

CLAIMS

1. A method of video processing, comprising:
determining, for a conversion between a video unit of a video and a bitstream representation of the video, whether to enable a mirrored padding process for padding an unavailable luma sample during an application of a loop filtering tool to the video unit; and
performing the conversion based on the determining.
2. The method of claim 1, wherein the loop filtering tool includes a cross-component adaptive loop filtering (CC-ALF) tool.
3. The method of claim 1, wherein the loop filtering tool includes an adaptive loop filtering (ALF) tool.
4. The method of claim 1, wherein the mirrored padding process includes padding a second sample that is a corresponding sample of a first sample in a filter support region in the loop filtering tool even when the second sample is available, and wherein the first sample is unavailable and to be padded.
5. The method of claim 1, wherein the mirrored padding process is further used for deriving the unavailable luma sample and one or more corresponding luma samples to the unavailable luma sample.
6. The method of claim 5, wherein a corresponding luma sample is determined based on a distance of the corresponding luma sample from a representative luma sample and/or a distance of the unavailable sample from the representative luma sample.
7. The method of claim 6, wherein the representative luma sample is defined as a collocated luma sample of a chroma sample to be filtered.
8. The method of claim 7, wherein a position of the collocated luma sample of the chroma sample depends on a color format of the video.

9. The method of claim 8, wherein the collocated luma sample of the chroma sample located at (x, y) is defined as one located at (2x, 2y) in the color format being 4:2:0.
10. The method of claim 8, wherein the collocated luma sample of the chroma sample located at (x, y) is defined as one located at (2x, y) in the color format being 4:2:2.
11. The method of claim 8, wherein the collocated luma sample of the chroma sample located at (x, y) is defined as one located at (x, y) in the color format being 4:4:4.
12. The method of claim 6, wherein the distance refers to a distance along a first direction between a first row containing the corresponding luma sample and a second row containing the representative luma sample.
13. The method of claim 6, wherein the distance is calculated as a difference along a first direction between a pixel line along a second direction containing the corresponding luma sample and a row containing the representative luma sample.
14. The method of claim 13, wherein C represents a center line along the second direction where the representative luma sample is located, M represents a line along the second direction where the unavailable sample is located and N represents a line along the second direction in which the corresponding luma sample is located, where C, M and N are positive integers and M is not equal to N.
15. The method of claim 5, wherein the one or more corresponding luma samples to be padded in the mirrored padding process are based on a number of rows of samples utilized by a shape of a filter used by the CC-ALF tool.
16. The method of claim 5, wherein the unavailable luma sample is located at row M and samples located at row N are determined as the one or more corresponding luma samples to be padded, and wherein $d(C, M) = d(N, C)$, whereby $d(x, y)$ denotes a distance between row x and row y, and M, C, N are positive integers.

17. The method of claim 6, wherein the mirrored padding process corresponds to one used during an application of an adaptive loop filtering (ALF) tool in a case that 1) a center luma sample is selected as the representative luma sample and 2) the CC-ALF tool has a $K \times L$ filter shape, whereby K is odd number and L is a positive integer.
18. The method of claim 6, wherein, in a case that the CC-ALF tool has a $K \times L$ filter shape and the unavailable luma sample is located at row M above or row N below from a virtual boundary, the mirrored padding process includes padding the one or more corresponding luma samples located at row N or M away from the virtual boundary from a nearest sample row above the row N or below the row M , whereby K is odd number and, L , M , N are positive integers.
19. The method of claim 18, wherein the unavailable luma sample is padded using a nearest row below the virtual boundary in a case that the virtual boundary is above the representative luma sample and wherein the one or more corresponding luma samples are padded using a nearest row above a row containing the one or more corresponding luma samples in a case that the virtual boundary is above the representative luma sample.
20. The method of claim 18, wherein the unavailable luma sample is padded using a nearest row above the virtual boundary in a case that the virtual boundary is below the representative luma sample and wherein the one or more corresponding luma samples are padded using a nearest row below a row containing the one or more corresponding luma samples in a case that the virtual boundary is below the representative luma sample.
21. The method of claim 19 or 20, wherein $K=2$, $y_L=0$, $y_{P1}=1$, and the virtual boundary is equal to $CtbSizeY-4$, whereby y_L and y_{P1} are y-coordinates of two sample rows and $CtbSizeY$ represents a size of coding tree unit (CTU).
22. The method of claim 21, wherein, in a case that y_L is equal to $CtbSizeY - 4$ and a row above y_L is unavailable, a sample (x, y_{P1}) in a row at y_{P1} is padded using a sample (x, y_L) in a row at y_L .

23. The method of claim 19 or 20, wherein $K=4$, $yM1=-1$, $yL=0$, $yP1=1$, $yP2=2$, and the virtual boundary is equal to $CtbSizeY-4$, whereby $yM1$, yL , $yP1$, $yP2$ are y-coordinates of four sample rows and $CtbSizeY$ represents a size of coding tree unit (CTU).

24. The method of claim 23, wherein, in a case that yL is equal to $CtbSizeY - 3$ and a row above $yM1$ is unavailable, a sample $(x, yP2)$ in a row at $yP2$ is padded using a sample $(x, yP1)$ in a row at $yP1$.

25. The method of claim 23, wherein, in a case that yL is equal to $CtbSizeY - 4$ and a row above $yM1$ is unavailable, a sample $(x, yM1)$ in a row at $yM1$ is padded using a sample (x, yL) in a row at yL and samples $(x, yP2)$ and $(x, yP1)$ in rows at $yP2$ and $yP1$ are padded using a sample (x, yL) in the row at yL .

26. The method of claim 19 or 20, wherein $K=6$, $yM2=-2$, $yM1=-1$, $yL=0$, $yP1=1$, $yP2=2$, $yP3=3$ and the virtual boundary is equal to $CtbSizeY-4$, whereby $yM2$, $yM1$, yL , $yP1$, $yP2$, $yP3$ are y-coordinates of six sample rows and $CtbSizeY$ represents a size of coding tree unit (CTU).

27. The method of claim 26, wherein, in a case that yL is equal to $CtbSizeY - 2$ and a row above $yM2$ is unavailable, a sample $(x, yP3)$ in a row at $yP3$ is padded using a sample $(x, yP2)$ in a row at $yP2$.

28. The method of claim 26, wherein, in a case that yL is equal to $CtbSizeY - 3$ and a row above $yM2$ and a row at $yM2$ are unavailable, a sample $(x, yM2)$ in a row at $yM2$ is padded using a sample $(x, yM1)$ in a row at $yM1$ and samples $(x, yP3)$ and $(x, yP2)$ in rows at $yP3$ and $yP2$ are padded using a sample $(x, yP1)$ in a row at $yP1$.

29. The method of claim 26, wherein, in a case that yL is equal to $CtbSizeY - 4$ and a row above $yM2$, a row at $yM2$ and a row at $yM1$ are unavailable, samples $(x, yM2)$ and $(x, yM1)$ in rows at $yM2$ and $yM1$ are padded using a sample (x, yL) at a row at yL and samples $(x, yP3)$, $(x, yP2)$, and $(x, yP1)$ in rows $yP3$, $yP2$, and $yP1$ are padded using a sample (x, yL) in the row at yL .

30. The method of claim 21, wherein in a case that y_L is equal to $CtbSizeY - 5$ and a row at y_{P1} is unavailable, a sample (x, y_{P1}) in a row at y_{P1} is padded using a sample (x, y_L) in a row at y_L .
31. The method of claim 23, wherein, in a case that y_L is equal to $CtbSizeY - 6$ and a row at y_{P2} is unavailable, a sample (x, y_{P2}) in a row at y_{P2} is padded using a sample (x, y_{P1}) in a row at y_{P1} .
32. The method of claim 23, wherein, in a case that y_L is equal to $CtbSizeY - 5$ and rows at y_{P2} and y_{P1} are unavailable, a sample (x, y_{P1}) in a row at y_{P1} and a sample (x, y_{P2}) in a row at y_{P2} are padded using a sample (x, y_L) in a row at y_L and a sample (x, y_{M1}) in a row at y_{M1} is padded using a sample (x, y_L) in a row at y_L .
33. The method of claim 26, wherein, in a case that y_L is equal to $CtbSizeY - 7$ and a row at y_{P3} is unavailable, a sample (x, y_{P3}) in the row at y_{P3} is padded using a sample (x, y_{P2}) in a row at y_{P2} .
34. The method of claim 26, wherein, in a case that y_L is equal to $CtbSizeY - 6$ and a row at y_{P3} and a row at y_{P2} are unavailable, a sample (x, y_{P3}) in the row at y_{P3} and a sample (x, y_{P2}) in the row at y_{P2} are padded using a sample (x, y_{P1}) in a row at y_{P1} and a sample (x, y_{M2}) is padded using a sample (x, y_{M1}) in a row at y_{M1} .
35. The method of claim 26, wherein, in a case that y_L is equal to $CtbSizeY - 5$ and rows at y_{P3} , y_{P2} , and y_{P1} are unavailable, a sample (x, y_{P3}) in a row at y_{P3} , a sample (x, y_{P2}) in a row at y_{P2} , and a sample (x, y_{P1}) in a row at y_{P1} are padded using a sample (x, y_L) in a row at y_L and a sample (x, y_{M2}) in a row at y_{M2} and a sample (x, y_{M1}) in a row at y_{M1} are padded using a sample (x, y_L) in the row at y_L .
36. The method of claim 5, wherein the unavailable luma sample is located at row M and samples located at row N are determined as the one or more corresponding luma samples to be padded, and wherein $d(C, M) = d(N, C) - \text{offset}$ or $d(C, M) < d(N, C)$, whereby $d(x, y)$ denotes a distance between row x and row y , offset is an integer, and M, C, N are positive integers.

37. The method of claim 5, wherein the unavailable luma sample is located at row M and samples located at row N are determined as the one or more corresponding luma samples to be padded, and wherein $d(M, C) = d(C, N) - \text{offset}$ or $d(C, M) < d(N, C)$, whereby $d(x, y)$ denotes a distance between row x and row y, offset is an integer, and M, C, N are positive integers.

38. The method of claim 36 or 37, wherein the offset is equal to 1.

39. The method of claim 36, wherein, in a case that the unavailable luma sample is located at row M above or row N below from a virtual boundary, the mirrored padding process includes padding the one or more corresponding luma samples located at row N below the virtual boundary or row M above the virtual boundary from a nearest sample row above the row N or below the row M, whereby M and N are positive integers.

40. The method of claim 39, wherein the unavailable luma sample is padded using a nearest row above the virtual boundary in a case that the virtual boundary is below the representative luma sample and wherein the one or more corresponding luma samples are padded using a nearest row below a row containing the one or more corresponding luma samples.

41. The method of claim 39, wherein the unavailable luma sample is padded using a nearest row below the virtual boundary in a case that the virtual boundary is above the representative luma sample and wherein the one or more corresponding samples are padded using a nearest row above a row containing the one or more corresponding luma samples.

42. The method of claim 40 or 41, wherein $K=2$, $y_L=0$, $y_{P1}=1$, and the virtual boundary is equal to $CtbSizeY-4$, whereby y_L and y_{P1} are y-coordinates of two sample rows and $CtbSizeY$ represents a size of coding tree unit (CTU).

43. The method of claim 42, wherein, in a case that y_L is equal to $CtbSizeY - 5$ and a row at y_{P1} is unavailable, a sample (x, y_{P1}) in a row at y_{P1} is padded using a sample (x, y_L) in a row at y_L .

44. The method of claim 40 or 41, wherein $K=4$, $yM1=-1$, $yL=0$, $yP1=1$, $yP2=2$, and the virtual boundary is equal to $CtbSizeY-4$, whereby $yM1$, yL , $yP1$, $yP2$ are y-coordinates of four sample rows and $CtbSizeY$ represents a size of coding tree unit (CTU).

45. The method of claim 44, wherein, in a case that yL is equal to $CtbSizeY - 4$ and a row above $yM1$ and a row at $yM1$ are unavailable, a sample $(x, yM1)$ in a row at $yM1$ is padded using a sample (x, yL) in a row at yL and a sample $(x, yP2)$ in a row at $yP2$ is padded using a sample $(x, yP1)$ in a row at $yP1$.

46. The method of claim 44, wherein in a case that yL is equal to $CtbSizeY - 6$ and a row at $yP2$ is unavailable, a sample $(x, yP2)$ in the row at $yP2$ is padded using a sample $(x, yP1)$ in a row at $yP1$.

47. The method of claim 44, wherein, in a case that yL is equal to $CtbSizeY - 5$ and rows at $yP2$ and $yP1$ are unavailable, a sample $(x, yP2)$ at row $yP2$ are padded using a sample (x, yL) in a row at yL and a sample $(x, yM1)$ in a row at $yM1$ is padded using a sample (x, yL) in the row at yL .

48. The method of claim 40 or 41, wherein $K=6$, $yM2=-2$, $yM1=-1$, $yL=0$, $yP1=1$, $yP2=2$, $yP3=3$ and the virtual boundary is equal to $CtbSizeY-4$, whereby $yM2$, $yM1$, yL , $yP1$, $yP2$, $yP3$ are y-coordinates of six sample rows and $CtbSizeY$ represents a size of coding tree unit (CTU).

49. The method of claim 48, wherein, in a case that yL is equal to $CtbSizeY - 3$ and a row above $yM2$ and a row at $yM2$ are unavailable, a sample $(x, yM2)$ in a row at $yM2$ is padded using a sample $(x, yM1)$ in a row at $yM1$ and a sample $(x, yP3)$ in a row at $yP3$ is padded using a sample $(x, yP2)$ in a row at $yP2$.

50. The method of claim 48, wherein, in a case that yL is equal to $CtbSizeY - 4$ and a row above $yM2$, a row at $yM2$ and a row at $yM1$ are unavailable, samples $(x, yM2)$ and $(x, yM1)$ in rows at $yM2$ and $yM1$ are padded using a sample (x, yL) in a row at yL and samples $(x, yP3)$ and $(x, yP2)$ in rows $yP3$ and $yP2$ are padded using a sample $(x, yP1)$ in a row at $yP1$.

51. The method of claim 48, wherein, in a case that y_L is equal to $CtbSizeY - 7$ and a row at $yP3$ is unavailable, a sample $(x, yP3)$ in the row at $yP3$ is padded using a sample $(x, yP2)$ in a row at $yP2$ and a sample $(x, yM2)$ in a row at $yM2$ is padded using a sample $(x, yM1)$ in a row at $yM1$.
52. The method of claim 48, wherein, in a case that y_L is equal to $CtbSizeY - 6$ and a row at $yP3$ and a row at $yP2$ are unavailable, a sample $(x, yP3)$ in the row at $yP3$ and a sample $(x, yP2)$ in the row at $yP2$ are padded using a sample $(x, yP1)$ in a row at $yP1$ and a sample $(x, yM2)$ in a row at $yM2$ and a sample $(x, yM1)$ in a row at $yM1$ are padded using a sample (x, y_L) in a row at y_L .
53. The method of claim 48, wherein, in a case that y_L is equal to $CtbSizeY - 5$ and rows at $yP3$, $yP2$, and $yP1$ are unavailable, a sample $(x, yP3)$ in a row at $yP3$, a sample $(x, yP2)$ in a row at $yP2$, and a sample $(x, yP1)$ in a row at $yP1$ are padded using a sample (x, y_L) in a row at y_L and a sample $(x, yM2)$ in a row at $yM2$ and a sample $(x, yM1)$ in a row at $yM1$ are padded using a sample (x, y_L) in the row at y_L .
54. The method of claim 1, wherein a result of the determining is included in the bitstream representation at a sequence level, a picture level, a slice level, or a tile group level.
55. The method of any of claims 1-54, wherein the first direction is a vertical direction and the second direction is a horizontal direction.
56. The method of any of claims 1-54, wherein the first direction is a horizontal direction and the second direction is a vertical direction.
57. The method of claim 55 or 56, wherein an orientation of the first direction and the second direction depends on an orientation of a boundary of a virtual buffer.
58. A method of video processing, comprising:
determining, for a conversion between a video unit of a video and a bitstream representation of the video, whether to apply a repetitive padding process and/or a mirrored padding process for padding a sample located at a virtual boundary based on coded information of the video unit; and

performing the conversion based on the determining.

59. The method of claim 58, wherein the coded information includes a size of the video unit that is a coding tree unit (CTU) or coding tree block (CTB).
60. The method of claim 59, wherein the mirrored padding process is applied in a case that the CTU or CTB size is greater than or equal to T, whereby T is a positive integer.
61. The method of claim 59, wherein the repetitive padding process is applied in a case that the CTU or CTB size is smaller than or equal to T, whereby T is a positive integer.
62. The method of any of previous claims, wherein the video unit comprises a picture, a subpicture, a slice, a tile or a 360-degree boundary of the video.
63. The method of any of previous claims, wherein in the CC-ALF tool, sample values of the video unit of a video component are predicted from sample values of the video unit of another video component.
64. The method of any of claims 1 to 63, wherein the conversion includes encoding the video into the bitstream representation.
65. The method of any of claims 1 to 63, wherein the conversion includes decoding the video from the bitstream representation.
66. A video processing apparatus comprising a processor configured to implement a method recited in any one or more of claims 1 to 65.
67. A computer readable medium storing program code that, when executed, causes a processor to implement a method recited in any one or more of claims 1 to 65.
68. A computer readable medium that stores a coded representation or a bitstream representation generated according to any of the above described methods.