Claims

1. Video decoder configured to

decode a data stream into a plurality of pictures of a video,

wherein the data stream comprises a plurality of pictures in at least two layers,

wherein the pictures (1212) of at least one layer are split into a predetermined layer-specific number of subpictures (L2(1), L2(2), L2(3), L2(4)), one or more of the pictures or subpictures of one layer corresponds to one picture or subpictures in one or more other layer, and at least one of the subpictures comprises boundaries for boundary extension for motion compensation, and

interpret an indication that at least one of the boundaries of corresponding subpictures (L2(1), L2(2), L2(3), L2(4)) or corresponding pictures in different layers are aligned with each other.

2. Video decoder according to claim 1, wherein each of the pluralities of pictures (1212, 1213, 1214) in the at least two layers is split into one or more subpictures (L2(1), L2(2), L2(3), L2(4)), and wherein the video decoder is

configured to interpret the indication to the extent that all of the boundaries of corresponding subpictures in the different layers are aligned with each other.

3. Video decoder according to claim 1 or 2,

wherein the pictures (1212, 1213, 1214) of each layer have the same resolution, and/or
wherein the resolution is different between layers, and/or
wherein the resolution within each layer can change between consecutive pictures.

4. Video decoder according to any one of claims 1 to 3,

wherein the pictures (1211) of one layer are not split into subpictures, and the subpictures (L2(1), L2(2), L2(3), L2(4)) into which one of the pictures (1212, 1213, 1214) of one of the other layers is split into correspond to one of the pictures (1211) which is not split.

5. Video decoder according to claim 4, wherein the decoder is further configured to

interpret an indication that the outer boundaries of subpictures (L2(1), L2(2), L2(3), L2(4)) of one picture (1212) in one layer are aligned with the boundaries of one corresponding picture (1211) in a different layer.

6. Video decoder according to claim 5, further configured to

interpret an indication that a lower layer has a subset of boundaries of a corresponding higher layer.

7. Video decoder according to any one of claims 1 to 6, further configured to

interpret an indication, e.g. a subpictures_in_ols_coherent_flag, that each of the subpictures of one layer corresponds to one of the subpictures of another layer, wherein the indication is in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.

8. Video decoder according to any one of claims 1 to 7, further configured to

interpret an indication that the subpicture boundaries are aligned across at least two layers, wherein the indication is in a video parameter set, VPS, or a sequence parameter set, SPS.

9. Video decoder according to claim 8, further configured to

interpret an indication, e.g. a subpictures_in_ols_aligned_flag, that the subpicture boundaries are aligned across the at least two layers, wherein the indication is in a predetermined section of the VPS, e.g. general_constraint_info() or profile_tier_level().

10. Video decoder according to any one of claims 1 to 9,

wherein each subpicture (L2(1), L2(2), L2(3), L2(4)) is assigned a subpicture identification, and the decoder is further configured to interpret an indication that the subpicture identifications are unique for all layers.

11. Video decoder according to claim 10, further configured to

interpret an indication, e.g. a unique_subpictures_ids_in_ols_flag, that the subpicture identifications are unique for all layers in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.

12. Video decoder according to any one of claims 1 to 9, further configured to

interpret an indication that the subpictures (L2(1), L2(2), L2(3), L2(4)) of different layers corresponding to each other have the same subpicture identification.

13. Video decoder according to claim 12, further configured to

interpret an indication, e.g. an aligned_subpictures_ids_in_ols_flag, that the subpictures of different layers corresponding to each other have the same subpicture identification in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.

14. Video decoder according to any one of claims 1 to 13, further configured to

interpret an indication that relative subpicture positions and subpicture dimensions are the same for the corresponding subpictures in all layers, e.g. the indices of syntax elements indicating position and dimensions of corresponding subpictures that represent a signaling order in the data stream are equal.

15. Video decoder according to claim 14, wherein each of the pluralities of pictures (1212, 1213, 1214) in the at least two layers is split into one or more subpictures (L2(1), L2(2), L2(3), L2(4)), and

wherein the indication comprises, for each of one or more layers, a flag which indicates whether the pictures (1213, 1214) of one or more higher layers, higher than the respective layer (1212), are split into subpictures (L2(1), L2(2), L2(3), L2(4)) so that the predetermined layer-specific number of subpictures is equal for the respective layer and the one or more higher layers and the boundaries of predetermined layer-specific number of subpictures spatially coincide between the respective layer and the one or more higher layers.

16. Video decoder according to claim 15, wherein the one or more higher layers use a picture of the respective layer for prediction.

17. Video decoder according to claim 14, 15, or 16, wherein the flag, for each of one or more layers, when indicating that the pictures (1213, 1214) of one or more higher layers, higher than the respective layer (1212), are split into subpictures (L2(1), L2(2), L2(3), L2(4)) so that the predetermined layer-specific number of subpictures is equal for the respective layer and the one or more higher layers and the boundaries of predetermined layer-specific number of subpictures spatially coincide between the respective layer and the one or more higher layers, also indicates that IDs of the subpictures (L2(1), L2(2), L2(3), L2(4)) are the same between the respective layer and the one or more higher layers.

18. Video decoder according to any one of claims 14 to 17, wherein

the indication is comprised in a sequence parameter set, SPS.

19. Video decoder according to any one of claims 1 to 18, further configured to

determine that at least one of the boundaries of one of the subpictures or pictures of a certain layer is to be used for boundary extension for motion compensation by determining that the pictures of the certain layer and at least one other layer have been split into subpictures using the same predetermined layer-specific number and that the boundaries of the resulting subpictures are aligned, or

determine that at least one of the boundaries of one of the subpictures or pictures of a certain layer is to not be used for boundary extension for motion compensation by interpreting an indication for one of the subpictures, that the subpicture is independent regarding a boundary extension property from neighboring subpictures within the same layer or across one or more layers.

20. Video decoder according to any one of claims 1 to 19, further configured to

interpret an indication whether or not the subpicture boundaries are used for sample extrapolation in motion compensation that is performed across layers.

21. Video decoder according to any one of claims 1 to 20, further configured to

~~interpret an indication whether or not the subpicture boundaries of aligned subpictures are used for interlayer motion compensation prediction that is performed across layers.~~

~~22. Video decoder according to any one of claims 1 to 21, further configured to~~

~~interpret an indication, e.g. a reduced_subpic_reference_flag, that for decoding a predetermined spatial section of the video at a predetermined layer, for at least one of the other layers as to which subpictures of the at least one other layers are required for decoding.~~

~~23. Video decoder according to claim 22, further configured to~~

~~interpret an indication, for each layer, which subpictures are required for the spatial selection of the video, which preferably indicates the corresponding subpicture identifications, wherein the indication is in particular preferably in a supplemental enhancement information, SEI, message, or in a video parameter set, VPS, e.g. num_sub_pic_ids and subPicIdToDecodeForReference, or~~

~~derive which subpictures are required for the spatial selection of the video, in accordance to scaling factors and/or offsets.~~

~~24. Video decoder according to claim 22 or 23, further configured to~~

~~interpret an indication, in a supplemental enhancement information, SEI, message or in a video parameter set, VPS, of the required profile/tier/level, PTL, for a data stream containing only the required subpictures, e.g. a subpic_add_ptl_present_flag[i].~~

~~25. Video processing apparatus (1960) configured to~~

~~process a data stream (1945) of constant bitrate which has a plurality of pictures (1910, 1920) encoded thereinto, in a manner according to which each of the plurality of pictures (1910, 1920) is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and~~

~~wherein the video processing apparatus (1960) is configured to produce from the data stream (1945) a subpicture data stream (1955) relating to at least one subpicture (1911, 1921) with a constant bitrate, by keeping dummy data (d) which is included in~~

the data stream for the at least one subpicture and removing dummy data (d) included in the data stream for another subpicture to which the extracted data stream not relates.

26. Video processing apparatus according to claim 25, further configured to

interpret (decode and parse from the data stream) an indication that at least one of the subpictures of the data stream is in constant bitrate in a video parameter set, VPS, or in an SEI message, e.g. a cbr_flag.

27. Video processing apparatus according to claim 25 or 26, further configured to

interpret an indication that a subpicture of the data stream is not in constant bitrate in a video parameter set, VPS, or in an SEI message and to remove all dummy data, e.g. FD_NUT and filler payload supplemental enhancement information, SEI, messages.

28. Video processing apparatus according to claim 25 or 26, further configured to

decode an indication from the data steam for the production of the extracted data stream (1955) whether the production shall end-up into the extracted data stream being of constant bitrate in which case the video processing apparatus performs the keeping and removal of the dummy data (d) or whether the production shall not end-up into the extracted data stream (1955) being of constant bitrate in which case the video processing apparatus performs removal all dummy data (d).

29. Video processing apparatus according to claim 25 or 26, wherein dummy data comprises e.g. FD_NUT and filler payload supplemental enhancement information, SEI, messages.

30. Video processing apparatus (1960) configured to

perform subpicture extraction on a data stream (1945) which has a plurality of pictures (1910, 1920) of a video encoded thereinto in a plurality of layers, wherein each of the plurality of pictures of all layers is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and

wherein the video processing apparatus (1960) is configured to perform the subpicture extraction on the data stream to an extracted data stream (1955) related to one or more subpictures (1911, 1921) of interest by dropping NAL units (1942, 1943, 1952, 1953; 2045, 2046, 2055, 2056) of the data stream not corresponding to the one or more subpictures (1911, 1921) and rewriting parameter sets and/or picture headers (HI1, HI2).

31. Video processing apparatus according to claim 30, further configured to

derive additional information for rewriting from the data stream, the additional information relating to HRD related information, picture size and/or a subdivisioning into subpictures.

32. Video processing apparatus according to claim 30 or 31, further configured to

interpret an indication in the data stream that the rewriting is allowed, e.g. with a supplemental enhancement information, SEI, message.

33. Video processing apparatus (1960) according to any one of claims 30 to 32, further configured to

perform the subpicture extraction such that the extracted data stream (1955) consists of extracted sets of subpictures, which are rectangular in that each of them corresponds to a rectangular region in the data stream.

34. Video processing apparatus according to any one of claims 30 to 33, further configured to rewrite variables indicating one or more of

subpicture width in luma samples,
subpicture height in luma samples,
level information,
HRD-related parameters, and
picture size.

35. Video encoder configured to

encode a plurality of pictures of a video into a data stream,

wherein the data stream comprises a plurality of pictures in at least two layers,

~~wherein the pictures (1212) of at least one layer are split into a predetermined layer-specific number of subpictures (L2(1), L2(2), L2(3), L2(4)), one or more of the pictures or subpictures of one layer corresponds to one picture or subpictures in one or more other layer, and at least one of the subpictures comprises boundaries for boundary extension for motion compensation, and~~

~~indicate that at least one of the boundaries of corresponding subpictures (L2(1), L2(2), L2(3), L2(4)) or corresponding pictures in different layers are aligned with each other.~~

~~36. Video encoder according to claim 35, configured to split each of the pluralities of pictures (1212, 1213, 1214) in the at least two layers into one or more subpictures (L2(1), L2(2), L2(3), L2(4)), and wherein the video encoder is~~

~~configured to indicate to the extent that all of the boundaries of corresponding subpictures in the different layers are aligned with each other.~~

~~37. Video encoder according to claims 35 and 36,~~

~~wherein the pictures (1212, 1213, 1214) of each layer have the same resolution, and/or~~
~~wherein the resolution is different between layers, and/or~~
~~wherein the resolution within each layer can change between consecutive pictures.~~

~~38. Video encoder according to any one of claims 35 to 37,~~

~~wherein the pictures (1211) of one layer are not split into subpictures, and the subpictures (L2(1), L2(2), L2(3), L2(4)) into which one of the pictures (1212, 1213, 1214) of one of the other layers is split into correspond to one of the pictures (1211) which is not split.~~

~~39. Video encoder according to claim 38, wherein the encoder is further configured to~~

~~indicate that the outer boundaries of subpictures (L2(1), L2(2), L2(3), L2(4)) of one picture (1212) in one layer are aligned with the boundaries of one corresponding picture (1211) in a different layer.~~

~~40. Video encoder according to claim 39, further configured to~~

indicate that a lower layer has a subset of boundaries of a corresponding higher layer.

41. Video encoder according to any one of claims 35 to 40, further configured to

indicate, e.g. with a subpictures_in_ols_coherent_flag, that each of the subpictures of one layer corresponds to one of the subpictures of another layer, wherein the indication is in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.

42. Video encoder according to any one of claims 35 to 41, further configured to

indicate that the subpicture boundaries are aligned across at least two layers, wherein the indication is in a video parameter set, VPS, or a sequence parameter set, SPS.

43. Video encoder according to claim 42, further configured to

indicate, e.g. with a subpictures_in_ols_aligned_flag, that the subpicture boundaries are aligned across the at least two layers, wherein the indication is in a predetermined section of the VPS, e.g. general_constraint_info() or profile_tier_level().

44. Video encoder according to any one of claims 35 to 43,

wherein each subpicture (L2(1), L2(2), L2(3), L2(4)) is assigned a subpicture identification, and the encoder is further configured to indicate that the subpicture identifications are unique for all layers.

45. Video encoder according to claim 44, further configured to

Indicate, e.g. with a unique_subpictures_ids_in_ols_flag, that the subpicture identifications are unique for all layers in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.

46. Video encoder according to any one of claims 35 to 43, further configured to

indicate that the subpictures (L2(1), L2(2), L2(3), L2(4)) of different layers corresponding to each other have the same subpicture identification.

47. Video encoder according to claim 46, further configured to

Indicate, e.g. with an aligned_subpictures_ids_in_ols_flag, that the subpictures of different layers corresponding to each other have the same subpicture identification in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.

48. Video encoder according to any one of claims 35 to 47, further configured to

indicate that relative subpicture positions and subpicture dimensions are the same for the corresponding subpictures in all layers e.g. the indices of syntax elements which are used for a signaling order in the data stream of corresponding subpictures or pictures are equal.

49. Video encoder according to claim 48, configured to split each of the pluralities of pictures (1212, 1213, 1214) in the at least two layers into one or more subpictures (L2(1), L2(2), L2(3), L2(4)), and

wherein the indication comprises , for each of one or more layers, a flag which indicates that the pictures (1213, 1214) of one or more higher layers, higher than the respective layer (1212), are split into subpictures (L2(1), L2(2), L2(3), L2(4)) so that the predetermined layer-specific number of subpictures is equal for the respective layer and the one or more higher layers and the boundaries of predetermined layer-specific number of subpictures spatially coincide between the respective layer and the one or more higher layers.

50. Video encoder according to claim 49, wherein the one or more higher layers use a picture of the respective layer for prediction.

51. Video encoder according to claim 48, 49, or 50, wherein the flag, for each of one or more layers, when indicating that the pictures (1213, 1214) of one or more higher layers, higher than the respective layer (1212), are split into subpictures (L2(1), L2(2), L2(3), L2(4)) so that the predetermined layer-specific number of subpictures is equal for the respective layer and the one or more higher layers and the boundaries of predetermined layer-specific number of subpictures spatially coincide between the respective layer and the one or more higher layers, also indicates that IDs of the subpictures (L2(1), L2(2), L2(3), L2(4)) are the same between the respective layer and the one or more higher layers.

52. Video encoder according to any one of claims 48 to 51, wherein

the indication is comprised in a sequence parameter set, SPS.

53. Video encoder according to any one of claims 35 to 52, further configured to

signal that at least one of the boundaries of one of the subpictures or pictures of a certain layer is to not be used for boundary extension for motion compensation by indicating for one of the subpictures, that the subpicture is independent regarding a boundary extension property from neighboring subpictures within the same layer or across one or more layers.

54. Video encoder according to any one of claims 35 to 53, further configured to

indicate whether or not the subpicture boundaries are used for sample extrapolation in motion compensation that is performed across layers.

55. Video encoder according to any one of claims 35 to 54, further configured to

indicate whether or not the subpicture boundaries of aligned subpictures are used for interlayer motion compensation prediction that is performed across layers.

56. Video encoder according to any one of claims 35 to 55, further configured to

indicate, that for decoding a predetermined spatial section of the video at a predetermined layer, for at least one of the other layers as to which subpictures of the at least one other layers are required for decoding, e.g. with a reduced_subpic_reference_flag.

57. Video encoder according to claim 56, further configured to

indicate, for each layer, which subpictures are required for the spatial selection of the video,

preferably by indication of the corresponding subpicture identifications, wherein the indication is in particular preferably in a supplemental enhancement information, SEI, message, or in a video parameter set, VPS, e.g. with num_sub_pic_ids and subPicIdToDecodeForReference, or

by scaling factors and/or offsets.

58. Video encoder according to claim 56 or 57, further configured to

indicate, in a supplemental enhancement information, SEI, message or in a video parameter set, VPS, the required profile/tier/level, PTL, for the data stream containing only the required subpictures, e.g. with a subpic_add_ptl_present_flag[i].

59. Video encoder (1930), configured to

encode a plurality of pictures (1910, 1920) into a data stream (1945), in a manner according to which each of the plurality of pictures (1910, 1920) is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and

wherein the video encoder (1930) is configured to encode into the data stream (1945) a subpicture data stream relating to at least one subpicture (1911, 1921) with constant bitrate, by including into the data stream dummy data (d) for the at least one subpicture and not including dummy data (d) into the data stream for another subpicture to which the extracted data stream not relates.

60. Video encoder according to claim 59, further configured to

indicate that at least one of the subpictures of the data stream is in constant bitrate in a video parameter set, VPS, or in an SEI message, e.g. a cbr_flag.

61. Video encoder according to claim 59 or 60, further configured to

indicate that a subpicture of the data stream is not in constant bitrate in a video parameter set, VPS, or in an SEI message and to not include dummy data, e.g. FD_NUT and filler payload supplemental enhancement information, SEI, messages.

62. Video encoder according to claim 59 or 60, further configured to

indicate into the data steam for the production of the extracted data stream (1955) whether the production shall end-up into the extracted data stream being of constant bitrate in which case the video encoder performs the including and not including of

the dummy data (d) or whether the production shall not end-up into the extracted data stream being (1955) of constant bitrate in which case the video encoder performs not including any dummy data (d).

63. Video encoder according to claim 59 or 60, wherein dummy data comprises e.g. FD_NUT and filler payload supplemental enhancement information, SEI, messages.

64. Video encoder (1930), configured to

encode a plurality of pictures (1910, 1920) of a video into a data stream (1945) in a plurality of layers, wherein the data stream (1945) has a plurality of pictures, wherein each of the plurality of pictures of all layers is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and

wherein the video encoder (1930) is configured to indicate subpicture extraction on the data stream to a data stream related to one or more subpictures (1911, 1921) of interest by not including NAL units (1942, 1943, 1952, 1953; 2045, 2046, 2055, 2056) into the data stream not corresponding to the one or more subpictures (1911, 1921) and rewriting parameter sets and/or picture headers (HI1, HI2).

65. Video encoder according to claim 64, further configured to

indicate additional information for rewriting into the data stream, the additional information relating to HRD related information, picture size and/or a subdivisioning into subpictures.

66. Video encoder according to claim 64 or 65, further configured to

indicate in the data stream that the rewriting is allowed, e.g. with a supplemental enhancement information, SEI, message.

67. Video encoder according to any one of claims 64 to 66, further configured to indicate that rewriting is allowed of variables indicating one or more of

subpicture width in luma samples,
subpicture height in luma samples,
level information,
HRD-related parameters, and

picture size.

68. Video encoder configured to

encode a plurality of pictures of a video into a data stream,

wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation,

wherein the video encoder is configured to encode the plurality of pictures in units of slices and write into a slice header of the slices a first syntax element and a subpicture identification parameter,

wherein the video encoder is configured to write the first syntax element and the subpicture identification parameter into the data stream

in a manner increased by one, and

separated by a bit, set to one, in the slice header of at least one of the slices.

69. Video encoder of claim 68, further configured to

write into the slice header of the slices the first syntax element at a first bit length and the subpicture identification parameter at a second bit length,

check if a sum of the first and second bit lengths is larger than 24 bits,

write the bit between the first syntax element and the subpicture identification parameter if the sum of the first and second bit lengths is larger than 24 bits, and

write another bit, set to one, after the subpicture identification parameter.

70. Video encoder configured to

encode a plurality of pictures of a video into a data stream, wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation, and

wherein the video encoder is configured to encode the plurality of pictures in units of slices and write into a slice header of the slices a first syntax element and a subpicture identification parameter,

wherein the video encoder is configured to write the first syntax element and the subpicture identification parameter into the data stream,

so that the first syntax element is written at a first bit length and the subpicture identification parameter is written at a second bit length,

in a manner so that the first syntax element precedes the subpicture identification parameter,

in a manner so that the first syntax element is written into the data stream increased by one, and

in a manner so that the subpicture identification parameter is written into the data stream increased by a certain value and followed by a bit, set to one, and

determine the certain value, by

checking if a sum of the first and second bit lengths is smaller than 31 bits,

setting the certain value to the value 1, if the sum of the first and second bit lengths is smaller than 31 bits, and

setting the certain value to the value 4, if the sum of the first and second bit lengths is not smaller than 31 bits.

71. Video encoder according to any one of claims 68 to 70,

wherein the first syntax element is the picture order count parameter.

72. Video encoder (2610) configured to

encode a plurality of pictures of a video into a data stream (2065), wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation,

wherein the video encoder (2610) is configured to encode each of the subpictures using context-adaptive binary arithmetic coding,

wherein the video encoder is configured to provide the data stream for at least one subpicture at the end of one or more slices (2631, 2632, 2633) of each subpicture with zero-words so as to avoid that any of the subpictures exceeds a predetermined bin-to-bit ratio.

73. Video encoder according to claim 72, further configured to

evaluate each subpicture for an independence property, e.g. subpic_treated_as_pic_flag, and for corresponding level conformance indication, e.g. in a supplemental enhancement information, SEI, message, and

provide the zero-words for a subpicture only in response to and in accordance with the evaluation.

74. Video encoder (2610) according to claim 72 or 73, configured to provide the data stream at the end of one or more slices of each subpicture of the at least one subpicture with the zero-words such that the number of bins coded for the respective subpicture into the data stream using the context adaptive arithmetic coding is less than or equal to a number determined using a product between a predetermined factor and a byte length of one or more VCL NAL units of the data stream associated with the respective subpicture.

75. Video encoder (2610) according to claim 72 or 73, configured to provide the data stream at the end of one or more slices of each subpicture of the at least one subpicture with the zero-words such that the number of bins coded for the respective subpicture into the data stream using the context adaptive arithmetic coding is less than or equal to a number determined using a sum of a first product between a first predetermined factor and a byte length of one or more VCL NAL units of the data stream associated with the respective subpicture and a second product between a second predetermined factor, a minimum number of bits per coding block and a number of coding blocks the respective subpicture is composed of.

76. Method for decoding a video comprising

decoding a data stream into a plurality of pictures of a video,

wherein the data stream comprises a plurality of pictures in at least two layers,

wherein the pictures (1212) of at least one layer are split into a predetermined layer-specific number of subpictures (L2(1), L2(2), L2(3), L2(4)), one or more of the pictures or subpictures of one layer corresponds to one picture or subpictures in one or more other layer, and at least one of the subpictures comprises boundaries for boundary extension for motion compensation, and

interpreting an indication that at least one of the boundaries of corresponding subpictures L2(1), L2(2), L2(3), L2(4)) or corresponding pictures in different layers are aligned with each other.

77. Method for decoding a video according to claim 76, wherein each of the pluralities of pictures (1212, 1213, 1214) in the at least two layers is split into one or more subpictures L2(1), L2(2), L2(3), L2(4)), and comprising

interpreting the indication to the extent that all of the boundaries of corresponding subpictures in the different layers are aligned with each other.

78. Method for decoding a video according to claim 76 or 77,

wherein the pictures (1212, 1213, 1214) of each layer have the same resolution, and/or
wherein the resolution is different between layers, and/or
wherein the resolution within each layer can change between consecutive pictures.

79. Method for decoding a video according to claim 76, 77 or 78,

wherein the pictures (1211) of one layer are not split into subpictures, and the subpictures L2(1), L2(2), L2(3), L2(4)) into which one of the pictures (1212, 1213, 1214) of one of the other layers is split into correspond to one of the pictures (1211) which is not split.

80. Method for decoding a video according to claim 79, further comprising

interpreting an indication that the outer boundaries of subpictures L2(1), L2(2), L2(3), L2(4)) of one picture (1212) in one layer are aligned with the boundaries of one corresponding picture in a different layer (1211).

~~81. Method for decoding a video according to claim 80, further comprising~~

~~interpreting an indication that a lower layer has a subset of boundaries of a corresponding higher layer.~~

~~82. Method for decoding a video according to any one of claims 76 to 81, further comprising~~

~~interpreting an indication, e.g. a subpictures_in_ols_coherent_flag, that each of the subpictures of one layer corresponds to one of the subpictures of another layer, wherein the indication is in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.~~

~~83. Method for decoding a video according to any one of claims 76 to 82, further comprising~~

~~interpreting an indication that the subpicture boundaries are aligned across at least two layers, wherein the indication is in a video parameter set, VPS, or a sequence parameter set, SPS.~~

~~84. Method for decoding a video according to claim 83, further comprising~~

~~interpreting an indication, e.g. a subpictures_in_ols_aligned_flag, that the subpicture boundaries are aligned across the at least two layers, wherein the indication is in a predetermined section of the VPS, e.g. general_constraint_info() or profile_tier_level().~~

~~85. Method for decoding a video according to any one of claims 76 to 84,~~

~~wherein each subpicture L2(1), L2(2), L2(3), L2(4)) is assigned a subpicture identification, and the method further comprises interpreting an indication that the subpicture identifications are unique for all layers.~~

~~86. Method for decoding a video according to claim 85, further comprising~~

~~Interpreting, e.g. a unique_subpictures_ids_in_ols_flag, an indication that the subpicture identifications are unique for all layers in a predetermined section, e.g.~~

general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.

87. Method for decoding a video according to any one of claims 76 to 84, further comprising

interpreting an indication that the subpictures L2(1), L2(2), L2(3), L2(4)) of different layers corresponding to each other have the same subpicture identification.

88. Method for decoding a video according to claim 87, further comprising

interpreting an indication, e.g. an aligned_subpictures_ids_in_ols_flag, that the subpictures of different layers corresponding to each other have the same subpicture identification in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.

89. Method for decoding a video according to any one of claims 76 to 88, further comprising

interpreting an indication that relative subpicture positions and subpicture dimensions are the same for the corresponding subpictures in all layers, e.g. the indices of syntax elements which are used for a signaling order in the data stream of corresponding subpictures or pictures are equal.

90. Method for decoding a video according to claim 89, wherein each of the pluralities of pictures (1212, 1213, 1214) in the at least two layers is split into one or more subpictures L2(1), L2(2), L2(3), L2(4)), and

wherein the indication comprises , for each of one or more layers, a flag which indicates whether the pictures (1213, 1214) of one or more higher layers, higher than the respective layer (1212), are split into subpictures L2(1), L2(2), L2(3), L2(4)) so that the predetermined layer-specific number of subpictures is equal for the respective layer and the one or more higher layers and the boundaries of predetermined layer-specific number of subpictures spatially coincide between the respective layer and the one or more higher layers.

91. Method for decoding a video according to claim 90, wherein the one or more higher layers use a picture of the respective layer for prediction.

92. Method for decoding a video according to claim 89, 90, or 91, wherein the flag, for each of one or more layers, when indicating that the pictures (1213, 1214) of one or more higher layers, higher than the respective layer (1212), are split into subpictures (L2(1), L2(2), L2(3), L2(4)) so that the predetermined layer-specific number of subpictures is equal for the respective layer and the one or more higher layers and the boundaries of predetermined layer-specific number of subpictures spatially coincide between the respective layer and the one or more higher layers, also indicates that IDs of the subpictures L2(1), L2(2), L2(3), L2(4)) are the same between the respective layer and the one or more higher layers.

93. Method for decoding a video according to any one of claims 89 to 92, wherein

the indication is comprised in a sequence parameter set, SPS.

94. Method for decoding a video according to any one of claims 76 to 93, further comprising

determining that at least one of the boundaries of one of the subpictures or pictures of a certain layer is to be used for boundary extension for motion compensation by determining that the pictures of the certain layer and at least one other layer have been split into subpictures using the same predetermined layer-specific number and that the boundaries of the resulting subpictures are aligned, or

determining that at least one of the boundaries of one of the subpictures or pictures of a certain layer is to not be used for boundary extension for motion compensation by interpreting an indication for one of the subpictures, that the subpicture is independent regarding a boundary extension property from neighboring subpictures within the same layer or across one or more layers.

95. Method for decoding a video according to any one of claims 76 to 94, further comprising

interpreting an indication whether or not the subpicture boundaries are used for sample extrapolation in motion compensation that is performed across layers.

96. Method for decoding a video according to any one of claims 76 to 95, further comprising

interpreting an indication whether or not the subpicture boundaries of aligned subpictures are used for interlayer motion compensation prediction that is performed across layers.

97. Method for decoding a video according to any one of claims 76 to 96, further comprising

interpreting an indication, e.g. a reduced_subpic_reference_flag, that for decoding a predetermined spatial section of the video at a predetermined layer, for at least one of the other layers as to which subpictures of the at least one other layers are required for decoding.

98. Method for decoding a video according to claim 97, further comprising

interpreting an indication, for each layer, which subpictures are required for the spatial selection of the video, which preferably indicates the corresponding subpicture identifications, wherein the indication is in particular preferably in a supplemental enhancement information, SEI, message, or in a video parameter set, VPS, e.g. num_sub_pic_ids and subPicIdToDecodeForReference, or

deriving which subpictures are required for the spatial selection of the video, in accordance to scaling factors and/or offsets.

99. Method for decoding a video according to claim 97 or 98, further comprising

interpreting an indication, in a supplemental enhancement information, SEI, message or in a video parameter set, VPS, of the required profile/tier/level, PTL, for a data stream containing only the required subpictures, e.g. a subpic_add_ptl_present_flag[i].

100. Method for processing a video, comprising

processing a data stream (1945) of constant bitrate which has a plurality of pictures (1910, 1920) encoded thereinto, in a manner according to which each of the plurality of pictures (1910, 1920) is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and

wherein the method comprises producing from the data stream (1945) a subpicture data stream (1955) relating to at least one subpicture (1911, 1921) with a constant bitrate, by keeping dummy data (d) which is included in the data stream for the at least one subpicture and removing dummy data (d) included in the data stream for another subpicture to which the extracted data stream not relates.

101. Method for processing a video according to claim 100, further comprising

interpreting an indication that at least one of the subpictures of the data stream is in constant bitrate in a video parameter set, VPS, or in an SEI message, e.g. a cbr_flag.

102. Method for processing a video according to claim 100 or 101, further comprising

interpreting an indication that a subpicture of the data stream is not in constant bitrate in a video parameter set, VPS, or in an SEI message and to remove all dummy data, e.g. FD_NUT and filler payload supplemental enhancement information, SEI, messages.

103. Method for processing a video according to claim 100 or 101, further comprising

decoding an indication from the data steam for the production of the extracted data stream (1955) whether the production shall end-up into the extracted data stream being of constant bitrate in which case the video processing apparatus performs the keeping and removal of the dummy data (d) or whether the production shall not end-up into the extracted data stream (1955) being of constant bitrate in which case the video processing apparatus performs removal all dummy data (d).

104. Method for processing a video according to claim 100 or 101, wherein dummy data comprises e.g. FD_NUT and filler payload supplemental enhancement information, SEI, messages.

105. Method for processing a video comprising

performing subpicture extraction on a data stream (1945) which has a plurality of pictures (1910, 1920) of a video encoded thereinto in a plurality of layers, wherein each of the plurality of pictures of all layers is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and

wherein the method comprises performing the subpicture extraction on the data stream to an extracted data stream (1955) related to one or more subpictures (1911, 1921) of interest by dropping NAL units (1942, 1943, 1952, 1953; 2045, 2046, 2055, 2056) of the data stream not corresponding to the one or more subpictures (1911, 1921) and rewriting parameter sets and/or picture headers (HI1, HI2).

106. Method for processing a video according to claim 105, further comprising

deriving additional information for rewriting from the data stream, the additional information relating to HRD related information, picture size and/or a subdivisioning into subpictures.

107. Method for processing a video according to claim 105 or 106, further comprising

interpreting an indication in the data stream that the rewriting is allowed, e.g. with a supplemental enhancement information, SEI, message.

108. Method for processing a video according to any one of claims 105 or 107, further comprising

performing the subpicture extraction such that the extracted data stream (1955) consists of extracted sets of subpictures, which are rectangular in that each of them corresponds to a rectangular region in the data stream

109. Method for processing a video according to any one of claims 105 or 108, further comprising rewriting variables indicating one or more of

subpicture width in luma samples,
subpicture height in luma samples,
level information,
HRD-related parameters, and
picture size.

110. Method for encoding a video, comprising

encoding a plurality of pictures of a video into a data stream,

wherein the data stream comprises a plurality of pictures in at least two layers,

wherein the pictures (1212) of at least one layer are split into a predetermined layer-specific number of subpictures (L2(1), L2(2), L2(3), L2(4)), one or more of the pictures or subpictures of one layer corresponds to one picture or subpictures in one or more other layer, and at least one of the subpictures comprises boundaries for boundary extension for motion compensation, and

indicating that at least one of the boundaries of corresponding subpictures (L2(1), L2(2), L2(3), L2(4)) or corresponding pictures in different layers are aligned with each other.

111. Method for encoding a video according to claim 110, comprising splitting each of the pluralities of pictures (1212, 1213, 1214) in the at least two layers into one or more subpictures (L2(1), L2(2), L2(3), L2(4)), and the method comprising

indicating to the extent that all of the boundaries of corresponding subpictures in the different layers are aligned with each other

112. Method for encoding a video according to claim 110 or 111,

wherein the pictures (1212, 1213, 1214) of each layer have the same resolution, and/or
wherein the resolution is different between layers, and/or
wherein the resolution within each layer can change between consecutive pictures.

113. Method for encoding a video according to claim 110, 111 or 112,

wherein the pictures (1211) of one layer are not split into subpictures, and the subpictures (L2(1), L2(2), L2(3), L2(4)) into which one of the pictures (1212, 1213, 1214) of one of the other layers is split into correspond to one of the pictures (1211) which is not split.

114. Method for encoding a video according to claim 113, further comprising

indicating that the outer boundaries of subpictures (L2(1), L2(2), L2(3), L2(4)) of one picture (1212) in one layer are aligned with the boundaries of one corresponding picture (1211) in a different layer.

115. Method for encoding a video according to claim 114, further comprising

~~indicate that a lower layer has a subset of boundaries of a corresponding higher layer.~~

~~116. Method for encoding a video according to any one of claims 110 to 115, further comprising~~

~~indicating, e.g. with a subpictures_in_ols_coherent_flag, that each of the subpictures of one layer corresponds to one of the subpictures of another layer, wherein the indication is in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.~~

~~117. Method for encoding a video according to any one of claims 110 to 116, further comprising~~

~~indicating that the subpicture boundaries are aligned across at least two layers, wherein the indication is in a video parameter set, VPS, or a sequence parameter set, SPS.~~

~~118. Method for encoding a video according to claim 117, further comprising~~

~~indicating, e.g. with a subpictures_in_ols_aligned_flag, that the subpicture boundaries are aligned across the at least two layers, wherein the indication is in a predetermined section of the VPS, e.g. general_constraint_info() or profile_tier_level().~~

~~119. Method for encoding a video according to any one of claims110 to 118,~~

~~wherein each subpicture (L2(1), L2(2), L2(3), L2(4)) is assigned a subpicture identification, and the method further comprises indicating that the subpicture identifications are unique for all layers.~~

~~120. Method for encoding a video according to claim 119, further comprising~~

~~Indicating, e.g. with a unique_subpictures_ids_in_ols_flag, that the subpicture identifications are unique for all layers in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.~~

~~121. Method for encoding a video according to any one of claims 110 to 118, further comprising~~

~~indicate that the subpictures (L2(1), L2(2), L2(3), L2(4)) of different layers corresponding to each other have the same subpicture identification.~~

~~122. Method for encoding a video according to claim 121, further comprising~~

~~Indicating, e.g. with an aligned_subpictures_ids_in_ols_flag, that the subpictures of different layers corresponding to each other have the same subpicture identification in a predetermined section, e.g. general_constraint_info() or profile_tier_level(), of a video parameter set, VPS, or a sequence parameter set, SPS.~~

~~123. Method for encoding a video according to any one of claims 110 to 122, further comprising~~

~~indicating that relative subpicture positions and subpicture dimensions are the same for the corresponding subpictures in all layers e.g. the indices of syntax elements which are used for a signaling order in the data stream of corresponding subpictures or pictures are equal.~~

~~124. Method for encoding a video according to claim 123, comprising splitting each of the pluralities of pictures (1212, 1213, 1214) in the at least two layers into one or more subpictures (L2(1), L2(2), L2(3), L2(4)), and~~

~~indicating for each of one or more layers, that the pictures (1213, 1214) of one or more higher layers, higher than the respective layer (1212), are split into subpictures (L2(1), L2(2), L2(3), L2(4)) so that the predetermined layer-specific number of subpictures is equal for the respective layer and the one or more higher layers and the boundaries of predetermined layer-specific number of subpictures spatially coincide between the respective layer and the one or more higher layers.~~

~~125. Method for encoding a video according to claim 124, wherein the one or more higher layers use a picture of the respective layer for prediction.~~

~~126. Method for encoding a video according to claim 123, 124, or 125, wherein the flag, for each of one or more layers, when indicating that the pictures (1213, 1214) of one or more higher layers, higher than the respective layer (1212), are split into subpictures (L2(1), L2(2), L2(3), L2(4)) so that the predetermined layer-specific number of subpictures is equal for the respective layer and the one or more higher layers and the boundaries of predetermined layer-specific number of subpictures spatially~~

coincide between the respective layer and the one or more higher layers, also indicates that IDs of the subpictures (L2(1), L2(2), L2(3), L2(4)) are the same between the respective layer and the one or more higher layers.

127. Method for encoding a video according to any one of claims 123 to 126, wherein

the indication is comprised in a sequence parameter set, SPS.

128. Method for encoding a video according to any one of claims 110 to 127, further comprising

signaling that at least one of the boundaries of one of the subpictures or pictures of a certain layer is to not be used for boundary extension for motion compensation by indicating for one of the subpictures, that the subpicture is independent regarding a boundary extension property from neighboring subpictures within the same layer or across one or more layers.

129. Method for encoding a video according to any one of claims 110 to 128, further comprising

indicating whether or not the subpicture boundaries are used for sample extrapolation in motion compensation that is performed across layers.

130. Method for encoding a video according to any one of claims 110 to 129, further comprising

indicating whether or not the subpicture boundaries of aligned subpictures are used for interlayer motion compensation prediction that is performed across layers.

131. Method for encoding a video according to any one of claims 110 to 130, further comprising

indicating, that for decoding a predetermined spatial section of the video at a predetermined layer, for at least one of the other layers as to which subpictures of the at least one other layers are required for decoding, e.g. with a reduced_subpic_reference_flag.

132. Method for encoding a video according to claim 131, further comprising

indicating, for each layer, which subpictures are required for the spatial selection of the video,

preferably by indication of the corresponding subpicture identifications, wherein the indication is in particular preferably in a supplemental enhancement information, SEI, message, or in a video parameter set, VPS, e.g. with num_sub_pic_ids and subPicIdToDecodeForReference, or

by scaling factors and/or offsets.

133. Method for encoding a video according to claim 131 or 132, further comprising

indicating, in a supplemental enhancement information, SEI, message or in a video parameter set, VPS, the required profile/tier/level, PTL, for the data stream containing only the required subpictures, e.g. with a subpic_add_ptl_present_flag[i].

134. Method for encoding a video, comprising

encoding a plurality of pictures (1910, 1920) into a data stream (1945), in a manner according to which each of the plurality of pictures (1910. 1920) is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and

wherein the method comprises encoding into the data stream (1945) a subpicture data stream relating to at least one subpicture (1911, 1921) with constant bitrate, by including into the data stream dummy data (d) for the at least one subpicture and not including dummy (d) data into the data stream for another subpicture to which the extracted data stream not relates.

135. Method for encoding a video according to claim 134, further comprising

indicating that at least one of the subpictures of the data stream is in constant bitrate in a video parameter set, VPS, or in an SEI message, e.g. a cbr_flag.

136. Method for encoding a video according to claim 134 or 135, further comprising

indicating that a subpicture of the data stream is not in constant bitrate in a video parameter set, VPS, or in an SEI message and to remove all dummy data, e.g. FD_NUT and filler payload supplemental enhancement information, SEI, messages.

137. Method for encoding a video according to claim 134 or 135, further comprising

indicating into the data steam for the production of the extracted data stream (1955) whether the production shall end-up into the extracted data stream being of constant bitrate in which case the video encoder performs the including and not including of the dummy data (d) or whether the production shall not end-up into the extracted data stream (1955) being of constant bitrate in which case the video encoder performs not including any dummy data (d).

138. Method for encoding a video according to claim 134 or 135, wherein dummy data comprises e.g. FD_NUT and filler payload supplemental enhancement information, SEI, messages.

139. Method for encoding a video, comprising

encoding a plurality of pictures (1910, 1920) of a video into a data stream (1945) in a plurality of layers, wherein the data stream (1945) has a plurality of pictures, wherein each of the plurality of pictures of all layers is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and

indicating subpicture extraction on the data stream to a data stream related to one or more subpictures (1911, 1921) of interest by not including NAL units (1942, 1943, 1952, 1953; 2045, 2046, 2055, 2056) into the data stream not corresponding to the one or more subpictures (1911, 1921) and rewriting parameter sets and/or picture headers (HI1, HI2).

140. Method for encoding a video according to claim 139, further comprising

indicating additional information for rewriting into the data stream, the additional information relating to HRD related information, picture size and/or a subdivisioning into subpictures.

141. Method for encoding a video according to claim 139 or 140, further comprising

indicating in the data stream that the rewriting is allowed, e.g. with a supplemental enhancement information, SEI, message.

142. Method for encoding a video according to any one of claims 139 to 141, further comprising indicating that rewriting is allowed of variables indicating one or more of

subpicture width in luma samples,
subpicture height in luma samples,
level information,
HRD-related parameters, and
picture size.

143. Method for encoding a video, comprising

encoding a plurality of pictures of a video into a data stream, wherein the data stream comprises a plurality of pictures, wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation, and

wherein the method comprises encoding the plurality of pictures in units of slices and writing into a slice header of the slices a first syntax element and a subpicture identification parameter,

wherein the method comprises writing the first syntax element and the subpicture identification parameter into the data stream

in a manner increased by one, and

separated by a bit, set to one, in the slice header of at least one of the slices.

144. Method for encoding a video of claim 143, further comprising

writing into the slice header of the slices the first syntax element at a first bit length and the subpicture identification parameter at a second bit length,

checking if a sum of the first and second bit lengths is larger than 24 bits,

writing the bit between the first syntax element and the subpicture identification parameter if the sum of the first and second bit lengths is larger than 24 bits, and

writing another bit, set to one, after the subpicture identification parameter.

145. Method for encoding a video, comprising

encoding a plurality of pictures of a video into a data stream, wherein the data stream comprises a plurality of pictures, wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation, and

wherein the method comprises encoding the plurality of pictures in units of slices and write into a slice header of the slices a first syntax element and a subpicture identification parameter,

wherein the method comprises writing the first syntax element and the subpicture identification parameter into the data stream,

so that the first syntax element is written at a first bit length and the subpicture identification parameter is written at a second bit length,

in a manner so that the first syntax element precedes the subpicture identification parameter,

in a manner so that the first syntax element is written into the data stream increased by one, and

in a manner so that the subpicture identification parameter is written into the data stream increased by a certain value and followed by a bit, set to one, and

determining the certain value, by

checking if a sum of the first and second bit lengths is smaller than 31 bits,

setting the certain value to the value 1, if the sum of the first and second bit lengths is smaller than 31 bits, and

setting the certain value to the value 4, if the sum of the first and second bit lengths is not smaller than 31 bits.

146. Method for encoding a video according to claim 145,

wherein the first syntax element is the picture order count parameter.

147. Method for encoding a video, comprising

encoding a plurality of pictures of a video into a data stream, wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation,

wherein the method comprises encoding each of the subpictures using context-adaptive binary arithmetic coding,

wherein the method comprises providing the data stream (2605) for at least one subpicture at the end of one or more slices (2631, 2632, 2633) of each subpicture with zero-words so as to avoid that any of the subpictures exceeds a predetermined bin-to-bit ratio.

148. Method for encoding a video according to claim 147, further comprising

evaluating each subpicture for an independence property, e.g. subpic_treated_as_pic_flag, and for corresponding level conformance indication, e.g. in a supplemental enhancement information, SEI, message, and

providing the zero-words for a subpicture only in response to and in accordance with the evaluation.

149. Method for encoding a video according to claim 147 or 148, comprising providing the data stream at the end of one or more slices of each subpicture of the at least one subpicture with the zero-words such that the number of bins coded for the respective subpicture into the data stream using the context adaptive arithmetic coding is less than or equal to a number determined using a product between a predetermined factor and a byte length of one or more VCL NAL units of the data stream associated with the respective subpicture.

150. Method for encoding a video according to claim 147 or 148 or 149, comprising providing the data stream at the end of one or more slices of each subpicture of the at least one subpicture with the zero-words such that the number of bins coded for the respective subpicture into the data stream using the context adaptive arithmetic

coding is less than or equal to a number determined using a sum of a first product between a first predetermined factor and a byte length of one or more VCL NAL units of the data stream associated with the respective subpicture and a second product between a second predetermined factor, a minimum number of bits per coding block and a number of coding blocks the respective subpicture is composed of.

151. Computer program product including a program for a processing device, comprising software code portions for performing the steps of any one of claims 76 to 150, when the program is run on the processing device.

152. Computer program product according to claim 151, wherein the computer program product comprises a computer-readable medium on which the software code portions are stored, wherein the program is directly loadable into an internal memory of the processing device.

153. Video decoder (2640) configured to

decode a plurality of pictures of a video from a data stream (2065), wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation,

wherein the video decoder (2640) is configured to decode each of the subpictures using context-adaptive binary arithmetic decoding,

wherein the video decoder is configured to decode for at least one subpicture at the end of one or more slices (2631, 2632, 2633) of each subpicture a number of zero-words so that a bin-to-bit ratio is below a predetermined bin-to-bit ratio.

154. Video decoder (2640) according to claim 153, configured to

determine the number of zero-words by continuing reading zero-words until the bin-to-bit ratio is below the predetermined bin-to-bit ratio, or by discriminating zero-words from other syntax elements syntactically.

155. Video decoder according to claim 153 or 154, further configured to

evaluate each subpicture for an independence property, e.g. subpic_treated_as_pic_flag, and for corresponding level conformance indication, e.g. in a supplemental enhancement information, SEI, message, and

decode the zero-words for a subpicture only in response to and in accordance with the evaluation.

156. Video decoder (2640) according to claim 153, 154, or 155, configured to

decode the data stream at the end of one or more slices of each subpicture of the at least one subpicture with the zero-words such that the number of bins coded for the respective subpicture into the data stream using the context adaptive arithmetic coding is less than or equal to a number determined using a product between a predetermined factor and a byte length of one or more VCL NAL units of the data stream associated with the respective subpicture.

157. Video decoder (2640) according to claim 153, 154, or 155, configured to

decode the data stream at the end of one or more slices of each subpicture of the at least one subpicture with the zero-words such that the number of bins coded for the respective subpicture into the data stream using the context adaptive arithmetic coding is less than or equal to a number determined using a sum of a first product between a first predetermined factor and a byte length of one or more VCL NAL units of the data stream associated with the respective subpicture and a second product between a second predetermined factor, a minimum number of bits per coding block and a number of coding blocks the respective subpicture is composed of.

158. Data stream, having

a video encoded thereinto, wherein the video comprises a plurality of pictures,

wherein the data stream comprises a plurality of pictures in at least two layers,

wherein the pictures (1212) of at least one layer are split into a predetermined layer-specific number of subpictures (L2(1), L2(2), L2(3), L2(4)), one or more of the pictures or subpictures of one layer corresponds to one picture or subpictures in one or more other layer, and at least one of the subpictures comprises boundaries for boundary extension for motion compensation, and

an indication that at least one of the boundaries of corresponding subpictures (L2(1), L2(2), L2(3), L2(4)) or corresponding pictures in different layers are aligned with each other.

~~159. Data stream according to claim 158, wherein each of the pluralities of pictures (1212, 1213, 1214) in the at least two layers is split into one or more subpictures (L2(1), L2(2), L2(3), L2(4)), and having~~

~~an indication to the extent that all of the boundaries of corresponding subpictures in the different layers are aligned with each other.~~

~~160. Data stream (1945) of constant bitrate, having~~

~~a plurality of pictures (1910, 1920) encoded thereinto,~~

~~in a manner according to which each of the plurality of pictures (1910, 1920) is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and~~

~~wherein the data stream (1945) is encoded in a manner so that a subpicture data stream (1955) relating to at least one subpicture (1911, 1921) is extractable therefrom at a constant bitrate, by including dummy data (d), which is included in the data stream for the at least one subpicture and removing dummy data (d) included in the data stream for another subpicture to which the extracted data stream not relates.~~

~~161. Data stream (1945),~~

~~a video encoded thereinto, wherein the video has a plurality of pictures (1910, 1920), encoded into the data stream in a plurality of layers,~~

~~wherein each of the plurality of pictures of all layers is split into a predetermined number of subpictures (1911, 1912, 1913, 1921, 1922, 1923), each subpicture comprising boundaries for boundary extension for motion compensation, and~~

~~wherein the data stream is for subpicture extraction to an extracted data stream (1955) related to one or more subpictures (1911, 1921) of interest by dropping NAL units (1942, 1943, 1952, 1953; 2045, 2046, 2055, 2056) of the data stream not corresponding to the one or more subpictures (1911, 1921) and rewriting parameter sets and/or picture headers (HI1, HI2).~~

~~162. Data stream according to claim 161, having an indication that rewriting is allowed of variables indicating one or more of~~

~~subpicture width in luma samples,~~
~~subpicture height in luma samples,~~
~~level information,~~
~~HRD-related parameters, and~~
~~picture size.~~

~~163. Data stream, having~~

~~a video encoded thereinto, wherein the video comprises a plurality of pictures,~~

~~wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation, and~~

~~wherein the plurality of pictures is encoded in units of slices, and~~

~~a first syntax element and a subpicture identification parameter written into the data stream into a slice header of the slices,~~

~~wherein the first syntax element and the subpicture identification parameter is written into the data stream~~

~~in a manner increased by one, and~~

~~separated by a bit, set to one, in the slice header of at least one of the slices.~~

~~164. Data stream, according to claim 163, further having~~

~~the first syntax element written the slice header of the slices at a first bit length and the subpicture identification parameter written the slice header of the slices at a second bit length,~~

~~written the bit between the first syntax element and the subpicture identification parameter if the sum of the first and second bit lengths is larger than 24 bits, and~~

~~writing another bit, set to one, after the subpicture identification parameter.~~

~~165. Data stream, having~~

~~a video encoded thereinto, wherein the video comprises a plurality of pictures,~~

~~wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation, and~~

~~wherein the plurality of pictures is encoded in units of slices and a first syntax element and a subpicture identification parameter are written into a slice header of the slices,~~

~~wherein the first syntax element and the subpicture identification parameter are written into the data stream,~~

~~so that the first syntax element is written at a first bit length and the subpicture identification parameter is written at a second bit length,~~

~~in a manner so that the first syntax element precedes the subpicture identification parameter,~~

~~in a manner so that the first syntax element is written into the data stream increased by one, and~~

~~in a manner so that the subpicture identification parameter is written into the data stream increased by a certain value and followed by a bit, set to one, and~~

~~wherein the certain value, has~~

~~the value 1, if the sum of the first and second bit lengths is smaller than 31 bits, and~~

~~the value 4, if the sum of the first and second bit lengths is not smaller than 31 bits.~~

~~166. Data stream according to claim 165,~~

~~wherein the first syntax element is the picture order count parameter.~~

~~167. Data stream (2605), having~~

~~a video encoded thereinto, wherein the video comprises a plurality of pictures,~~

~~wherein each of the plurality of pictures is split into a predetermined number of subpictures, each subpicture comprising boundaries for boundary extension for motion compensation, and~~

~~wherein each of the subpictures is encoded using context-adaptive binary arithmetic coding, and~~

~~wherein the data stream comprises zero-words for at least one subpicture at the end of one or more slices (2631, 2632, 2633) of each subpicture so as to avoid that any of the subpictures exceeds a predetermined bin-to-bit ratio.~~

~~168. Data stream according to claim 167, having at the end of one or more slices of each subpicture of the at least one subpicture with the zero-words such that the number of bins coded for the respective subpicture into the data stream using the context adaptive arithmetic coding is less than or equal to a number determined using a product between a predetermined factor and a byte length of one or more VCL NAL units of the data stream associated with the respective subpicture.~~

~~169. Data stream according to claim 167, having at the end of one or more slices of each subpicture of the at least one subpicture with the zero-words such that the number of bins coded for the respective subpicture into the data stream using the context adaptive arithmetic coding is less than or equal to a number determined using a sum of a first product between a first predetermined factor and a byte length of one or more VCL NAL units of the data stream associated with the respective subpicture and a second product between a second predetermined factor, a minimum number of bits per coding block and a number of coding blocks the respective subpicture is composed of.~~

CLAIMS

1. An encoder configured to:

encode a picture of a video into a data stream, the picture comprising a plurality of subpictures,

wherein

the encoding of the picture comprises encoding, into the data stream, a first subpicture of the plurality of subpictures such that BinCountsInNalUnits for the first subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

2. The encoder of claim 1, wherein the encoding of the picture comprises encoding into the data stream, a second subpicture of the plurality of subpictures such that BinCountsInNalUnits for the second subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

3. The encoder of claim 1, wherein the encoding of the first subpicture comprises encoding a value of 1 for a subpic_treated_as_pic_flag associated with the first subpicture.

4. The encoder of claim 3, wherein the encoding of the first subpicture comprises

determining that BinCountsInNalUnits for the first subpicture is greater than (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32,

where

RawMinCuBits = MinCbSizeY * MinCbSizeY * (BitDepth + 2 * BitDepth / (SubWidthC * SubHeightC));

based on the value of 1 for the subpic treated as pic flag associated with the first subpicture and the determination that BinCountsInNalUnits for the first subpicture is greater than (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32,

adding one or more cabac_zero_words to the bitstream until BinCountsInNalUnits for the first subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

5. The encoder of claim 4, wherein the encoding of the picture comprises encoding into the data stream, a second subpicture of the plurality of subpictures such that BinCountsInNalUnits for the second subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

6. The encoder of claim 5, wherein the encoding of the second subpicture comprises encoding a value of 1 for a subpic_treated_as_pic_flag associated with the second subpicture.

7. The encoder of claim 6, wherein the encoding of the second subpicture comprises determining that BinCountsInNalUnits for the second subpicture is greater than (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32,
where
RawMinCuBits = MinCbSizeY * MinCbSizeY * (BitDepth + 2 * BitDepth / (SubWidthC * SubHeightC));
based on the value of 1 for the subpic_treated_as_pic_flag associated with the second subpicture and the determination that BinCountsInNalUnits for the second subpicture is greater than (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32,
adding one or more cabac_zero_words to the bitstream until BinCountsInNalUnits for the second subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

8. A video bitstream comprising an encoded picture, the encoded picture comprising a plurality of subpictures, the plurality of subpictures comprising a first subpicture such that BinCountsInNalUnits for the first subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

9. The video bitstream of claim 8, wherein the plurality of subpictures comprises a second subpicture such that BinCountsInNalUnits for the second subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

10. A decoder configured to decode a picture from a video bitstream, the picture comprising a plurality of subpictures, the plurality of subpictures comprising a first subpicture such that BinCountsInNalUnits for the first subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

11. The decoder of claim 10, wherein the plurality of subpictures comprises a second subpicture such that BinCountsInNalUnits for the second subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

12. An encoding method comprising the steps of:

encoding a picture of a video into a data stream, the picture comprising a plurality of subpictures,

wherein

the step of encoding the picture of the video into the data stream comprises encoding, into the data stream, a first subpicture of the plurality of subpictures such that BinCountsInNalUnits for the first subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

13. The encoding method of claim 12, wherein the step of encoding the picture of the video into the data stream comprises encoding into the data stream, a second subpicture of the plurality of subpictures such that BinCountsInNalUnits for the second subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

14. A decoding method comprising the steps of:

decoding a picture from a video bitstream, the picture comprising a plurality of subpictures, the plurality of subpictures comprising a first subpicture such that BinCountsInNalUnits for the first subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.

15. The decoder method claim 14, wherein the plurality of subpictures comprises a second subpicture such that BinCountsInNalUnits for the second subpicture is less than or equal to (32 ÷ 3) * NumBytesInVclNalUnits + (RawMinCuBits * PicSizeInMinCbsY) ÷ 32.