CLAIMS

1. A method of processing video data, comprising:

determining, for a conversion between a picture in a video comprising one or more coding tree blocks and a bitstream of the video, gradients of a subset of samples in an 8×8 region for deriving a classification of a 4×4 block of a first coding tree block in an adaptive loop filtering process, wherein the 4×4 block is located within the first coding tree block and the 8×8 region is centered at the 4×4 block; and

performing the conversion based on the determining,

wherein the adaptive loop filtering process comprises:

determining a filtering coefficient set for a sample of the 4×4 block based on the gradients;

determining a clipping value set for the sample; and

applying a filter on the sample based on the filtering coefficient set and the clipping value set,

wherein in case it is disallowed to use samples across a boundary of a video unit in the adaptive loop filtering process, left-most two columns of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a left boundary of the video unit, and

wherein the boundary of the video unit comprises a slice boundary or a tile boundary.

2. The method of claim 1, wherein the boundary of the video unit comprises a sub-picture boundary, a 360-degree virtual boundary or an adaptive loop filtering virtual boundary.

3. The method of claim 1 or 2, wherein in case it is disallowed to use samples across the boundary of the video unit in the adaptive loop filtering process, top-most two lines of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a top boundary of the video unit.

4. The method of any one of claims 1-3, wherein in case it is disallowed to use samples across the boundary of the video unit in the adaptive loop filtering process, right-most two lines

of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a right boundary of the video unit.

5. The method of any one of claims 1-4, wherein in case it is disallowed to use samples across the boundary of the video unit in the adaptive loop filtering process, lowest two lines of padded samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a bottom boundary of the video unit.

6. The method of claim 2, wherein the adaptive loop filtering virtual boundary is enabled for the first coding tree block in case a bottom boundary of the first coding tree block is not at a bottom boundary of the picture.

7. The method of claim 2 or 6, wherein the adaptive loop filtering virtual boundary is enabled for the first coding tree block in case the first coding tree block is at a bottom boundary of the picture and a vertical distance between a top-left sample of the first coding tree block and the bottom boundary of the picture is no smaller than a certain value.

8. The method of any one of claims 2 and 6-7, wherein a one side padding operation is applied to samples across the 360-degree virtual boundary regardless of a position of the 360-degree virtual boundary within the picture, wherein in the one side padding operation, if one sample to be used is outside the 360-degree virtual boundary, it is copied from an available sample inside the 360-degree virtual boundary.

9. The method of any one of claims 1-8, wherein separate syntax elements indicating whether samples across different kinds of boundaries are allowed to be used are signaled at different levels, and wherein the different kinds of boundaries comprise a slice boundary, a tile boundary and a sub-picture boundary.

10. The method of any one of claims 1-9, wherein a first syntax element for the tile boundary of the separate syntax elements is included in a picture parameter set to indicate whether samples across tile boundaries are allowed to be used; a second syntax element for the slice boundary of

the separate syntax elements is included in the picture parameter set to indicate whether samples across slice boundaries are allowed to be used; a third syntax element for the sub-picture boundary of the separate syntax elements is included in the sequence parameter set to indicate whether samples across sub-picture boundaries are allowed to be used.

11. The method of claim 9, wherein the separate syntax elements are further applied in at least one of deblocking filtering process, sample adaptive offset (SAO) filtering process, bilateral filtering process, or Hadamard transform filtering process.

12. The method of any one of claims 1-11, wherein the 8×8 region is located within a 10×10 region, in case it is disallowed to use samples across a boundary of a video unit in the adaptive loop filtering process, left-most three columns of samples in the 10×10 region including the two columns of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a left boundary of the video unit.

13. The method of any one of claims 1-12, wherein the conversion includes encoding the video into the bitstream.

14. The method of any one of claims 1-12, wherein the conversion includes decoding the video from the bitstream.

15. An apparatus for processing video data comprising a processor and a non-transitory memory with instructions thereon, wherein the instructions upon execution by the processor, cause the processor to:

determine, for a conversion between a picture in a video comprising one or more coding tree blocks and a bitstream of the video, gradients of a subset of samples in an 8×8 region for deriving a classification of a 4×4 block of a first coding tree block in an adaptive loop filtering process, wherein the 4×4 block is located within the first coding tree block and the 8×8 region is centered at the 4×4 block; and

perform the conversion based on the determination,

wherein the adaptive loop filtering process comprises:

determining a filtering coefficient set for a sample of the 4×4 block based on the gradients;

determining a clipping value set for the sample; and

applying a filter on the sample based on the filtering coefficient set and the clipping value set,

wherein in case it is disallowed to use samples across a boundary of a video unit in the adaptive loop filtering process, left-most two columns of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a left boundary of the video unit, and

wherein the boundary of the video unit comprises a slice boundary or a tile boundary.

16. The apparatus of claim 15, wherein the boundary of the video unit comprises a sub-picture boundary, a 360-degree virtual boundary or an adaptive loop filtering virtual boundary; and

wherein in case it is disallowed to use samples across the boundary of the video unit in the adaptive loop filtering process:

top-most two lines of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a top boundary of the video unit;

right-most two lines of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a right boundary of the video unit;

lowest two lines of padded samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a bottom boundary of the video unit;

wherein the adaptive loop filtering virtual boundary is enabled for the first coding tree block in case a bottom boundary of the first coding tree block is not at a bottom boundary of the picture, or in case the first coding tree block is at a bottom boundary of the picture and a vertical distance between a top-left sample of the first coding tree block and the bottom boundary of the picture is no smaller than a certain value;

wherein a one side padding operation is applied to samples across the 360-degree virtual boundary regardless of a position of the 360-degree virtual boundary within the picture, wherein in the one side padding operation, if one sample to be used is outside the 360-degree virtual boundary, it is copied from an available sample inside the 360-degree virtual boundary;

wherein separate syntax elements indicating whether samples across different kinds of boundaries are allowed to be used are signaled at different levels, and wherein the different kinds of boundaries comprise a slice boundary, a tile boundary and a sub-picture boundary;

wherein a first syntax element for the tile boundary of the separate syntax elements is included in a picture parameter set to indicate whether samples across tile boundaries are allowed to be used; a second syntax element for the slice boundary of the separate syntax elements is included in the picture parameter set to indicate whether samples across slice boundaries are allowed to be used; a third syntax element for the sub-picture boundary of the separate syntax elements is included in the sequence parameter set to indicate whether samples across sub-picture boundaries are allowed to be used; and

wherein the separate syntax elements are further applied in at least one of deblocking filtering process, sample adaptive offset (SAO) filtering process, bilateral filtering process, or Hadamard transform filtering process.

17. A non-transitory computer-readable storage medium storing instructions that cause a processor to:

determine, for a conversion between a picture in a video comprising one or more coding tree blocks and a bitstream of the video, gradients of a subset of samples in an 8×8 region for deriving a classification of a 4×4 block of a first coding tree block in an adaptive loop filtering process, wherein the 4×4 block is located within the first coding tree block and the 8×8 region is centered at the 4×4 block; and

perform the conversion based on the determination,

wherein the adaptive loop filtering process comprises:

determining a filtering coefficient set for a sample of the 4×4 block based on the gradients;

determining a clipping value set for the sample; and

applying a filter on the sample based on the filtering coefficient set and the clipping value set,

wherein in case it is disallowed to use samples across a boundary of a video unit in the adaptive loop filtering process, left-most two columns of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a left boundary of the video unit, and

wherein the boundary of the video unit comprises a slice boundary or a tile boundary.

18. The non-transitory computer-readable storage medium of claim 17, wherein the boundary of the video unit comprises a sub-picture boundary, a 360-degree virtual boundary or an adaptive loop filtering virtual boundary;

wherein in case it is disallowed to use samples across the boundary of the video unit in the adaptive loop filtering process:

top-most two lines of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a top boundary of the video unit;

right-most two lines of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a right boundary of the video unit; and

lowest two lines of padded samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a bottom boundary of the video unit,

wherein the adaptive loop filtering virtual boundary is enabled for the first coding tree block in case a bottom boundary of the first coding tree block is not at a bottom boundary of the picture, or in case the first coding tree block is at a bottom boundary of the picture and a vertical distance between a top-left sample of the first coding tree block and the bottom boundary of the picture is no smaller than a certain value;

wherein a one side padding operation is applied to samples across the 360-degree virtual boundary regardless of a position of the 360-degree virtual boundary within the picture, wherein in the one side padding operation, if one sample to be used is outside the 360-degree virtual boundary, it is copied from an available sample inside the 360-degree virtual boundary;

wherein separate syntax elements indicating whether samples across different kinds of boundaries are allowed to be used are signaled at different levels, and wherein the different kinds of boundaries comprise a slice boundary, a tile boundary and a sub-picture boundary;

wherein a first syntax element for the tile boundary of the separate syntax elements is included in a picture parameter set to indicate whether samples across tile boundaries are allowed to be used; a second syntax element for the slice boundary of the separate syntax elements is included in the picture parameter set to indicate whether samples across slice boundaries are allowed to be used; a third syntax element for the sub-picture boundary of the separate syntax elements is included in the sequence parameter set to indicate whether samples across sub-picture boundaries are allowed to be used; and

wherein the separate syntax elements are further applied in at least one of deblocking filtering process, sample adaptive offset (SAO) filtering process, bilateral filtering process, or Hadamard transform filtering process.

19. A non-transitory computer-readable recording medium storing a bitstream of a video which is generated by a method performed by a video processing apparatus, wherein the method comprises:

determining gradients of a subset of samples in a region with a dimension of 8×8 for deriving a classification of a 4×4 block of a first coding tree block in a picture of a video in an adaptive loop filtering process, wherein the 4×4 block is located within the first coding tree block and the 4×4 block is located within the 8×8 region; and

generating the bitstream based on the determining,

wherein the adaptive loop filtering process comprises:

determining a filtering coefficient set for a sample of the 4×4 block based on the gradients;

determining a clipping value set for the sample; and

applying a filter on the sample based on the filtering coefficient set and the clipping value set,

wherein in case it is disallowed to use samples across a boundary of a video unit in the adaptive loop filtering process, left-most two columns of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a left boundary of the video unit.

20. The non-transitory computer-readable storage medium of claim 19, wherein the boundary of the video unit comprises a slice boundary, a tile boundary, a sub-picture boundary, a 360-degree virtual boundary or an adaptive loop filtering virtual boundary;

wherein in case it is disallowed to use samples across the boundary of the video unit in the adaptive loop filtering process:

top-most two lines of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a top boundary of the video unit;

right-most two lines of samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a right boundary of the video unit; and

lowest two lines of padded samples in the 8×8 region are padded when there is a sample in the 4×4 block located at a bottom boundary of the video unit,

wherein the adaptive loop filtering virtual boundary is enabled for the first coding tree block in case a bottom boundary of the first coding tree block is not at a bottom boundary of the picture, or in case the first coding tree block is at a bottom boundary of the picture and a vertical distance between a top-left sample of the first coding tree block and the bottom boundary of the picture is no smaller than a certain value;

wherein a one side padding operation is applied to samples across the 360-degree virtual boundary regardless of a position of the 360-degree virtual boundary within the picture, wherein in the one side padding operation, if one sample to be used is outside the 360-degree virtual boundary, it is copied from an available sample inside the 360-degree virtual boundary;

wherein separate syntax elements indicating whether samples across different kinds of boundaries are allowed to be used are signaled at different levels, and wherein the different kinds of boundaries comprise a slice boundary, a tile boundary and a sub-picture boundary;

wherein a first syntax element for the tile boundary of the separate syntax elements is included in a picture parameter set to indicate whether samples across tile boundaries are allowed to be used; a second syntax element for the slice boundary of the separate syntax elements is included in the picture parameter set to indicate whether samples across slice boundaries are allowed to be used; a third syntax element for the sub-picture boundary of the separate syntax elements is included in the sequence parameter set to indicate whether samples across sub-picture boundaries are allowed to be used; and

wherein the separate syntax elements are further applied in at least one of deblocking filtering process, sample adaptive offset (SAO) filtering process, bilateral filtering process, or Hadamard transform filtering process.