

## CLAIMS

What is claimed is:

1. A method of decoding video data, comprising:

determining a luma block that corresponds to a chroma block;

determining a set of down-sampled samples of reconstructed neighboring luma samples, wherein the reconstructed neighboring luma samples comprise a plurality of reconstructed luma samples that are above the luma block or a plurality of reconstructed luma samples that are left to the luma block;

~~determining~~calculating a first pair of luma value and chroma value ~~according to~~using N down-sampled neighboring luma samples of the set ~~of down-sampled samples~~ and N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma samples; wherein N is a positive integer and larger than 1 and a minimum value of the N down-sampled neighboring luma samples is not less than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said N down-sampled neighboring luma samples;

~~determining~~calculating a second pair of luma value and chroma value ~~according to~~using M down-sampled neighboring luma samples of the set ~~of down-sampled samples~~ and M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples; wherein M is a positive integer and larger than 1 and a maximum value of the M down-sampled neighboring luma samples is not larger than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said M down-sampled neighboring luma samples;

determining one or more linear model parameters based on the first and second pairs of luma value and chroma value;

determining a predictive block based on the one or more linear model parameters; and

reconstructing the chroma block based on the predictive block;

~~wherein a minimum value of the N down-sampled neighboring luma samples is not less than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and a maximum value of the M down-sampled neighboring luma samples is not larger than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and M, N is a positive integer and larger than 1.~~

2. A method of decoding video data, comprising:

determining a luma block that corresponds to a chroma block;

determining a set of down-sampled samples of reconstructed neighboring luma samples, wherein the reconstructed neighboring luma samples comprise a plurality of reconstructed luma samples that are above the luma block and a plurality of reconstructed luma samples that are left to the luma block;

~~determining~~calculating a first pair of luma value and chroma value ~~according to~~using N down-sampled neighboring luma samples of the ~~set of down-sampled samples~~ and N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma samples, wherein N is a positive integer and ~~determining~~larger than 1 and a minimum value of the N down-sampled neighboring luma samples is not less than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said N down-sampled neighboring luma samples;

calculating a second pair of luma value and chroma value ~~according to~~using M down-sampled neighboring luma samples of the ~~set of down-sampled samples~~ and M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples; wherein M is a positive integer and larger than 1 and a maximum value of the M down-sampled neighboring luma samples is not larger than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said M down-sampled neighboring luma samples;

determining one or more linear model parameters based on the first and second pairs of luma value and chroma value;

determining a predictive block based on the one or more linear model parameters; and reconstructing the chroma block based on the predictive block;

~~wherein the minimum value of the N down-sampled neighboring luma samples is not less than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and the maximum value of the M down-sampled neighboring luma samples is not larger than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and M, N is a positive integer and larger than 1.~~

3. The method of claim 1 or 2, wherein the set of down-sampled samples of reconstructed neighboring luma samples consists of:

the N down-sampled neighboring luma samples and the M down-sampled neighboring luma samples, and the sum of N and M is equal to a number of down-sampled neighboring luma samples in the set.

4. The method of any one of claims 1 to 3, wherein

the luma value of the first pair of luma value and chroma value is the mean luma value of the N down-sampled neighboring luma samples, and

the chroma value of the first pair of luma value and chroma value is the mean chroma value of the N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma samples;

and wherein

the luma value of the second pair of luma value and chroma value is the mean luma value of the M down-sampled neighboring luma samples, and

the chroma value of the second pair of luma value and chroma value is the mean chroma value of the M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples.

5. The method of any one of claims 1 to 3,

wherein the luma value of the first pair of luma value and chroma value is the mean luma value of said N down-sampled neighboring luma samples within a first luma value range, and the chroma value of the first pair of luma value and chroma value is the mean chroma value of said N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma samples within the first luma value range; and

wherein the luma value of the second pair of luma value and chroma value is the mean luma value of said M down-sampled neighboring luma samples within a second luma value range, and the chroma value of the second pair of luma value and chroma value is the

mean chroma value of said M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples within the second luma value range.

6. The method of claim 5, wherein

the first luma value range ~~is within~~ a range of [MaxLumaValue-T<sub>1</sub>, MaxLumaValue];  
and

the second luma value range ~~is within~~ a range of [MinLumaValue, MinLumaValue+T<sub>2</sub>];

wherein the MaxLumaValue and MinLumaValue respectively represent the maximum luma value and the minimum luma value in the set of down-sampled samples of reconstructed neighboring luma samples, and T<sub>1</sub>, T<sub>2</sub> are predefined thresholds.

7. The method of any one of claims 1 to 6, wherein M and N are equal.

8. The method of claim 7, wherein M=N=2.

9. The method of any one of claims 1 to 6, wherein M and N is defined based on the block size of the luma block.

10. The method of any one of claims 1 to 6 and claim 9, wherein

$$M=(W+H)>>t,$$

$$N=(W+H)>>r,$$

wherein the t and r are the number of right shift bits, W indicates the width of the luma block and H indicates the height of the luma block.

11. The method of any one of claims 1 to 10, wherein the reconstructed neighboring luma samples comprise:

a top-right neighbouring luma sample outside the luma block and luma samples that are right to the top-right neighbouring luma sample outside the luma block; and/or

a left-below neighbouring luma sample outside the luma block and luma samples that are below of the left-below neighbouring luma sample outside the luma block.

12. The method of any one of claims 1 to 11, wherein the plurality of reconstructed luma samples that are above the luma block are reconstructed neighboring luma samples adjacent to the respective top boundary, and the plurality of reconstructed luma samples that are left to the luma block are reconstructed neighboring luma samples adjacent to the respective left boundary.

13. The method of any one of claims 1 to 12, wherein the reconstructed neighboring luma samples excludes luma samples that are above of a top-left neighbouring luma sample outside the luma block, and/or luma samples that are left of the top-left neighbouring luma sample.

14. The method of any one of claims 1 to 13, wherein the reconstructed neighboring luma samples comprise a first set of reconstructed neighboring luma samples and a second set of reconstructed neighboring luma samples, and wherein the first set of reconstructed neighboring luma samples comprises reconstructed neighboring luma samples with the luma value being less than or equal to a threshold; and the second set of reconstructed neighboring luma samples comprises reconstructed neighboring luma samples with the luma value being larger than the threshold.

15. The method of any one of claims 1 to 14, wherein the set of down-sampled samples of the reconstructed neighboring luma samples are obtained by down-sampling on the reconstructed neighboring luma samples.

16. A method of encoding video data, comprising:

- determining a luma block that corresponds to a chroma block;
- determining a set of down-sampled samples of reconstructed neighboring luma samples, wherein the reconstructed neighboring luma samples comprise a plurality of

reconstructed luma samples that are above the luma block or a plurality of reconstructed luma samples that are left to the luma block;

~~determining~~calculating a first pair of luma value and chroma value ~~according to~~using N down-sampled neighboring luma samples of the set of down-sampled samples and N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma samples; wherein N is a positive integer and larger than 1 and a minimum value of the N down-sampled neighboring luma samples is not less than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said N down-sampled neighboring luma samples;

~~determining~~calculating a second pair of luma value and chroma value ~~according to~~using M down-sampled neighboring luma samples of the set of down-sampled samples and M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples; wherein M is a positive integer and larger than 1 and a maximum value of the M down-sampled neighboring luma samples is not larger than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said M down-sampled neighboring luma samples;

determining one or more linear model parameters based on the first and second pairs of luma value and chroma value;

determining a predictive block based on the one or more linear model parameters; and

encoding the chroma block based on the predictive block;

~~wherein the minimum value of the N down-sampled neighboring luma samples is not less than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and the maximum value of the M down-sampled neighboring luma samples is not larger than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and M, N is a positive integer and larger than 1.~~

∴

17. A method of encoding video data, comprising:

determining a luma block that corresponds to a chroma block;

determining a set of down-sampled samples of reconstructed neighboring luma samples, wherein the reconstructed neighboring luma samples comprise a plurality of

reconstructed luma samples that are above the luma block and a plurality of reconstructed luma samples that are left to the luma block;

~~determining~~calculating a first pair of luma value and chroma value ~~according to~~using N down-sampled neighboring luma samples of the set of down-sampled samples and N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma samples; wherein N is a positive integer and larger than 1 and a minimum value of the N down-sampled neighboring luma samples is not less than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said N down-sampled neighboring luma samples;

~~determining~~calculating a second pair of luma value and chroma value ~~according to~~using M down-sampled neighboring luma samples of the set of down-sampled samples and M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples; wherein M is a positive integer and larger than 1 and a maximum value of the M down-sampled neighboring luma samples is not larger than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said M down-sampled neighboring luma samples;

determining one or more linear model parameters based on the first and second pairs of luma value and chroma value;

determining a predictive block based on the one or more linear model parameters; and

encoding the chroma block based on the predictive block;

~~wherein the minimum value of the N down-sampled neighboring luma samples is not less than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and the maximum value of the M down-sampled neighboring luma samples is not larger than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and M, N is a positive integer and larger than 1.~~

∴

18. The method of claim 16 or 17, wherein the set of down-sampled samples of reconstructed neighboring luma samples consists of:

the N down-sampled neighboring luma samples and the M down-sampled neighboring luma samples, and the sum of N and M is equal to a number of down-sampled neighboring luma samples in the set.

19. The method of any one of claims 16 to 18,

wherein the luma value of the first pair of luma value and chroma value is the mean luma value of said N down-sampled neighboring luma samples, and the chroma value of the first pair of luma value and chroma value is the mean chroma value of said N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma samples; and

wherein the luma value of the second pair of luma value and chroma value is the mean luma value of said M down-sampled neighboring luma samples, and the chroma value of the second pair of luma value and chroma value is the mean chroma value of said M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples.

20. The method of any one of claims 16 to 18,

wherein the luma value of the first pair of luma value and chroma value is the mean luma value of said N down-sampled neighboring luma samples within a first luma value range, and the chroma value of the first pair of luma value and chroma value is the mean chroma value of said N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma samples within the first luma value range; and

wherein the luma value of the second pair of luma value and chroma value is the mean luma value of said M down-sampled neighboring luma samples within a second luma value range, and the chroma value of the second pair of luma value and chroma value is the mean chroma value of said M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples within the second luma value range.

21. The method of claim 20, wherein

the first luma value range ~~is within~~ a range of [MaxLumaValue-T<sub>1</sub>, MaxLumaValue];  
and/or,

the second luma value range ~~is within~~ a range of [MinLumaValue,  
MinLumaValue+T<sub>2</sub>],

wherein the MaxLumaValue and MinLumaValue respectively represent the maximum luma value and the minimum luma value in the set of down-sampled samples of reconstructed neighboring luma samples, and  $T_1$ ,  $T_2$  are predefined thresholds.

22. The method of any one of claims 16 to 21, wherein M and N are equal.

23. The method of claim 22, wherein  $M=N=2$ .

24. The method of any one of claims 16 to 21, wherein M and N is defined based on the block size of the luma block.

25. The method of any one of claims 16 to 21 and claim 24, wherein

$$M=(W+H)>>t,$$

$$N=(W+H)>>r,$$

wherein the t and r are the respective numbers of right shift bits, W indicates the width of the luma block and H indicates the height of the luma block.

26. The method of any one of claims 16 to 25, wherein the reconstructed neighboring luma samples comprise:

a top-right neighbouring luma sample outside the luma block and luma samples that are right to the top-right neighbouring luma sample outside the luma block; and/or

a left-below neighbouring luma sample outside the luma block and luma samples that are below of the left-below neighbouring luma sample outside the luma block.

27. The method of any one of claims 16 to 26, wherein the plurality of reconstructed luma samples that are above the luma block are reconstructed neighboring luma samples adjacent to the respective top boundary, and the plurality of reconstructed luma samples that are left to the luma block are reconstructed neighboring luma samples adjacent to the respective left boundary.

28. The method of any one of claims 16 to 27, wherein the reconstructed neighboring luma samples excludes luma samples that are above of a top-left neighbouring luma sample outside the luma block, and/or luma samples that are left of the top-left neighbouring luma sample.

29. The method of any one of claims 16 to 28,

wherein the reconstructed neighboring luma samples comprise a first set of reconstructed neighboring luma samples and a second set of reconstructed neighboring luma samples, and

wherein the first set of reconstructed neighboring luma samples comprises reconstructed neighboring luma samples with the luma value being less than or equal to a threshold; and the second set of reconstructed neighboring luma samples comprises reconstructed neighboring luma samples with the luma value being larger than the threshold.

30. The method of any one of claims 16 to 29, wherein the set of down-sampled samples of the reconstructed neighboring luma samples are obtained by down-sampling on the reconstructed neighboring luma samples.

31. A device of decoding video data, comprising:

a video data memory and a video decoder;

wherein the video decoder is configured to:

determine a luma block that corresponds to a chroma block;

determine a set of down-sampled samples of reconstructed neighboring luma samples, wherein the reconstructed neighboring luma samples comprise a plurality of reconstructed luma samples that are above the luma block or a plurality of reconstructed luma samples that are left to the luma block;

~~determine~~calculate a first pair of luma value and chroma value ~~according to~~using N down-sampled neighboring luma samples of the set of down-sampled samples and N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma samples; wherein N is a positive integer and larger than 1 and a minimum value of the N

down-sampled neighboring luma samples is not less than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said N down-sampled neighboring luma samples;

~~determine~~calculate a second pair of luma value and chroma value ~~according to~~using M down-sampled neighboring luma samples of the set ~~of down-sampled samples~~ and M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples, wherein M is a positive integer and larger than 1 and a maximum value of the M down-sampled neighboring luma samples is not larger than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said M down-sampled neighboring luma samples,

determine one or more linear model parameters based on the first and second pairs of luma value and chroma value;

determine a predictive block based on the one or more linear model parameters; and

reconstruct the chroma block based on the predictive block;

~~wherein the minimum value of the N down-sampled neighboring luma samples is not less than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and the maximum value of the M down-sampled neighboring luma samples is not larger than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and M, N is a positive integer and larger than 1.~~

32. A device of decoding video data, comprising:

a video data memory and a video decoder;

wherein the video decoder is configured to:

determine a luma block that corresponds to a chroma block;

determine a set of down-sampled samples of reconstructed neighboring luma samples, wherein the reconstructed neighboring luma samples comprise a plurality of reconstructed luma samples that are above the luma block and a plurality of reconstructed luma samples that are left to the luma block;

~~determine~~calculate a first pair of luma value and chroma value ~~according to~~using N down-sampled neighboring luma samples of the set ~~of down-sampled samples~~ and N reconstructed neighboring chroma samples that correspond to the N down-sampled neighboring luma

samples; wherein N is a positive integer and larger than 1 and a minimum value of the N down-sampled neighboring luma samples is not less than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said N down-sampled neighboring luma samples;

~~determine~~calculate a second pair of luma value and chroma value ~~according to~~using M down-sampled neighboring luma samples of the set of down-sampled samples and M reconstructed neighboring chroma samples that correspond to the M down-sampled neighboring luma samples; wherein M is a positive integer and larger than 1 and a maximum value of the M down-sampled neighboring luma samples is not larger than respective luma value of the remaining down-sampled neighboring luma samples of the set, which are different from said M down-sampled neighboring luma samples;

determine one or more linear model parameters based on the first and second pairs of luma value and chroma value;

determine a predictive block based on the one or more linear model parameters; and

reconstruct the chroma block based on the predictive block;

~~wherein the minimum value of the N down-sampled neighboring luma samples is not less than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and the maximum value of the M down-sampled neighboring luma samples is not larger than the luma value of the remaining down-sampled neighboring luma samples of the set of down-sampled samples, and M, N is a positive integer and larger than 1.~~

33. The device of claim 31 or 32, wherein the set of down-sampled samples of reconstructed neighboring luma samples consists of:

the N down-sampled neighboring luma samples and the M down-sampled neighboring luma samples, and the sum of N and M is equal to a number of down-sampled neighboring luma samples in the set.

34. The device of any one of claims 31 to 33, wherein M and N are equal.

35. The device of claim 34, wherein  $M=N=2$ .

36. A decoding apparatus, comprising:

a memory storage comprising instructions; and

one or more processors in communication with the memory,

wherein the one or more processors, by executing the instructions, perform the method according to any one of claims 1 to 15.

37. An encoding apparatus, comprising:

a memory storage comprising instructions; and

one or more processors in communication with the memory,

wherein the one or more processors, by executing the instructions, perform the method according to any one of claims 16 to 30.

38. A computer program product storing instructions which, when executed by a processor in a device, cause the device to perform the method according to any of claims 1 to 30.