

30. A device for coding video data, the device comprising:

means for determining that a first codeword representing a selected transform scheme of a set of transform candidates of a multiple transform selection (MTS) scheme for a current block of video data has a value indicating that a discrete cosine transform 2 (DCT-2) primary transform is to be applied to the current block;

means for coding a second codeword representing a secondary transform from a set of available secondary transforms to be applied to the current block when the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block; and

means for applying the DCT-2 primary transform and the secondary transform during coding of residual data for the current block.

31. The device of claim 30, wherein the second codeword comprises a value for a low-frequency non-separable transform (LFNST) syntax element.

32. The device of claim 30, wherein the device comprises a video decoder;

wherein the means for coding the second codeword comprises means for decoding the second codeword; and

wherein the means for applying the DCT-2 primary transform and the secondary transform comprises:

means for applying the secondary transform to decoded transform coefficients to produce intermediate transform coefficients; and

means for applying the DCT-2 primary transform to the intermediate transform coefficients to produce a residual block for the current block.

33. A non-transitory computer-readable storage medium having stored thereon instructions that, when executed, cause a processor of a device for coding video data to:

determine that a first codeword representing a selected transform scheme of a set of transform candidates of a multiple transform selection (MTS) scheme for a current block of video data has a value indicating that a discrete cosine transform 2 (DCT-2) primary transform is to be applied to the current block;

code a second codeword representing a secondary transform from a set of available secondary transforms when the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block; and

apply the DCT-2 primary transform and the secondary transform during coding of residual data for the current block.

34. The non-transitory computer-readable storage medium of claim 33, wherein the second codeword comprises a value for a low-frequency non-separable transform (LFNST) syntax element.

35. The non-transitory computer-readable storage medium of claim 33,

wherein the instructions that cause the processor to code the second codeword comprise instructions that cause the processor to decode the second codeword; and

wherein the instructions that cause the processor to apply the DCT-2 primary transform

and the secondary transform comprise instructions that cause the processor to:

apply the secondary transform to decoded transform coefficients to produce intermediate transform coefficients; and

apply the DCT-2 primary transform to the intermediate transform coefficients to produce a residual block for the current block.

36. The method of claim 1, wherein determining that the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block comprises determining that the first codeword has a value of zero.

37. The device of claim 18, wherein, to determine that the first codeword has the value indicating that the DCT -2 primary transform is to be applied to the current block, the one or more processors are configured to determine that the first codeword has a value of zero.

38. The device of claim 30, wherein the means for determining that the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block comprises means for determining that the first codeword has a value of zero.

39. The computer-readable storage medium of claim 33, wherein the instructions that cause the processor to determine that the first codeword has the value indicating that the DCT-2 primary transform is to be applied to the current block comprise instructions that cause the processor to determine that the first codeword has a value of zero.