

Amended Set of Claims 1 to 48

1. A method for encoding video data, the method comprising:
generating a bitstream that includes data that represent a residual quad tree (RQT) for a coding unit (CU), the CU being larger than a maximum-allowable transform unit (TU) size, the RQT including a hierarchy of nodes, wherein a root node of the RQT corresponds to the CU as a whole and leaf nodes of the RQT correspond to TUs of the CU,
wherein the bitstream includes a coded block flag (CBF) of the root node, the CBF indicating whether any of the TUs of the CU are associated with a significant chroma coefficient block that is based on samples of a particular chroma component;
and
outputting the bitstream.
2. The method of claim 1, wherein the root node is associated with a Y CBF that indicates whether any of the TUs of the CU are associated with a significant luma coefficient block.
3. The method of claim 1, wherein:
the root node is associated with a flag,
if the flag has a first value, at least one of the TUs of the CU is associated with a significant coefficient block, and
if the flag has a second value that is different than the first value, none of the TUs of the CU is associated with a significant coefficient block, and no node in the RQT is associated with a Y CBF, a U CBF, or a V CBF.
4. The method of claim 1, wherein for each respective node in the RQT:
if a Y CBF of the respective node, a U CBF of the respective node, and a V CBF of the respective node all have a first value, the respective node is not associated with a split flag, the split flag indicating whether the respective node has a plurality of child

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nodes,

if at least one of the Y CBF of the respective node, U CBF of the respective node, and the V CBF of the respective node has a second value that is different than the first value, the respective node is associated with the split flag,

wherein the Y CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant Y coefficient block,

wherein the U CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant U coefficient block, and

wherein the V CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant V coefficient block.

5. The method of claim 1, further comprising:

selecting, based at least in part on a CBF of a node of the RQT, a coding context; and

performing, based on the selected coding context, context-adaptive binary arithmetic coding (CABAC) encoding on a split flag of the node, the split flag indicating whether the node has a plurality of child nodes.

6. The method of claim 5, wherein selecting the coding context comprises selecting, based on a Y CBF of the node, a U CBF of the node, and a V CBF of the node, the coding context.

7. The method of claim 1, further comprising performing, based at least in part on a same coding context, CABAC encoding on a Y CBF, a U CBF, and a V CBF of a node in the RQT.

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8. The method of claim 1, wherein a non-leaf node of the RQT is associated with a split flag, a Y CBF, a U CBF, and a V CBF, the split flag indicating that the non-leaf node has a plurality of descendant nodes, the Y CBF indicating whether any of the descendant nodes is associated with a significant luma coefficient block, the U CBF indicating whether any of the descendant nodes is associated with a significant U coefficient block, the V CBF indicating whether any of the descendant nodes is associated with a significant V coefficient block.

9. The method of claim 1, further comprising:

selecting, based on depths of nodes of the RQT, coding contexts for Y, U, and V CBFs specified by the nodes of the RQT; and

performing, based on the coding contexts selected for the Y, U, and V CBFs, entropy encoding operations on the Y, U, and V CBFs.

10. The method of claim 9, wherein selecting the coding contexts comprises selecting a coding context for a CBF, wherein an index value of the coding context is equal to a depth of a node in the RQT that specifies the CBF.

11. The method of claim 1, wherein, for each respective node in the RQT:

the respective node does not include a U CBF unless the respective node is the root node or a U CBF of a parent node of the respective node indicates that a descendant node of the parent node is associated with a significant U chroma block; and

the respective node does not include a V CBF unless the respective node is the root node or a V CBF of the parent node of the respective node indicates that a descendant node of the parent node is associated with a significant V chroma block.

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12. A method for decoding video data, the method comprising:
parsing, from a bitstream that includes an encoded representation of the video data, a coded block flag (CBF) of a root node of a residual quad tree (RQT) of a coding unit (CU), wherein a pixel block of the CU is larger than a maximum-allowable transform unit (TU) size; and
if the CBF has a first value, parsing, from the bitstream, a chroma coefficient block associated with a leaf node of the RQT, wherein if the CBF has a second value that is different than the first value, the chroma coefficient block associated with the leaf node is not parsed from the bitstream.
13. The method of claim 12, wherein method further comprises parsing, from the bitstream, a Y CBF of the root node, the Y CBF of the root node indicating whether any leaf node of the RQT is associated with a significant luma coefficient block.
14. The method of claim 12, wherein the method further comprises parsing, from the bitstream, a flag of the root node, the flag indicating whether there is a leaf node of the RQT that is associated with a significant coefficient block, wherein if the flag indicates that no leaf node of the RQT is associated with a significant coefficient block, no node in the RQT is associated with a CBF.

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15. The method of claim 12, further comprising:
making, based on a Y CBF of a node of the RQT, a U CBF of the node, and a V CBF of the node, a determination to parse a split flag of a node of the RQT; and
in response to making the determination, determining, based on the split flag of the node, whether to parse from the bitstream a plurality of child nodes of the node,
wherein the Y CBF indicates whether the node or any descendant node of the node is associated with a significant Y coefficient block, the U CBF indicates whether the node or any descendant node of the node is associated with a significant U coefficient block, and the V CBF indicates whether the node or any descendant node of the node is associated with a significant V coefficient block.
16. The method of claim 12, wherein the method further comprises:
selecting, based on a CBF of a node of the RQT, a coding context; and
performing, based on the selected coding context, context-adaptive binary arithmetic coding (CABAC) decoding on a split flag of the node, the split flag indicating whether the node has a plurality of child nodes.
17. The method of claim 16, wherein selecting the coding context comprises selecting, based on a Y CBF of the node, a U CBF of the node, and a V CBF of the node, the coding context.
18. The method of claim 12, further comprising performing, based on a same coding context, CABAC decoding on a Y CBF, a U CBF, and a V CBF of a node of the RQT.

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19. The method of claim 12, wherein a non-leaf node of the RQT includes a split flag, a Y CBF, a U CBF, and a V CBF, the split flag indicating that the non-leaf node has a plurality of descendant nodes, the Y CBF indicating whether any of the descendant nodes is associated with a significant luma coefficient block, the U CBF indicating whether any of the descendant nodes is associated with a significant U coefficient block, the V CBF indicating whether any of the descendant nodes is associated with a significant V coefficient block.

20. The method of claim 12, further comprising:
selecting, based on depths of nodes of the RQT, coding contexts for Y, U, and V CBFs specified by the nodes of the RQT; and
performing, based on the coding contexts selected for the Y, U, and V CBFs, entropy decoding operations on the Y, U, and V CBFs.

21. The method of claim 20, wherein selecting the coding contexts comprises selecting a coding context for a CBF, wherein an index value of the coding context is equal to a depth of a node of the RQT that specifies the CBF.

22. The method of claim 12, wherein, for each respective node in the RQT:
the respective node does not include a U CBF unless the respective node is the root node or a U CBF of a parent node of the respective node indicates that a descendant node of the parent node is associated with a significant U chroma block; and
the respective node does not include a V CBF unless the respective node is the root node or a V CBF of the parent node of the respective node indicates that a descendant node of the parent node is associated with a significant V chroma block.

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23. A video encoding device that encodes video data, the video encoding device comprising one or more processors configured to generate a bitstream that includes data that represents a residual quad tree (RQT) for a coding unit (CU), the CU being larger than a maximum-allowable transform unit (TU) size, the RQT including a hierarchy of nodes, wherein a root node of the RQT corresponds to the CU as a whole and leaf nodes of the RQT correspond to TUs of the CU,

wherein the bitstream includes a coded block flag (CBF) of the root node, the CBF indicating whether any of the TUs of the CU are associated with a significant chroma coefficient block that is based on samples of a particular chroma component.

24. The video encoding device of claim 23, wherein the root node is associated with a Y CBF, the Y CBF indicating whether any of the TUs of the CU are associated with a significant luma coefficient block.

25. The video encoding device of claim 23, wherein:

the root node is associated with a flag,

if the flag has a first value, at least one of the TUs of the CU is associated with a significant coefficient block, and

if the flag has a second value that is different than the first value, none of the TUs of the CU is associated with a significant coefficient block, and no node in the RQT is associated with a Y CBF, a U CBF, or a V CBF.

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26. The video encoding device of claim 23, wherein for each respective node in the RQT:

if a Y CBF of the respective node, a U CBF of the respective node, and a V CBF of the respective node all have a first value, the respective node is not associated with a split flag, the split flag indicating whether the respective node has a plurality of child nodes,

if at least one of the Y CBF of the respective node, U CBF of the respective node, and the V CBF of the respective node has a second value that is different than the first value, the respective node is associated with the split flag,

wherein the Y CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant Y coefficient block,

wherein the U CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant U coefficient block, and

wherein the V CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant V coefficient block.

27. The video encoding device of claim 23, wherein the one or more processors are configured to:

select, based on a CBF of a node of the RQT, a coding context; and

perform, based on the selected coding context, context-adaptive binary arithmetic coding (CABAC) encoding on a split flag of the node, the split flag indicating whether the node has a plurality of child nodes.

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28. The video encoding device of claim 27, wherein the one or more processors are configured to select the coding context such that the one or more processors select, based on a Y CBF of the node, a U CBF of the node, and a V CBF of the node, the coding context.

29. The video encoding device of claim 23, wherein the one or more processors are configured to perform, based on a same coding context, CABAC encoding on a Y CBF, a U CBF, and a V CBF of a node of the RQT.

30. The video encoding device of claim 23, wherein a non-leaf node of the RQT includes a split flag, a Y CBF, a U CBF, and a V CBF, the split flag indicating that the non-leaf node has a plurality of descendant nodes, the Y CBF indicating whether any of the descendant nodes is associated with a significant luma coefficient block, the U CBF indicating whether any of the descendant nodes is associated with a significant U coefficient block, the V CBF indicating whether any of the descendant nodes is associated with a significant V coefficient block.

31. The video encoding device of claim 23, wherein the one or more processors are configured to:

select, based on depths of nodes of the RQT, coding contexts for Y, U, and V CBFs specified by the nodes of the RQT; and

perform, based on the coding contexts selected for the Y, U, and V CBFs, entropy encoding operations on the Y, U, and V CBFs.

32. The video encoding device of claim 31, wherein the one or more processors are configured to select the coding contexts such that the one or more processors select a coding context for a CBF, wherein an index value of the coding context is equal to a depth of a node of the RQT that specifies the CBF.

33. The video encoding device of claim 23, wherein, for each respective node in the RQT:

the respective node does not include a U CBF unless the respective node is the root node or a U CBF of a parent node of the respective node indicates that a descendant node of the parent node is associated with a significant U chroma block; and

the respective node does not include a V CBF unless the respective node is the root node or a V CBF of the parent node of the respective node indicates that a descendant node of the parent node is associated with a significant V chroma block.

34. A video decoding device that decodes video data, the video decoding device comprising one or more processors configured to:

parse, from a bitstream that includes an encoded representation of the video data, a coded block flag (CBF) of a root node of a residual quad tree (RQT) of a coding unit (CU), wherein a pixel block of the CU is larger than a maximum-allowable transform unit (TU) size; and

if the CBF has a first value, parse, from the bitstream, a chroma coefficient block associated with a leaf node of the RQT, wherein if the CBF has a second value that is different than the first value, the chroma coefficient block associated with the leaf node is not parsed from the bitstream.

35. The video decoding device of claim 34, wherein the one or more processors are further configured to parse, from the bitstream, a Y CBF of the root node, the Y CBF of the root node indicating whether any leaf node of the RQT is associated with a significant luma coefficient block.

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36. The video decoding device of claim 34, wherein the one or more processors are further configured to parse, from the bitstream, a flag of the root node, the flag indicating whether there is a leaf node of the RQT that is associated with a significant coefficient block, wherein if the flag indicates that no leaf node of the RQT is associated with a significant coefficient block, no node of the RQT includes a CBF

37. The video decoding device of claim 34, wherein the one or more processors are configured to:

make, based on a Y CBF of a node of the RQT, a U CBF of the node, and a V CBF of the node, a determination to parse a split flag of a node of the RQT; and
in response to making the determination, determine, based on the split flag of the node, whether to parse from the bitstream a plurality of child nodes of the node,
wherein the Y CBF indicates whether the node or any descendant node of the node is associated with a significant Y coefficient block, the U CBF indicates whether the node or any descendant node of the node is associated with a significant U coefficient block, and the V CBF indicates whether the node or any descendant node of the node is associated with a significant V coefficient block.

38. The video decoding device of claim 34, wherein the one or more processors are configured to:

select, based on a CBF of a node of the RQT, a coding context; and
perform, based on the selected coding context, context-adaptive binary arithmetic coding (CABAC) decoding on a split flag of the node, the split flag indicating whether the node has a plurality of child nodes.

39. The video decoding device of claim 38, wherein the one or more processors are configured to select, based on a Y CBF of the node, a U CBF of the node, and a V CBF of the node, the coding context.

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40. The video decoding device of claim 34, wherein the one or more processors are configured to perform, based on a same coding context, CABAC decoding on a Y CBF of a node of the RQT, a U CBF of the node, and a V CBF of the node.

41. The video decoding device of claim 34, wherein a non-leaf node of the RQT includes a split flag, a Y CBF, a U CBF, and a V CBF, the split flag indicating that the non-leaf node has a plurality of descendant nodes, the Y CBF indicating whether any of the descendant nodes is associated with a significant luma coefficient block, the U CBF indicating whether any of the descendant nodes is associated with a significant U coefficient block, the V CBF indicating whether any of the descendant nodes is associated with a significant V coefficient block.

42. The video decoding device of claim 34, wherein the one or more processors are further configured to:

select, based on depths of nodes of the RQT, coding contexts for Y, U, and V CBFs specified by the nodes of the RQT; and

perform, based on the coding contexts selected for the Y, U, and V CBFs, entropy decoding operations on the Y, U, and V CBFs.

43. The video decoding device of claim 42, wherein the one or more processors are configured to select the coding contexts such that the one or more processors select a coding context for a CBF, wherein an index value of the coding context is equal to a depth of a node of the RQT that specifies the CBF.

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44. The video decoding device of claim 34, wherein, for each respective node in the RQT:

the respective node does not include a U CBF unless the respective node is the root node or a U CBF of a parent node of the respective node indicates that a descendant node of the parent node is associated with a significant U chroma block; and

the respective node does not include a V CBF unless the respective node is the root node or a V CBF of the parent node of the respective node indicates that a descendant node of the parent node is associated with a significant V chroma block.

45. A video encoding device that encodes video data, the video encoding device comprising means for generating a bitstream that includes data that represent a residual quad tree (RQT) for a coding unit (CU), the CU being larger than a maximum-allowable transform unit (TU) size, the RQT including a hierarchy of nodes, wherein a root node of the RQT corresponds to the CU as a whole and leaf nodes of the RQT correspond to TUs of the CU,

wherein the bitstream includes a coded block flag (CBF) of the root node, the CBF indicating whether any of the TUs of the CU are associated with a significant chroma coefficient block that is based on samples of a particular chroma component.

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46. A video decoding device that decodes video data, the video decoding device comprising:

means for parsing, from a bitstream that includes an encoded representation of the video data, a coded block flag (CBF) of a root node of a residual quad tree (RQT) of a coding unit (CU), wherein a pixel block of the CU is larger than a maximum-allowable transform unit (TU) size; and

means for parsing, if the CBF has a first value, from the bitstream, a chroma coefficient block associated with a leaf node of the RQT, wherein if the CBF has a second value that is different than the first value, the chroma coefficient block associated with the leaf node is not parsed from the bitstream.

47. A computer-readable storage medium that stores instructions that, when executed by one or more processors of a video encoding device, configure the video encoding device to generate a bitstream that includes data that represent a residual quad tree (RQT) for a coding unit (CU), the CU being larger than a maximum-allowable transform unit (TU) size, the RQT including a hierarchy of nodes, wherein a root node of the RQT corresponds to the CU as a whole and leaf nodes of the RQT correspond to TUs of the CU,

wherein the bitstream includes a coded block flag (CBF) of the root node, the CBF indicating whether any of the TUs of the CU are associated with a significant chroma coefficient block that is based on samples of a particular chroma component.

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48. A computer-readable storage medium that stores instructions that, when executed by one or more processors of a video decoding device, configure the video decoding device to:

parse, from a bitstream that includes an encoded representation of video data, a coded block flag (CBF) of a root node of a residual quad tree (RQT) of a coding unit (CU), wherein a pixel block of the CU is larger than a maximum allowable transform unit (TU) size; and

if the CBF has a first value, parse, from the bitstream, a chroma coefficient block associated with a leaf node of the RQT, wherein if the CBF has a second value that is different than the first value, the chroma coefficient block associated with the leaf node is not parsed from the bitstream.

CLAIMS

Claim 1: A method for encoding video data, the method comprising:

- receiving or generating the video data, the video data representing a series of pictures;
- generating a bitstream that includes a sequence of bits that forms an encoded representation of the video data, the bitstream including data that represent a residual quad tree (RQT) for a coding unit (CU) of a picture of the series of pictures, the CU being larger than a maximum-allowable transform unit (TU) size, the RQT including a hierarchy of nodes, wherein a root node of the RQT corresponds to the CU as a whole, each of the nodes of the RQT corresponds to a respective block, and respective leaf nodes of the RQT correspond to respective TUs of the CU, wherein generating bitstream comprises:
 - generating residual data for the CU based on predicted video blocks for one or more prediction units (PUs) of the CU and an original video block of the CU, wherein the residual data for the CU is partitioned into residual video blocks and each of the TUs of the CU is associated with a different one of the residual pixel blocks;
 - for each respective node of the RQT, responsive to determining a block corresponding to the respective node is larger than the maximum-allowable TU size, automatically splitting, without encoding in the bitstream a split flag for the respective node, the block corresponding to the respective node into four sub-blocks corresponding to additional nodes of the RQT; and
 - generating two chroma coded block flags (CBFs) at the root node of the RQT, each of the chroma CBFs indicating whether any of the TUs of the CU are associated with a significant chroma coefficient block that is based on samples of a respective chroma component; and
 - outputting the bitstream.

Claim 2: The method of claim 1, wherein the root node is associated with a Y CBF that indicates whether any of the TUs of the CU are associated with a significant luma coefficient block.

Claim 3: The method of claim 1, wherein:

- the root node is associated with a flag,
- if the flag has a first value, at least one of the TUs of the CU is associated with a significant coefficient block, and

if the flag has a second value that is different than the first value, none of the TUs of the CU is associated with a significant coefficient block, and no node in the RQT is associated with a Y CBF, a U CBF, or a V CBF.

Claim 4: The method of claim 1, wherein for each respective node in the RQT:

if a Y CBF of the respective node, a U CBF of the respective node, and a V CBF of the respective node all have a first value, the respective node is not associated with a respective split flag indicating whether the respective node has a plurality of child nodes,

if at least one of the Y CBF of the respective node, the U CBF of the respective node, and the V CBF of the respective node has a second value that is different than the first value, the respective node is associated with the respective split flag,

wherein the Y CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant Y coefficient block,

wherein the U CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant U coefficient block, and

wherein the V CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant V coefficient block.

Claim 5: The method of claim 1, further comprising:

selecting, based at least in part on a CBF of a node of the RQT, a coding context; and performing, based on the selected coding context, context-adaptive binary arithmetic coding (CABAC) encoding on a split flag of the node, the split flag indicating whether the node has a plurality of child nodes.

Claim 6: The method of claim 5, wherein selecting the coding context comprises selecting, based on a Y CBF of the node, a U CBF of the node, and a V CBF of the node, the coding context.

Claim 7: The method of claim 1, further comprising performing, based at least in part on a same coding context, CABAC encoding on a Y CBF, a U CBF, and a V CBF of a node in the RQT.

Claim 8: The method of claim 1, wherein a non-leaf node of the RQT is associated with a split flag, a Y CBF, a U CBF, and a V CBF, the split flag associated with the non-leaf node indicating that the non-leaf node has a plurality of descendant nodes, the Y CBF indicating whether any of the descendant nodes is associated with a significant luma coefficient block, the U CBF indicating whether any of the descendant nodes is associated with a significant U coefficient block, the V CBF indicating whether any of the descendant nodes is associated with a significant V coefficient block.

Claim 9: The method of claim 1, further comprising:
 selecting, based on depths of nodes of the RQT, coding contexts for Y, U, and V CBFs specified by the nodes of the RQT; and
 performing, based on the coding contexts selected for the Y, U, and V CBFs, entropy encoding operations on the Y, U, and V CBFs.

Claim 10: The method of claim 9, wherein selecting the coding contexts comprises selecting a coding context for a CBF, wherein an index value of the coding context is equal to a depth of a node in the RQT that specifies the CBF.

Claim 11: The method of claim 1, wherein, for each respective node in the RQT:
 the respective node does not include a U CBF unless the respective node is the root node or a U CBF of a parent node of the respective node indicates that a descendant node of the parent node is associated with a significant U chroma block; and
 the respective node does not include a V CBF unless the respective node is the root node or a V CBF of the parent node of the respective node indicates that a descendant node of the parent node is associated with a significant V chroma block.

Claim 12: A method for decoding video data, the method comprising:
 receiving a bitstream that includes an encoded representation of the video data, the video data representing a series of pictures;

for each respective node of a residual quad tree (RQT) of a coding unit (CU) of a picture of the series of pictures, responsive to determining a block corresponding to the respective node is larger than a maximum-allowable transform unit (TU) size, automatically splitting, without parsing from the bitstream a split flag for the respective node, the block

corresponding to the respective node into four sub-blocks corresponding to additional nodes of the RQT, the RQT including a hierarchy of nodes, a root node of the RQT corresponding to the CU as a whole, and respective leaf nodes of the RQT corresponding to respective TUs of the CU, each of the TUs of the CU being associated with a different residual pixel block;

parsing, from the bitstream, two chroma coded block flags (CBFs) at the root node of the RQT, wherein the CU is larger than the maximum-allowable TU size;

for each of the chroma CBFs, determining, based on the respective chroma CBF, whether any TU of the CU is associated with a significant chroma coefficient block that is based on samples of a respective chroma component;

based on a particular TU of the CU being associated with a significant chroma coefficient block, performing an inverse transform on coefficient blocks to reconstruct the residual pixel block associated with the particular TU of the CU, the significant chroma coefficient block being one of the coefficient blocks; and

reconstructing a video block of the CU based on one or more predictive pixel blocks of prediction units (PUs) of the CU and the residual pixel blocks associated with the TUs of the CU.

Claim 13: The method of claim 12, wherein the method further comprises parsing, from the bitstream, a Y CBF of the root node, the Y CBF of the root node indicating whether any leaf node of the RQT is associated with a significant luma coefficient block.

Claim 14: The method of claim 12, wherein the method further comprises parsing, from the bitstream, a flag of the root node, the flag indicating whether there is a leaf node of the RQT that is associated with a significant coefficient block, wherein if the flag indicates that no leaf node of the RQT is associated with a significant coefficient block, no node in the RQT is associated with a CBF.

Claim 15: The method of claim 12, further comprising:

making, based on a Y CBF of a node of the RQT, a U CBF of the node, and a V CBF of the node, a determination to parse a split flag of a node of the RQT; and

in response to making the determination, determining, based on the split flag of the node, whether to parse from the bitstream a plurality of child nodes of the node,

wherein the Y CBF indicates whether the node or any descendant node of the node is associated with a significant Y coefficient block, the U CBF indicates whether the node or

any descendant node of the node is associated with a significant U coefficient block, and the V CBF indicates whether the node or any descendant node of the node is associated with a significant V coefficient block.

Claim 16: The method of claim 12, wherein the method further comprises:
 selecting, based on a CBF of a node of the RQT, a coding context; and
 performing, based on the selected coding context, context-adaptive binary arithmetic coding (CABAC) decoding on a split flag of the node, the split flag indicating whether the node has a plurality of child nodes.

Claim 17: The method of claim 16, wherein selecting the coding context comprises selecting, based on a Y CBF of the node, a U CBF of the node, and a V CBF of the node, the coding context.

Claim 18: The method of claim 12, further comprising performing, based on a same coding context, CABAC decoding on a Y CBF, a U CBF, and a V CBF of a node of the RQT.

Claim 19: The method of claim 12, wherein a non-leaf node of the RQT includes a split flag, a Y CBF, a U CBF, and a V CBF, the split flag of the non-leaf node indicating that the non-leaf node has a plurality of descendant nodes, the Y CBF indicating whether any of the descendant nodes is associated with a significant luma coefficient block, the U CBF indicating whether any of the descendant nodes is associated with a significant U coefficient block, the V CBF indicating whether any of the descendant nodes is associated with a significant V coefficient block.

Claim 20: The method of claim 12, further comprising:
 selecting, based on depths of nodes of the RQT, coding contexts for Y, U, and V CBFs specified by the nodes of the RQT; and
 performing, based on the coding contexts selected for the Y, U, and V CBFs, entropy decoding operations on the Y, U, and V CBFs.

Claim 21: The method of claim 20, wherein selecting the coding contexts comprises selecting a coding context for a CBF, wherein an index value of the coding context is equal to

a depth of a node of the RQT that specifies the CBF.

Claim 22: The method of claim 12, wherein, for each respective node in the RQT:

the respective node does not include a U CBF unless the respective node is the root node or a U CBF of a parent node of the respective node indicates that a descendant node of the parent node is associated with a significant U chroma block; and

the respective node does not include a V CBF unless the respective node is the root node or a V CBF of the parent node of the respective node indicates that a descendant node of the parent node is associated with a significant V chroma block.

Claim 23: A video encoding device that encodes video data, the video encoding device comprising:

one or more data storage media configured to store the video data, the video data representing a series of pictures; and

one or more processors configured to generate a bitstream that includes a sequence of bits that forms an encoded representation of the video data, the bitstream including data that represents a residual quad tree (RQT) for a coding unit (CU) of a picture of the series of pictures, the CU being larger than a maximum-allowable transform unit (TU) size, the RQT including a hierarchy of nodes, wherein a root node of the RQT corresponds to the CU as a whole, each of the nodes of the RQT corresponds to a respective block, and respective leaf nodes of the RQT correspond to respective TUs of the CU, wherein the instructions configure the video encoding device such that, as part of generating the bitstream, the video encoding device:

generates residual data for the CU based on predicted video blocks for one or more prediction units (PUs) of the CU and an original video block of the CU, wherein the residual data for the CU is partitioned into residual video blocks and each of the TUs of the CU is associated with a different one of the residual pixel blocks;

for each respective node of the RQT, responsive to determining a block corresponding to the respective node is larger than the maximum-allowable TU size, automatically splits, without encoding in the bitstream a split flag for the respective node, the block corresponding to the respective node into four sub-blocks corresponding to additional nodes of the RQT; and

includes two chroma coded block flags (CBFs) at the root node of the RQT, each of the chroma CBFs indicating whether any of the TUs of the CU are associated with a significant chroma coefficient block that is based on samples of a respective chroma component.

Claim 24: The video encoding device of claim 23, wherein the root node is associated with a Y CBF, the Y CBF indicating whether any of the TUs of the CU are associated with a significant luma coefficient block.

Claim 25: The video encoding device of claim 23, wherein:

the root node is associated with a flag,

if the flag has a first value, at least one of the TUs of the CU is associated with a significant coefficient block, and

if the flag has a second value that is different than the first value, none of the TUs of the CU is associated with a significant coefficient block, and no node in the RQT is associated with a Y CBF, a U CBF, or a V CBF.

Claim 26: The video encoding device of claim 23, wherein for each respective node in the RQT:

if a Y CBF of the respective node, a U CBF of the respective node, and a V CBF of the respective node all have a first value, the respective node is not associated with a respective split flag indicating whether the respective node has a plurality of child nodes,

if at least one of the Y CBF of the respective node, the U CBF of the respective node, and the V CBF of the respective node has a second value that is different than the first value, the respective node is associated with the respective split flag,

wherein the Y CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant Y coefficient block,

wherein the U CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant U coefficient block, and

wherein the V CBF indicates whether any TU that corresponds to the respective node or a descendant node of the respective node is associated with a significant V coefficient block.

Claim 27: The video encoding device of claim 23, wherein the one or more processors are configured to:

select, based on a CBF of a node of the RQT, a coding context; and

perform, based on the selected coding context, context-adaptive binary arithmetic coding (CABAC) encoding on a split flag of the node, the split flag indicating whether the node has a plurality of child nodes.

Claim 28: The video encoding device of claim 27, wherein the one or more processors are configured to select the coding context such that the one or more processors select, based on a Y CBF of the node, a U CBF of the node, and a V CBF of the node, the coding context.

Claim 29: The video encoding device of claim 23, wherein the one or more processors are configured to perform, based on a same coding context, CABAC encoding on a Y CBF, a U CBF, and a V CBF of a node of the RQT.

Claim 30: The video encoding device of claim 23, wherein a non-leaf node of the RQT includes a split flag, a Y CBF, a U CBF, and a V CBF, the split flag of the non-leaf node indicating that the non-leaf node has a plurality of descendant nodes, the Y CBF indicating whether any of the descendant nodes is associated with a significant luma coefficient block, the U CBF indicating whether any of the descendant nodes is associated with a significant U coefficient block, the V CBF indicating whether any of the descendant nodes is associated with a significant V coefficient block.

Claim 31: The video encoding device of claim 23, wherein the one or more processors are configured to:

select, based on depths of nodes of the RQT, coding contexts for Y, U, and V CBFs specified by the nodes of the RQT; and

perform, based on the coding contexts selected for the Y, U, and V CBFs, entropy encoding operations on the Y, U, and V CBFs.

Claim 32: The video encoding device of claim 31, wherein the one or more processors are configured to select the coding contexts such that the one or more processors select a

coding context for a CBF, wherein an index value of the coding context is equal to a depth of a node of the RQT that specifies the CBF.

Claim 33: The video encoding device of claim 23, wherein, for each respective node in the RQT:

the respective node does not include a U CBF unless the respective node is the root node or a U CBF of a parent node of the respective node indicates that a descendant node of the parent node is associated with a significant U chroma block; and

the respective node does not include a V CBF unless the respective node is the root node or a V CBF of the parent node of the respective node indicates that a descendant node of the parent node is associated with a significant V chroma block.

Claim 34: A video decoding device that decodes video data, the video decoding device comprising:

one or more data storage media configured to store the video data; and

one or more processors configured to:

receive a bitstream that includes an encoded representation of the video data, the video data representing a series of pictures;

for each respective node of a residual quad tree (RQT) of a coding unit (CU) of a picture of the series of pictures, responsive to determining a block corresponding to the respective node is larger than a maximum-allowable transform unit (TU) size, automatically split, without parsing from the bitstream a split flag for the respective node, the block corresponding to the respective node into four sub-blocks corresponding to additional nodes of the RQT the RQT including a hierarchy of nodes, a root node of the RQT corresponding to the CU as a whole, and respective leaf nodes of the RQT corresponding to respective TUs of the CU, each of the TUs of the CU being associated with a different residual pixel block;

parse, from the bitstream, two chroma coded block flags (CBFs) at the root node of the RQT, wherein the CU is larger than the maximum-allowable TU size;

for each of the chroma CBFs, determine, based on the respective chroma CBF, whether any TU of the CU is associated with a significant chroma coefficient block that is based on samples of a respective chroma component;

based on a particular TU of the CU being associated with a significant chroma coefficient block, perform an inverse transform on coefficient blocks to reconstruct the

residual pixel block associated with the particular TU of the CU, the significant chroma coefficient block being one of the coefficient blocks; and

reconstruct a video block of the CU based on one or more predictive pixel blocks of prediction units (PUs) of the CU and the residual pixel blocks associated with the TUs of the CU.

Claim 35: The video decoding device of claim 34, wherein the one or more processors are further configured to parse, from the bitstream, a Y CBF of the root node, the Y CBF of the root node indicating whether any leaf node of the RQT is associated with a significant luma coefficient block.

Claim 36: The video decoding device of claim 34, wherein the one or more processors are further configured to parse, from the bitstream, a flag of the root node, the flag indicating whether there is a leaf node of the RQT that is associated with a significant coefficient block, wherein if the flag indicates that no leaf node of the RQT is associated with a significant coefficient block, no node of the RQT includes a CBF.

Claim 37: The video decoding device of claim 34, wherein the one or more processors are configured to:

make, based on a Y CBF of a node of the RQT, a U CBF of the node, and a V CBF of the node, a determination to parse a split flag of a node of the RQT; and

in response to making the determination, determine, based on the split flag of the node, whether to parse from the bitstream a plurality of child nodes of the node,

wherein the Y CBF indicates whether the node or any descendant node of the node is associated with a significant Y coefficient block, the U CBF indicates whether the node or any descendant node of the node is associated with a significant U coefficient block, and the V CBF indicates whether the node or any descendant node of the node is associated with a significant V coefficient block.

Claim 38: The video decoding device of claim 34, wherein the one or more processors are configured to:

select, based on a CBF of a node of the RQT, a coding context; and

perform, based on the selected coding context, context-adaptive binary arithmetic coding (CABAC) decoding on a split flag of the node, the split flag indicating whether the node has a plurality of child nodes.

Claim 39: The video decoding device of claim 38, wherein the one or more processors are configured to select, based on a Y CBF of the node, a U CBF of the node, and a V CBF of the node, the coding context.

Claim 40: The video decoding device of claim 34, wherein the one or more processors are configured to perform, based on a same coding context, CABAC decoding on a Y CBF of a node of the RQT, a U CBF of the node, and a V CBF of the node.

Claim 41: The video decoding device of claim 34, wherein a non-leaf node of the RQT includes a split flag, a Y CBF, a U CBF, and a V CBF, the split flag of the non-leaf node indicating that the non-leaf node has a plurality of descendant nodes, the Y CBF indicating whether any of the descendant nodes is associated with a significant luma coefficient block, the U CBF indicating whether any of the descendant nodes is associated with a significant U coefficient block, the V CBF indicating whether any of the descendant nodes is associated with a significant V coefficient block.

Claim 42: The video decoding device of claim 34, wherein the one or more processors are further configured to:

select, based on depths of nodes of the RQT, coding contexts for Y, U, and V CBFs specified by the nodes of the RQT; and

perform, based on the coding contexts selected for the Y, U, and V CBFs, entropy decoding operations on the Y, U, and V CBFs.

Claim 43: The video decoding device of claim 42, wherein the one or more processors are configured to select the coding contexts such that the one or more processors select a coding context for a CBF, wherein an index value of the coding context is equal to a depth of a node of the RQT that specifies the CBF.

Claim 44: The video decoding device of claim 34, wherein, for each respective node in the RQT:

the respective node does not include a U CBF unless the respective node is the root node or a U CBF of a parent node of the respective node indicates that a descendant node of the parent node is associated with a significant U chroma block; and

the respective node does not include a V CBF unless the respective node is the root node or a V CBF of the parent node of the respective node indicates that a descendant node of the parent node is associated with a significant V chroma block.

Claim 45: A video encoding device that encodes video data, the video encoding device comprising:

means for receiving or generating the video data, the video data representing a series of pictures; and

means for generating a bitstream that includes a sequence of bits that forms an encoded representation of the video data, the bitstream including data that represent a residual quad tree (RQT) for a coding unit (CU) of the video data, the CU being larger than a maximum-allowable transform unit (TU) size, the RQT including a hierarchy of nodes, wherein a root node of the RQT corresponds to the CU as a whole, each of the nodes of the RQT corresponds to a respective block, and respective leaf nodes of the RQT correspond to respective TUs of the CU, wherein the means for generating the bitstream comprises:

means for generating residual data for the CU based on predicted video blocks for one or more prediction units (PUs) of the CU and an original video block of the CU, wherein the residual data for the CU is partitioned into residual video blocks and each of the TUs of the CU is associated with a different one of the residual pixel blocks;

for each respective node of the RQT, means for automatically splitting, responsive to determining a block corresponding to the respective node is larger than the maximum-allowable TU size, without encoding in the bitstream a split flag for the respective node, the block corresponding to the respective node into four sub-blocks corresponding to additional nodes of the RQT; and

means for including two chroma coded block flags (CBFs) at the root node of the RQT, each of the chroma CBFs indicating whether any of the TUs of the CU are associated with a significant chroma coefficient block that is based on samples of a respective chroma component.

Claim 46: A video decoding device that decodes video data, the video decoding device comprising:

means for receiving a bitstream that includes an encoded representation of the video data, the video data representing a series of pictures;

for each respective node of a residual quad tree (RQT) of a coding unit (CU) of a picture of the series of pictures, means for automatically splitting, responsive to determining a block corresponding to the respective node is larger than a maximum-allowable transform unit (TU) size, without parsing from the bitstream a split flag for the respective node, the block corresponding to the respective node into four sub-blocks corresponding to additional nodes of the RQT, the RQT including a hierarchy of nodes, a root node of the RQT corresponding to the CU as a whole, and respective leaf nodes of the RQT corresponding to respective TUs of the CU, each of the TUs of the CU being associated with a different residual pixel block;

means for parsing, from the bitstream, two chroma coded block flags (CBFs) at the root node of the RQT, wherein the CU is larger than the maximum-allowable TU size;

for each of the chroma CBFs, means for determining, based on the respective chroma CBF, whether any TU of the CU is associated with a significant chroma coefficient block that is based on samples of a respective chroma component;

means for performing, based on a particular TU of the CU being associated with a significant chroma coefficient block, an inverse transform on coefficient blocks to reconstruct the residual pixel block associated with the particular TU of the CU, the significant chroma coefficient block being one of the coefficient blocks; and

means for reconstructing a video block of the CU based on one or more predictive pixel blocks of prediction units (PUs) of the CU and the residual pixel blocks associated with the TUs of the CU.

Claim 47: A non-transitory computer-readable storage medium that stores instructions that, when executed by one or more processors of a video encoding device, configure the video encoding device to:

receive or generate video data, the video data representing a series of pictures;

generate a bitstream that includes a sequence of bits that forms an encoded representation of the video data, the bitstream including data that represent a residual quad tree (RQT) for a coding unit (CU) of a picture of the series of pictures, the CU being larger than a maximum-allowable transform unit (TU) size, the RQT including a hierarchy of nodes, wherein a root node of the RQT corresponds to the CU as a whole, each of the nodes of the RQT corresponds to a respective block, and respective leaf nodes of the RQT correspond to respective TUs of the CU, wherein the instructions configure the video encoding device such that, as part of generating the bitstream, the video encoding device:

generate residual data for the CU based on predicted video blocks for one or more prediction units (PUs) of the CU and an original video block of the CU, wherein the residual data for the CU is partitioned into residual video blocks and each of the TUs of the CU is associated with a different one of the residual pixel blocks;

for each respective node of the RQT, responsive to determining a block corresponding to the respective node is larger than the maximum-allowable TU size, automatically splits, without encoding in the bitstream a split flag for the respective node, the block corresponding to the respective node into four sub-blocks corresponding to additional nodes of the RQT; and

includes two chroma coded block flags (CBFs) at the root node of the RQT, each of the chroma CBFs indicating whether any of the TUs of the CU are associated with a significant chroma coefficient block that is based on samples of a respective chroma component; and
output the bitstream.

Claim 48: A non-transitory computer-readable storage medium that stores instructions that, when executed by one or more processors of a video decoding device, configure the video decoding device to:

receive a bitstream that includes an encoded representation of video data, the video data representing a series of pictures;

for each respective node of a residual quad tree (RQT) of a coding unit (CU) of a picture of the series of pictures, responsive to determining a block corresponding to the respective node is larger than a maximum-allowable transform unit (TU) size, automatically split, without parsing from the bitstream a split flag for the respective node, the block corresponding to the respective node into four sub-blocks corresponding to additional nodes of the RQT, the RQT including a hierarchy of nodes, a root node of the RQT corresponding to the CU as a whole, and respective leaf nodes of the RQT corresponding to respective TUs of the CU, each of the TUs of the CU being associated with a different residual pixel block;

parse, from the bitstream, two chroma coded block flags (CBFs) at the root node of the RQT, wherein the CU is larger than the maximum-allowable TU size;

for each of the chroma CBFs, determining, based on the respective chroma CBF, whether any TU of the CU is associated with a significant chroma coefficient block that is based on samples of a respective chroma component;

based on a particular TU of the CU being associated with a significant chroma coefficient block, perform an inverse transform on coefficient blocks to reconstruct the residual pixel block associated with the particular TU of the CU, the significant chroma coefficient block being one of the coefficient blocks; and

reconstruct a video block of the CU based on one or more predictive pixel blocks of prediction units (PUs) of the CU and the residual pixel blocks associated with the TUs of the CU.

Claim 49: The method of claim 12, further comprising: reconstructing, based in part on the chroma coefficient block, a picture of the video data.

Claim 50: The video decoding device of claim 34, wherein the video decoding device comprises at least one of:

- an integrated circuit;
- a microprocessor; or
- a wireless communication device.

Claim 51: The video decoding device of claim 34, further comprising a display configured to display the decoded video data.

Claim 52: The video encoding device of claim 23, further comprising a camera configured to capture the video data.