CLAIMS

1. A method to reconstruct coded video data with one or more processors, the method comprising:

receiving a coded bitstream comprising one or more coded reshaped images in an input codeword representation;

receiving reshaping metadata for the one or more coded reshaped images in the coded bitstream, wherein the reshaping metadata comprise parameters to generate a forward reshaping function based on the reshaping metadata, wherein the forward reshaping function maps pixels of an image from a first codeword representation to the input codeword representation, wherein the reshaping metadata comprise:

a first parameter indicating a minimum bin index being used in reshaping;

a second parameter to determine an active maximum bin index being used in the reshaping, wherein the active maximum bin index is smaller or equal to a predefined maximum bin index, and determining the active maximum bin index comprises computing a difference between the predefined maximum bin index and the second parameter;

absolute delta codeword values for each active bin in the input codeword representation; and

signs of the absolute delta codeword values for each active bin in the input codeword representation;

generating a forward reshaping function based on the reshaping metadata;

generating an inverse reshaping function based on the reshaping metadata or the forward reshaping function, wherein the inverse reshaping function maps pixels of a reshaped image from the input codeword representation to the first codeword

representation; and

decoding the coded bitstream based on the forward reshaping function and the inverse reshaping function.

2. The method of claim 1, wherein the forward reshaping function is reconstructed as a piece-wise linear function with linear segments derived by the reshaping metadata.

3. A method for adaptive reshaping of a video sequence with a processor, the method comprising:

accessing with a processor an input image in a first codeword representation; and

generating a forward reshaping function mapping pixels of the input image to a second codeword representation, wherein generating the forward reshaping function comprises:

dividing the input image into multiple pixel regions;

assigning each of the pixel regions to one of multiple codeword bins according to a first luminance characteristic of each pixel region;

computing a bin metric for each of the multiple codeword bins according to a second luminance characteristic of each of the pixel regions assigned to each of the multiple codeword bins;

allocating a number of codewords in the second codeword representation to each of the multiple codeword bins according to the bin metric of each of the multiple codeword bins and a rate distortion optimization criterion;

generating the forward reshaping function in response to the allocation of codewords in the second codeword representation to each of the multiple codeword bins; and

generating reshaping parameters to represent the forward reshaping function, wherein the reshaping parameters comprise:

a first parameter to determine an active maximum codeword bin index used for reshaping, wherein the active maximum codeword bin index is smaller or equal to a predefined maximum codeword bin index;

a second parameter indicating a minimum codeword bin index being used in the reshaping;

absolute delta codeword values for each active codeword bin in the first codeword representation; and

signs of the absolute delta codeword values for each active bin in the first codeword representation.

4. The method of claim 3, wherein the first luminance characteristic of a pixel region comprises the average luminance pixel value in the pixel region.

5. The method of claim 3, wherein the second luminance characteristic of a pixel region comprises the variance of luminance pixel values in the pixel region.

6. The method of claim 5, wherein computing a bin metric for a codeword bin comprises computing the average of the variances of luminance pixel values for all pixel regions assigned to the codeword bin.

7. The method of claim 3, wherein allocating a number of codewords in the second codeword representation to a codeword bin according to its bin metric comprises:

assigning no codewords to the codeword bin, if no pixel regions are assigned to the codeword bin;

assigning a first number of codewords if the bin metric of the codeword bin is lower than an upper threshold value; and

assigning a second number of codewords to the codeword bin otherwise.

8. An apparatus comprising a processor and configured to perform a method as recited in claim 1.

9. A non-transitory computer-readable storage medium having stored thereon computer-executable instruction for executing a method with one or more processors in accordance with claim 1.

10. A method to reconstruct coded video data, the method comprising:

receiving a coded bitstream comprising one or more coded reshaped pictures in an input codeword representation;

receiving reshaping metadata for the one or more coded reshaped pictures in the coded bitstream;

wherein the reshaping metadata comprise:

a first parameter to determine a minimum bin index being used in reshaping;

a second parameter to determine a maximum bin index being used in reshaping;

a second parameter to determine an active maximum bin index being used in the reshaping, wherein the active maximum bin index is smaller or equal to a predefined maximum bin index, and determining the active maximum bin index comprises computing a difference between the predefined maximum

bin index and the second parameter;

a first set of parameters indicating absolute delta codeword values for each active bin in the input codeword representation; and

a second set of parameters indicating signs of the delta codeword values for each active bin in the input codeword representation;

generating a forward reshaping function based on the reshaping metadata, wherein the forward reshaping function maps pixels of a picture from a first codeword representation to the input codeword representation;

generating an inverse reshaping function based on the reshaping metadata or the forward reshaping function, wherein the inverse reshaping function maps pixels of a reshaped picture from the input codeword representation to the first codeword representation;

extracting from the coded bitstream a coded reshaped picture comprising one or more coded units, wherein:

for an inter-coded CU (inter-CU) in the coded reshaped picture:

applying the forward reshaping function to inter-prediction samples stored in a reference buffer in the first codeword representation to generate reshaped prediction samples for the inter-CU in the input codeword representation;

generating reshaped reconstructed samples of the inter-CU based on reshaped residuals in the inter-CU and the reshaped prediction samples for the inter-CU;

applying the inverse reshaping function to the reshaped reconstructed samples of the inter-CU to generate decoded samples of the inter-CU in the first codeword representation;

applying a loop filter to the decoded samples of the inter-CU to generate output

samples of the inter-CU; and

storing the output samples of the inter-CU in the reference buffer; and

generating a decoded picture in the first codeword representation based on output samples in the reference buffer.

11. The method of claim 10, wherein generating a reshaped reconstructed sample (*RecSample*) of the inter-CU comprises computing:

$$RecSample = (Res + Fwd(PredSample)),$$

wherein *Res* denotes a reshaped residual in the inter-CU in the input codeword representation, *Fwd*() denotes the forward reshaping function, and *PredSample* denotes an inter-prediction sample in the first codeword representation.

12. The method of claim 11, wherein generating an output sample to be stored in the reference buffer (*RecSampleInDPB*) comprises computing:

$$RecSampleInDPB = LPF(Inv(RecSample)),$$

wherein, *Inv*() denotes the inverse reshaping function and LPF() denotes a loop filter.

13. The method of claim 10, wherein for chroma residual samples in the inter-coded CU (inter-CU) in the input codeword representation, further comprising:

determining a chroma scaling factor based on luma pixel values in the input codeword representation and the reshaping metadata;

multiplying the chroma residual samples in the inter-CU with the chroma scaling factor to generate scaled chroma residual samples in the inter-CU in the first codeword representation;

generating reconstructed chroma samples of the inter-CU based on the scaled chroma

residuals in the inter-CU and chroma inter-prediction samples stored in the reference buffer to generate decoded chroma samples of the inter-CU;

applying the loop filter (270) to the decoded chroma samples of the inter-CU to generate output chroma samples of the inter-CU; and

storing the output chroma samples of the inter-CU in the reference buffer.

14. The method of claim 13, wherein in inter mode the chroma scaling factor is based on an average of inter-predicted luma values in the input codeword representation.

15. The method of claim 10, wherein the forward reshaping function is reconstructed as a piece-wise linear function with linear segments derived by the reshaping metadata.