

CLAIMS

1. A method for video processing, comprising:
determining, for a conversion of a block of a video picture in a video and a bitstream representation of the video, gradients of a subset of samples in a region for a classification operation in a filtering process, wherein the region has a dimension of $M \times N$ and the block has a dimension of $K \times L$, M , N , K , L being positive integers, and wherein the block is located within the region; and
performing the conversion based on the determining.
2. The method of claim 1, wherein the subset of samples comprises samples that do not require neighboring samples located across any boundaries of multiple video regions of the video picture for determining the gradients.
3. The method of claim 1 or 2, wherein the subset of samples comprises a current sample located at one or more boundaries of multiple video regions of the video picture.
4. The method of claim 3, wherein padded samples are generated in case at least one neighboring sample of the current sample is located across the one or more boundaries.
5. The method of claim 4, wherein the padded samples are generated using samples along a single side of a boundary.
6. The method of claim 5, wherein the padded samples are generated by repeating the samples at the one or more boundaries.
7. The method of any one or more of claims 3 to 6, wherein one or more lines of padded samples above the block are generated in case the current sample is located at a top boundary of a video unit.

8. The method of any one or more of claims 3 to 7, wherein one or more lines of padded samples to the left of the block are generated in case the current sample is located at a left boundary of a video unit.
9. The method of any one or more of claims 3 to 8, wherein one or more lines of padded samples to the right of the block are generated in case the current sample is located at a right boundary of a video unit.
10. The method of any one or more of claims 3 to 9, wherein one or more lines of padded samples below the block are generated in case the current sample is located at a bottom boundary of a video unit.
11. The method of any one or more of claims 3 to 9, wherein a boundary comprises a slice boundary, a brick boundary, a tile boundary, a sub-picture boundary, a 360-degree virtual boundary or an adaptive loop filtering virtual boundary.
12. The method of claim 11, wherein the adaptive loop filtering virtual boundary is enabled for the block in case the block is at a bottom boundary of the video picture such that samples in a first part of the block are disallowed to be used for a second part of the block in the filtering process, the first and second parts being divided by the adaptive loop filtering virtual boundary.
13. The method of claim 11, wherein the adaptive loop filtering virtual boundary is enabled for the block in case the block is at not a bottom boundary of the video picture such that samples in a first part of the block are disallowed to be used for a second part of the block in the filtering process, the first and second parts being divided by the adaptive loop filtering virtual boundary.
14. The method of any one or more of claims 7 to 13, wherein the one or more lines of padded samples comprise a single line or two lines of padded samples.
15. The method of any or more of claims 1 to 14, wherein the region is centered at the block.

16. The method of claim 15, wherein $M = N = 8$.
17. The method of claim 15 or 16, wherein $K = L = 4$.
18. The method of any one or more of claims 2 to 17, wherein, in case the current sample is located at a top boundary and a left boundary of a video unit, the region is adjusted based on:
 - determining an $M \times (N + K1)$ region based on $K1$ lines of padded samples above the block, $K1$ being a positive integer; and
 - determining an $(M + K2) \times (N + K1)$ region based on $K2$ lines of padded samples to the left of the block, $K2$ being a positive integer.
19. The method of any one or more of claims 2 to 17, wherein, in case the current sample is located at a top boundary and a left boundary of a video unit, the region is adjusted based on:
 - determining an $(M + K2) \times N$ region based on $K2$ lines of padded samples to the left of the block, $K2$ being a positive integer; and
 - determining an $(M + K2) \times (N + K1)$ region based on $K1$ lines of padded samples above the block, $K1$ being a positive integer.
20. The method of any one or more of claims 2 to 17, wherein, in case the current sample is located at a top boundary and a right boundary of a video unit, the region is adjusted based on:
 - determining an $M \times (N + K1)$ region based on $K1$ lines of padded samples above the block, $K1$ being a positive integer; and
 - determining an $(M + K2) \times (N + K1)$ region based on $K2$ lines of padded samples to the right of the block, $K2$ being a positive integer.
21. The method of any one or more of claims 2 to 17, wherein, in case the current sample is located at a top boundary and a right boundary of a video unit, the region is adjusted based on:
 - determining an $(M + K2) \times N$ region based on $K2$ lines of padded samples to the right of the block, $K2$ being a positive integer; and
 - determining an $(M + K2) \times (N + K1)$ region based on $K1$ lines of padded samples above the block, $K1$ being a positive integer.

22. The method of any one or more of claims 2 to 17, wherein, in case the current sample is located at a bottom boundary and a right boundary of a video unit, the region is adjusted based on:

determining an $M \times (N + K1)$ region based on $K1$ lines of padded samples below the block, $K1$ being a positive integer; and

determining an $(M + K2) \times (N + K1)$ region based on $K2$ lines of padded samples to the right of the block, $K2$ being a positive integer.

23. The method of any one or more of claims 2 to 17, wherein, in case the current sample is located at a bottom boundary and a right boundary of a video unit, the region is adjusted based on:

determining an $(M + K2) \times N$ region based on $K2$ lines of padded samples to the right of the block, $K2$ being a positive integer; and

determining an $(M + K2) \times (N + K1)$ region based on $K1$ lines of padded samples below the block, $K1$ being a positive integer.

24. The method of any one or more of claims 2 to 17, wherein, in case the current sample is located at a bottom boundary and a left boundary of a video unit, the region is adjusted based on:

determining an $M \times (N + K1)$ region based on $K1$ lines of padded samples below the block, $K1$ being a positive integer; and

determining an $(M + K2) \times (N + K1)$ region based on $K2$ lines of padded samples to the left of the block, $K2$ being a positive integer.

25. The method of any one or more of claims 2 to 17, wherein, in case the current sample is located at a bottom boundary and a left boundary of a video unit, the region is adjusted based on:

determining an $(M + K2) \times N$ region based on $K2$ lines of padded samples to the left of the block, $K2$ being a positive integer; and

determining an $(M + K2) \times (N + K1)$ region based on $K1$ lines of padded samples below the block, $K1$ being a positive integer.

26. The method of any one or more of claims 2 to 25, wherein the gradients are determined in part based on the padded samples.
27. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $M \times (N - C1)$ subregion of the region in case the block is at a top or a bottom boundary of a video unit, C1 being a positive integer.
28. The method of claim 27, wherein top or bottom C1 lines of samples are excluded for the classification operation.
29. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C1) \times N$ subregion of the region in case the block is at a left or a right boundary of a video unit, C1 being a positive integer.
30. The method of claim 29, wherein left or right C1 lines of samples are excluded for the classification operation.
31. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $M \times (N - C1 - C2)$ subregion of the region in case the block is at a top and a bottom boundary of a video unit, C1 and C2 being a positive integer.
32. The method of claim 31, wherein top C1 lines and bottom C2 lines of samples are excluded for the classification operation.
33. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C1) \times (N - C2)$ subregion of the region in case the block is at a top and a left boundary of a video unit, C1 and C2 being a positive integer.
34. The method of claim 33, wherein top C1 lines and left C2 lines of samples are excluded for the classification operation.

35. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C1) \times (N - C2)$ subregion of the region in case the block is at a top and a right boundary of a video unit, C1 and C2 being a positive integer.

36. The method of claim 35, wherein top C1 lines and right C2 lines of samples are excluded for the classification operation.

37. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C1) \times (N - C2)$ subregion of the region in case the block is at a bottom and a left boundary of a video unit, C1 and C2 being a positive integer.

38. The method of claim 37, wherein bottom C1 lines and left C2 lines of samples are excluded for the classification operation.

39. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C1) \times (N - C2)$ subregion of the region in case the block is at a bottom and a right boundary of a video unit, C1 and C2 being a positive integer.

40. The method of claim 39, wherein bottom C1 lines and right C2 lines of samples are excluded for the classification operation.

41. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C1 - C2) \times N$ subregion of the region in case the block is at a left and a right boundary of a video unit, C1 and C2 being a positive integer.

42. The method of claim 41, wherein top C1 lines and bottom C2 lines of samples are excluded for the classification operation.

43. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C3) \times (N - C1 - C2)$ subregion of the region in case the block is at a top boundary, a bottom boundary, and a left boundary of a video unit, C1, C2 and C3 being a positive integer.

44. The method of claim 43, wherein top C1 lines, bottom C2 lines, and left C3 lines of samples are excluded for the classification operation.
45. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C3) \times (N - C1 - C2)$ subregion of the region in case the block is at a top boundary, a bottom boundary, and a right boundary of a video unit, C1, C2 and C3 being a positive integer.
46. The method of claim 45, wherein top C1 lines, bottom C2 lines, and right C3 lines of samples are excluded for the classification operation.
47. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C1 - C2) \times (N - C3)$ subregion of the region in case the block is at a left boundary, a right boundary, and a top boundary of a video unit, C1, C2 and C3 being a positive integer.
48. The method of claim 47, wherein left C1 lines, right C2 lines, and top C3 lines of samples are excluded for the classification operation.
49. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C1 - C2) \times (N - C3)$ subregion of the region in case the block is at a left boundary, a right boundary, and a bottom boundary of a video unit, C1, C2 and C3 being a positive integer.
50. The method of claim 49, wherein left C1 lines, right C2 lines, and top C3 lines of samples are excluded for the classification operation.
51. The method of any one or more of claims 1 to 26, wherein the subset of samples is located in an $(M - C1 - C2) \times (N - C3 - C4)$ subregion of the region in case the block is at a left boundary, a right boundary, a top boundary and a bottom boundary of a video unit, C1, C2, C3, and C4 being a positive integer.

52. The method of claim 51, wherein left C1 lines, right C2 lines, top C3 lines, and bottom C4 of samples are excluded for the classification operation.
53. The method of any one or more of claims 27 to 52, wherein at least one of C1, C2, C3, or C4 is equal to 2.
54. The method of any one or more of claims 27 to 53, wherein C1, C2, C3, and C4 are equal to 2.
55. The method of any one or more of claims 7 to 54, wherein the video unit comprises a slice, a brick, or a tile.
56. The method of any one or more of claims 1 to 55, wherein the subset of samples comprises samples whose neighboring samples are not located across any boundaries of multiple video regions of the video picture.
57. A method for video processing, comprising:
determining, for a conversion of a block of a video picture in a video and a bitstream representation of the video, a uniform padding operation in an adaptive loop filtering process that is applicable to samples located at a 360 virtual boundary of multiple video regions of the video picture regardless of a position of the 360 virtual boundary within the video picture; and
performing the conversion based on the determining.
58. The method of claim 57, wherein the uniform padding operation comprises generating padded samples using samples along a single side of the 360 virtual boundary.
59. The method of claim 58, wherein the padded samples are generated by repeating the samples at the 360 virtual boundary.
60. The method of claim 58 or 59, wherein the 360 virtual boundary does not coincide with an actual boundary of the block.

61. The method of claim 57, wherein the uniform padding operation comprises generating padded samples using samples from both sides of the 360 virtual boundary.
62. The method of any one or more of claims 57 to 61, wherein the 360 virtual boundary comprises a wrap-around edge of an underlying 360 video projected on the video picture using an equi-rectangular projection format.
63. The method of any one or more of claims 1 to 62, wherein the conversion includes encoding the video into the bitstream representation.
64. The method of any one or more of claims 1 to 62, wherein the conversion includes decoding the bitstream representation into the video.
65. A video processing apparatus comprising a processor configured to implement a method recited in any one or more of claims 1 to 64.
66. A computer-readable medium having code stored thereon, the code, upon execution by a processor, causing the processor to implement a method recited in any one or more of claims 1 to 64.