Amended Set of Claims 1 to 40

1. A method of coding transform coefficients associated with residual video data in a video coding process, the method comprising:

arranging a block of transform coefficients into one or more sub-sets of transform coefficients based on a scan order;

coding a first portion of levels of transform coefficients in each sub-set, wherein the first portion of levels includes at least a significance of the transform coefficients in each subset; and

coding a second portion of levels of transform coefficients in each sub-set, wherein coding the first portion of levels of transform coefficients comprises coding the significance of transform coefficients in each sub-set according to the scan order, and wherein coding the second portion of levels of transform coefficients levels comprises coding levels of transform coefficients in each sub-set according to the scan order,

wherein the scan order includes both a scan pattern and a scan direction.

2. The method of claim 1, wherein arranging a block of transform coefficients comprises arranging the block of transform coefficients into a single set of transform coefficients corresponding to an entire transform unit.

3. The method of claim 1, wherein arranging a block of transform coefficients comprises arranging the block of transform coefficients into a plurality of sub-sets of transform coefficients.

4. The method of claim 1, wherein the coding steps use context adaptive binary arithmetic coding (CABAC).

5. The method of claim 1, wherein coding the first portion of levels of transform coefficients comprises coding significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set, and wherein coding the second portion of levels of transform coefficients comprises coding levels of transform coefficients in each sub-set in at least a second scan of transform coefficients in the respective sub-set.

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6. The method of claim 1, wherein coding the first portion of levels of transform coefficients comprises coding significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set, and wherein coding the second portion of levels of transform coefficients comprises:

coding bin one of the levels of transform coefficients in each sub-set in a second scan of transform coefficients in the respective sub-set;

coding remaining bins of the levels of transform coefficients in each sub-set in a third scan of transform coefficients in the respective sub-set; and

coding a sign of the levels of transform coefficients in each sub-set in a fourth scan of transform coefficients in the respective sub-set.

7. The method of claim 6, further comprising coding the sign of the levels of transform coefficients before coding the remaining bins of the levels of transform coefficients.

8. The method of claim 1, wherein coding the first portion of levels of transform coefficients comprises coding significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set, and wherein coding the second portion of levels of transform coefficients comprises:

coding bin one of the levels of transform coefficients in each sub-set in a second scan of transform coefficients in the respective sub-set;

coding bin two of the levels of transform coefficients in each sub-set in a third scan of transform coefficients in the respective sub-set;

coding a sign of the levels of transform coefficients in each sub-set in a fourth scan of transform coefficients in the respective sub-set; and

coding remaining bins of the levels of transform coefficients in each sub-set in a fifth scan of transform coefficients in the respective sub-set.

9. The method of claim 8, wherein the first, second, third, fourth, and fifth scans are performed in any order.

10. The method of claim 1, wherein coding the first portion of levels of transform coefficients comprises coding levels in a regular mode of context adaptive binary

arithmetic coding (CABAC), and wherein coding the second portion of levels of transform coefficients comprises coding levels in a bypass mode of CABAC.

11. A system for coding transform coefficients associated with residual video data in a video coding process, the system comprising:

a video coding processor configured to arrange a block of transform coefficients into one or more sub-sets of transform coefficients based on a scan order, code a first portion of levels of transform coefficients in each sub-set, wherein the first portion of levels includes at least a significance of the transform coefficients in each subset, and code a second portion of levels of transform coefficients in each sub-set, wherein the video coding processor is configured to code the significance of transform coefficients in each sub-set according to the scan order, and wherein the video coding unit is configured to code levels of transform coefficients in each sub-set according to the scan order,

wherein the scan order includes both a scan pattern and a scan direction.

12. The system of claim 11, wherein the video coding processor is configured to arrange the block of transform coefficients into a single set of transform coefficients corresponding to an entire transform unit.

13. The system of claim 1, wherein the video coding processor is configured to arrange the block of transform coefficients into a plurality of sub-sets of transform coefficients.

14. The system of claim 11, wherein the video coding processor is configured to code the first portion and the second portion using context adaptive binary arithmetic coding (CABAC).

15. The system of claim 11, wherein the video coding processor is configured to code significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set, and wherein the video coding unit is configured to code levels of transform coefficients in each sub-set in at least a second scan of transform coefficients in the respective sub-set.

16. The system of claim 11, wherein the video coding processor is configured to:

code significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set;

code bin one of the levels of transform coefficients in each sub-set in a second scan of transform coefficients in the respective sub-set;

code remaining bins of the levels of transform coefficients in each sub-set in a third scan of transform coefficients in the respective sub-set; and

code a sign of the levels of transform coefficients in each sub-set in a fourth scan of transform coefficients in the respective sub-set.

17. The system of claim 16, wherein the video coding processor is configured to code the sign of the levels of transform coefficients before coding the remaining bins of the levels of transform coefficients.

18. The system of claim 11, wherein the video coding processor is further configured to:

code a significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set;

code bin one of the levels of transform coefficients in each sub-set in a second scan of transform coefficients in the respective sub-set;

code bin two of the levels of transform coefficients in each sub-set in a third scan of transform coefficients in the respective sub-set;

code a sign of the levels of transform coefficients in each sub-set in a fourth scan of transform coefficients in the respective sub-set; and

code remaining bins of the levels of transform coefficients in each sub-set in a fifth scan of transform coefficients in the respective sub-set.

19. The system of claim 18, wherein the first, second, third, fourth, and fifth scans are performed in any order.

20. The system of claim 11, wherein the video coding processor is further configured to code the first portion of levels of transform coefficients in a regular mode of context adaptive binary arithmetic coding (CABAC), and wherein the video coding

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unit is further configured to code the second portion of levels of transform coefficients in a bypass mode of CABAC.

21. A system for coding transform coefficients associated with residual video data in a video coding process, the system comprising:

means for arranging a block of transform coefficients into one or more sub-sets of transform coefficients based on a scan order;

means for coding a first portion of levels of transform coefficients in each sub-set, wherein the first portion of levels includes at least a significance of the transform coefficients in each subset; and

means for coding a second portion of levels of transform coefficients in each sub-set,

wherein the means for coding the first portion of levels of transform coefficients comprises means for coding the significance of transform coefficients in each sub-set according to the scan order, and wherein the means for coding the second portion of levels of transform coefficients levels comprises means for coding levels of transform coefficients in each sub-set according to the scan order,

wherein the scan order includes both a scan pattern and a scan direction.

22. The system of claim 21, wherein the means for arranging a block of transform coefficients comprises means for arranging the block of transform coefficients into a single set of transform coefficients corresponding to an entire transform unit.

23. The system of claim 21, wherein the means for arranging a block of transform coefficients comprises means for arranging the block of transform coefficients into a plurality of sub-sets of transform coefficients.

24. The system of claim 21, wherein the means for coding the first portion and the means for coding the second portion use context adaptive binary arithmetic coding (CABAC).

25. The system of claim 21, wherein the means for coding the first portion of levels of transform coefficients comprises means for coding significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-

set, and wherein the means for coding the second portion of levels of transform coefficients comprises means for coding levels of transform coefficients in each sub-set in at least a second scan of transform coefficients in the respective sub-set.

26. The system of claim 21, wherein the means for coding the first portion of levels of transform coefficients comprises means for coding significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set, and wherein the means for coding the second portion of levels of transform coefficients comprises:

means for coding bin one of the levels of transform coefficients in each sub-set in a second scan of transform coefficients in the respective sub-set;

means for coding remaining bins of the levels of transform coefficients in each sub-set in a third scan of transform coefficients in the respective sub-set; and

means for coding a sign of the levels of transform coefficients in each sub-set in a fourth scan of transform coefficients in the respective sub-set.

27. The system of claim 26, further comprising means for coding the sign of the levels of transform coefficients before coding the remaining bins of the levels of transform coefficients.

28. The system of claim 21, wherein the means for coding the first portion of levels of transform coefficients comprises means for coding significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set, and wherein the means for coding the second portion of levels of transform coefficients comprises:

means for coding bin one of the levels of transform coefficients in each sub-set in a second scan of transform coefficients in the respective sub-set;

means for coding bin two of the levels of transform coefficients in each sub-set in a third scan of transform coefficients in the respective sub-set;

means for coding a sign of the levels of transform coefficients in each sub-set in a fourth scan of transform coefficients in the respective sub-set; and

means for coding remaining bins of the levels of transform coefficients in each sub-set in a fifth scan of transform coefficients in the respective sub-set.

29. The system of claim 28, wherein the first, second, third, fourth, and fifth scans are performed in any order.

30. The system of claim 21, wherein the means for coding the first portion of levels of transform coefficients comprises means for coding levels in a regular mode of context adaptive binary arithmetic coding (CABAC), and wherein the means for coding the second portion of levels of transform coefficients comprises means for coding levels in a bypass mode of CABAC.

31. A computer program product comprising a computer-readable storage medium having stored thereon instructions that, when executed, cause a processor of a device for coding transform coefficients associated with residual video data in a video coding process to:

arrange a block of transform coefficients into one or more sub-sets of transform coefficients based on a scan order;

code a first portion of levels of transform coefficients in each sub-set, wherein the first portion of levels includes at least a significance of the transform coefficients in each subset; and

code a second portion of levels of transform coefficients in each sub-set,

wherein the instructions further cause the processor to code the significance of transform coefficients in each sub-set according to the scan order, and to code levels of transform coefficients in each sub-set according to the scan order,

wherein the scan order includes both a scan pattern and a scan direction.

32. The computer program product of claim 31, further causing a processor to arrange the block of transform coefficients into a single set of transform coefficients corresponding to an entire transform unit.

33. The computer program product of claim 31, further causing a processor to arrange the block of transform coefficients into a plurality of sub-sets of transform coefficients.

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34. The computer program product of claim 31, wherein the processor is configured to code the first portion and to code the second portion using context adaptive binary arithmetic coding (CABAC).

35. The computer program product of claim 31, further causing a processor to code significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set, and to code levels of transform coefficients in each sub-set in at least a second scan of transform coefficients in the respective sub-set.

36. The computer program product of claim 31, further causing a processor to:

code significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set;

code bin one of the levels of transform coefficients in each sub-set in a second scan of transform coefficients in the respective sub-set;

code remaining bins of the levels of transform coefficients in each sub-set in a third scan of transform coefficients in the respective sub-set; and

code a sign of the levels of transform coefficients in each sub-set in a fourth scan of transform coefficients in the respective sub-set.

37. The computer program product of claim 36, further causing a processor to code the sign of the levels of transform coefficients before coding the remaining bins of the levels of transform coefficients.

38. The computer program product of claim 31, further causing a processor to:

code a significance of transform coefficients in each sub-set in a first scan of transform coefficients in the respective sub-set;

code bin one of the levels of transform coefficients in each sub-set in a second scan of transform coefficients in the respective sub-set;

code bin two of the levels of transform coefficients in each sub-set in a third scan of transform coefficients in the respective sub-set;

code a sign of the levels of transform coefficients in each sub-set in a fourth scan of transform coefficients in the respective sub-set; and

code remaining bins of the levels of transform coefficients in each sub-set in a fifth scan of transform coefficients in the respective sub-set.

39. The computer program product of claim 38, wherein the first, second, third, fourth, and fifth scans are performed in any order.

40. The computer program product of claim 31, further causing a processor to:

code the first portion of levels of transform coefficients in a regular mode of context adaptive binary arithmetic coding (CABAC); and code the second portion of levels of transform coefficients in a bypass mode of CABAC.

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CLAIMS

1. A method of coding transform coefficients associated with residual video data in a process of coding a predicted video block, the method comprising:

arranging a block of transform coefficients into one or more sub-sets of transform coefficients;

coding a position of a last significant coefficient in each sub-set;

coding a significance of transform coefficients in each sub-set according to a scan order, wherein the scan order includes both a scan pattern and a scan direction, wherein the scan direction is an inverse scan direction, and wherein the scan order starts at the position of the last significant coefficient in each sub-set; and

coding levels of transform coefficients in each sub-set according to the scan order with the inverse scan direction.

2. The method of claim 1, wherein the process of coding the predicted video block is a video decoding process, wherein coding the significance of the transform coefficients in each sub-set comprises decoding the significance of the transform coefficients in each sub-set, wherein coding the levels of the transform coefficients in each sub-set comprises decoding the levels of the transform coefficients in each sub-set, and wherein the method further comprises:

inverse transforming the block of transform coefficients to produce a block of residual video data;

performing a prediction process to produce predicted video data; and

decoding the predicted video block based on the predicted video data and the block of residual data.

3. The method of claim **1**, wherein the process of coding the predicted video block is a video encoding process, wherein coding the significance of the transform coefficients in each sub-set comprises encoding the significance of the transform coefficients in each sub-set, wherein coding the levels of the transform coefficients in each sub-set comprises encoding the levels of the transform coefficients in each sub-set, and wherein the method further comprises:

performing a prediction process for the predicted video block to produce predicted video data;

generating a block of residual video based on the predicted video data; and

transforming the block of residual video data to produce the block of transform coefficients.

4. The method of claim **1**, wherein arranging the block of transform coefficients comprises arranging the block of transform coefficients into a single set of transform coefficients corresponding to an entire transform unit.

5. The method of claim **1**, wherein coding the significance of the transform coefficients and coding the levels of the transform coefficients uses context adaptive binary arithmetic coding (CABAC).

6. The method of claim **1**, wherein coding the significance of the transform coefficients comprises coding the significance of the transform coefficients in each sub-set in a first scan of the transform coefficients in the respective sub-set, and wherein coding the levels of the transform coefficients comprises coding the levels of the transform coefficients in each sub-set in at least a second scan of the transform coefficients in the respective sub-set.

7. The method of claim **1**, wherein coding the significance of the transform coefficients comprises coding the significance of the transform coefficients in each sub-set in a first scan of the transform coefficients in the respective sub-set, and wherein coding the levels of the transform coefficients comprises:

coding bin one of the levels of the transform coefficients in each sub-set in a second scan of the transform coefficients in the respective sub-set;

coding at least some remaining bins of the levels of the transform coefficients in each sub-set in a third scan of the transform coefficients in the respective sub-set; and

coding a sign of the levels of the transform coefficients in each sub-set in a fourth scan of the transform coefficients in the respective sub-set.

8. The method of claim **7**, further comprising coding the sign of the levels of the transform coefficients before coding the remaining bins of the levels of the transform coefficients.

9. The method of claim **1**, wherein coding the significance of the transform coefficients comprises coding the significance of the transform coefficients in each sub-set in a first scan of the transform coefficients in the respective sub-set, and wherein coding the levels of the transform coefficients comprises:

coding bin one of the levels of the transform coefficients in each sub-set in a second scan of the transform coefficients in the respective sub-set;

coding bin two of the levels of the transform coefficients in each sub-set in a third scan of the transform coefficients in the respective sub-set;

coding a sign of the levels of the transform coefficients in each sub-set in a fourth scan of the transform coefficients in the respective sub-set; and

coding at least some remaining bins of the levels of the transform coefficients in each sub-set in a fifth scan of the transform coefficients in the respective sub-set.

10. An apparatus for coding transform coefficients associated with residual video data of a predicted video block, the apparatus comprising:

a memory configured to store video data; and

a video coder in communication with the memory and configured to:

arrange a block of transform coefficients into one or more sub-sets of transform coefficients,

code a position of a last significant coefficient in each sub-set,

code a significance of transform coefficients in each sub-set according to a scan order, wherein the scan order includes both a scan pattern and a scan direction, wherein the scan direction is an inverse scan direction, and wherein the scan order starts at the position of the last significant coefficient in each sub-set, and

code levels of transform coefficients in each sub-set according to the scan order with the inverse scan direction.

11. The apparatus of claim **10**, wherein the video coder is configured to decode the predicted video block, and wherein the video coder is further configured to:

inverse transform the block of transform coefficients to produce a block of residual video data;

perform a prediction process to produce predicted video data; and

decode the predicted video block based on the predicted video data and the block of residual data.

12. The apparatus of claim **10**, wherein the video coder is configured to encode the predicted video block, and wherein the video coder is further configured to:

perform a prediction process for the predicted video block to produce predicted video data;

generate a block of residual video based on the predicted video data; and

transform the block of residual video data to produce the block of transform coefficients.

13. The apparatus of claim **10**, wherein the video coder is configured to arrange the block of transform coefficients into a single set of transform coefficients corresponding to an entire transform unit.

14. The apparatus of claim **10**, wherein the video coder is configured to code the significance and the levels using context adaptive binary arithmetic coding (CABAC).

15. The apparatus of claim **10**, wherein the video coder is configured to code the significance of the transform coefficients in each sub-set in a first scan of the transform coefficients in the respective sub-set, and wherein the video coder is configured to code the levels of the transform coefficients in each sub-set in at least a second scan of the transform coefficients in the respective sub-set.

16. The apparatus of claim **10**, wherein the video coder is configured to:

code the significance of the transform coefficients in each sub-set in a first scan of the transform coefficients in the respective sub-set;

code bin one of the levels of the transform coefficients in each sub-set in a second scan of the transform coefficients in the respective sub-set;

code at least some remaining bins of the levels of the transform coefficients in each sub-set in a third scan of the transform coefficients in the respective sub-set; and

code a sign of the levels of the transform coefficients in each sub-set in a fourth scan of the transform coefficients in the respective sub-set.

17. The apparatus of claim **16**, wherein the video coder is configured to code the sign of the levels of the transform coefficients before coding the remaining bins of the levels of the transform coefficients.

18. The apparatus of claim **10**, wherein the video coder is further configured to:

code the significance of the transform coefficients in each sub-set in a first scan of the transform coefficients in the respective sub-set;

code bin one of the levels of the transform coefficients in each sub-set in a second scan of the transform coefficients in the respective sub-set;

code bin two of the levels of the transform coefficients in each sub-set in a third scan of the transform coefficients in the respective sub-set;

code a sign of the levels of the transform coefficients in each sub-set in a fourth scan of the transform coefficients in the respective sub-set; and

code at least some remaining bins of the levels of the transform coefficients in each sub-set in a fifth scan of the transform coefficients in the respective sub-set.

19. A non-transitory computer-readable storage medium having stored thereon instructions that, when executed, cause one or more processors of a device for coding transform coefficients associated with residual video data in a video decoding process to:

arrange a block of transform coefficients into one or more sub-sets of transform coefficients;

decode a position of a last significant coefficient in each sub-set;

decode a significance of transform coefficients in each sub-set according to a scan order, wherein the scan order includes both a scan pattern and a scan direction, wherein the scan direction is an inverse scan direction, and wherein the scan order starts at the position of the last significant coefficient in each sub-set;

decode levels of transform coefficients in each sub-set according to the scan order with the inverse scan direction;

inverse transform the block of transform coefficients to produce residual video data;

perform a prediction process to produce predicted video data; and

decode the block of data based on the predicted video data and the residual video data.

20. The non-transitory computer-readable storage medium of claim **19**, further comprising instructions to cause the one or more processors to:

decode the significance of the transform coefficients in each sub-set in a first scan of the transform coefficients in the respective sub-set;

decode bin one of the levels of the transform coefficients in each sub-set in a second scan of the transform coefficients in the respective sub-set;

decode at least some remaining bins of the levels of the transform coefficients in each sub-set in a third scan of the transform coefficients in the respective sub-set; and

decode a sign of the levels of the transform coefficients in each sub-set in a fourth scan of the transform coefficients in the respective sub-set.