CLAIMS

1. An encoding apparatus for determining a predictor for encoding a block of a video image, the encoding apparatus comprising:

~~processing circuitry (600)~~a memory storing instructions; and

a processor configured to execute the instructions to:

obtain an initial motion vector for the block;

perform a search to obtain a refined motion vector for the block based on the initial motion vector; and

determine, after the search, a predictor for the block according to the refined motion vector~~;~~

~~wherein the processing circuitry is configured to determine the predictor according to the refined motion vector~~ using interpolation filtering with an interpolation filter, ~~and to use~~

wherein the interpolation filtering comprises using at least one sample value of an integer sample position located inside a window and a padded sample value for an integer sample position located outside the window ~~for the interpolation filtering,~~ ,

wherein the padded sample value is based on at least one sample value of a sample located inside the window~~.~~, and

wherein the window is defined as an extension by a number of rows and a number of columns of a block located on a position of the initial motion vector.

2. A decoding apparatus for determining a predictor for decoding a block of a video image, the decoding apparatus comprising ~~processing circuitry configured to:~~

a memory storing instructions; and

a processor configured to execute the instructions to:

obtain an initial motion vector for the block;

perform a search to obtain a refined motion vector for the prediction block based on the initial motion vector; and

determine, after the search, a predictor for the block~~, according to the refined motion vector;~~

~~wherein the processing circuitry is configured to determine the predictor~~ according to the refined motion vector using interpolation filtering with an interpolation filter, ~~and to use~~

wherein the interpolation filtering comprises using at least one sample value of an integer sample position located inside a window and a padded sample value for an integer sample position located outside the window ~~for the interpolation filtering, ,~~

wherein the padded sample value is based on at least one sample value of a sample located inside the window~~.~~, and

wherein the window is defined as an extension by a number of rows and a number of columns of a block located on a position of the initial motion vector.

3. ~~The apparatus~~ An encoding method for determining a predictor for encoding a block of a video image, the encoding method comprising:

obtaining an initial motion vector for the block;

performing a search to obtain a refined motion vector for the block based on the initial motion vector; and

determining, after the search, a predictor for the block according to ~~claims 1 or 2, wherein the processing circuitry (600) is configured to determine~~the refined motion vector using interpolation filtering with an interpolation filter,

wherein the interpolation filtering comprises using at least one sample value of an integer sample position located inside a window and a padded sample value for an integer sample position located outside the window,

wherein the padded sample value is based on at least one sample value of a sample located inside the window, and

wherein the window is defined as an extension by a number of rows and a number of columns of a block located on a position of the initial motion vector.

4. A decoding method for determining a predictor for decoding a block of a video image, the decoding method comprising:

obtaining an initial motion vector for the block;

performing a search to obtain a refined motion vector for the prediction block based on the initial motion vector; and

determining, after the search, a predictor for the block according to the refined motion vector using interpolation filtering with an interpolation filter,

wherein the interpolation filtering comprises using at least one sample value of an integer sample position located inside a window and a padded sample value for an integer sample position located outside the window,

wherein the padded sample value is based on at least one sample value of a sample located inside the window, and

wherein the window is defined as an extension by a number of rows and a number of columns of a block located on a position of the initial motion vector.

5. The decoding method according to claim 4, wherein the search comprises determining a refinement ~~of~~value for the initial motion vector based on a search space of candidate motion vectors, and ~~to determine~~

wherein the refined motion vector is determined based on the initial motion vector and the refinement value.

~~4.~~6. The ~~apparatus~~decoding method according to claim ~~3~~5, wherein the search space is located on a position defined by the initial motion vector.

~~5.~~7. The ~~apparatus~~decoding method according to ~~any of the preceding claims, wherein the processing circuitry (600) is configured to obtain~~claim 4, further comprising obtaining a difference between the block and the predictor.

~~6.~~8. The ~~apparatus~~decoding method according to claim ~~5, wherein the processing circuitry (600) is~~7, further ~~configured to reconstruct~~comprising reconstructing the block based on the predictor and the difference between the block and the predictor.

~~7.~~9. The ~~apparatus~~decoding method according to ~~any of the preceding claims~~claim 4, wherein the padded sample value is determined by mirroring, with respect to ~~the~~an axis of the interpolation filter ~~the~~, a value of the corresponding ~~assessed~~ integer sample position.

~~8.~~10. The ~~apparatus~~decoding method according to ~~any of the preceding claims~~claim 4, wherein the interpolation filter is a one-dimensional filter or a separable two-dimensional filter.

~~9.~~11. The ~~apparatus~~decoding method according to ~~any of the preceding claims~~claim 4, wherein the window is formed by all integer sample positions accessible for obtaining the predictor in a position specified by the initial motion vector.

~~10.~~12. The ~~apparatus~~decoding method according to ~~any of the preceding claims~~claim 4, wherein the window is defined by its vertical and/or horizontal size with respect to ~~at least one of:~~

~~— a block with a size of the block located on the initial motion vector position,~~

~~— the initial motion vector position, and~~

the vertical and horizontal length of the interpolation filter that is used for determining the predictor.

~~11.~~13. The ~~apparatus~~decoding method according to ~~any of claims 1 to 6 or 8 to 10~~claim 4, wherein the padded sample value for the integer sample position outside of the window is determined to be equal to the sample value of the at least one used integer sample position located inside the window, ~~which~~wherein the sample value of the at least one used integer sample position located inside the window is closest to the integer sample position located outside the window.

~~12.~~14. The ~~apparatus~~decoding method according to ~~any of claims 1 to 11~~claim 4, wherein the number of sample values to be padded depends on the difference between the initial motion vector and the refined motion vector.

~~13.~~15. The ~~apparatus~~decoding method according to ~~any of the preceding claims~~claim 5, wherein ~~said processing circuitry (600) is configured to determine~~determining the refinement of the initial motion vector ~~by~~comprises template matching with a template or bilateral matching, wherein

~~said~~ the template or bilateral matching~~:~~ comprises:

~~accesses~~accessing sample values at integer sample positions within a further window ~~(1120),~~ the further window ~~(1120)~~ including said search space and further integer sample positions accessible for the template or bilateral matching,

~~pads~~padding at least one sample value ~~(1030)~~ at an integer sample position located out of the further window by a padded sample value which is based on at least one sample within said further window, and

~~uses~~using the accessed integer sample position values as well as the padded sample values to perform the template or bilateral matching.

~~14.~~16. The ~~apparatus~~decoding method according to claim ~~13~~15, wherein:

~~said~~the search space includes at least one fractional sample position ~~(1, 2, 6)~~ with a value obtained by interpolation filtering with a filter of a predefined tap-size; and

the interpolation filtering uses said accessed integer sample position values and the at least one padded sample value to obtain said at least one fractional sample position value.

~~15.~~17. The ~~apparatus~~decoding method according to claim ~~14~~16, wherein the padded sample value used in the template or bilateral matching is determined by mirroring with respect to ~~the~~an axis of ~~the~~a filter the value of the corresponding ~~accessed~~ integer sample position.

~~16.~~18. The ~~apparatus~~decoding method according to claim ~~13 or 14~~16, wherein the padded sample value used in the template or bilateral matching is determined to be equal to the value on a closest of the accessed integer sample positions.

~~17.~~19. The ~~apparatus~~decoding method according to ~~any of claims 13 to~~claim 16, wherein

the further window ~~(1120)~~ is defined by its vertical and/or horizontal size with respect to ~~at least one of:~~

the search space~~,~~.

~~a block with a size of the block located on the initial motion vector position,~~

~~the initial motion vector position.~~

~~18.~~20. The ~~apparatus~~decoding method according to ~~any of claims 13 to 17~~claim 16, wherein ~~said~~the further window ~~(1120)~~ is the same as said window.

~~19.~~21. The ~~apparatus~~decoding method according to ~~any of claims 1 to 18~~claim 5, wherein ~~said~~the refinement value is determined by bilateral matching and ~~said processing circuitry is configured to obtain~~ obtaining at least two initial motion vectors pointing to positions in different reference pictures ~~(Ref0, Ref1)~~ and forming a pair of initial motion vectors ~~(Pair_0, Pair_1, …, Pair_N).~~.

~~20.~~22. The ~~apparatus~~decoding method according to ~~any of claims 1 to 19~~claim 5, wherein ~~said~~the refinement value is determined by template matching~~, said processing circuitry being~~ and determining the motion vector further ~~configured to~~comprises:

~~obtain~~obtaining a template for the block; and

~~determine~~determining the refinement ~~of~~value to the initial motion vector by template matching with ~~said~~the template in ~~said~~the search space.

~~21. An encoding method for determining a predictor for encoding a block of a video image, the encoding method comprising the steps of:~~

~~obtaining (1310, 1410) an initial motion vector for the block;~~

~~obtaining (1320, 1330, 1340, 1720; 2115, 2120, 2130, 2140, 2150, 2160) a refined motion vector for the block based on the initial motion vector; and~~

~~determining (1780) a predictor for the block according to the refined motion vector, wherein the determining step (1780) determines the predictor according to the refined motion vector using interpolation with an interpolation filter, and uses at least one sample value of an integer sample position located inside a window and a padded sample value for an integer sample position located outside the window for the interpolation filtering, wherein the padded sample value is based on at least one sample value of a sample located inside the window.~~

~~22. A decoding method for determining a predictor for decoding a block of a video image, the decoding method comprising the steps of~~

~~obtaining an initial motion vector for the block;~~

~~obtaining a refined motion vector for the prediction block based on the initial motion vector; and~~

~~determining (1780) a predictor for the block according to the refined motion vector using interpolation with an interpolation filter, using at least one sample value of an integer sample position located inside a window and a padded sample value for an integer sample position located outside the window for the interpolation~~

filtering, wherein the padded sample value is based on at least one sample value of a sample located inside the window.

23. The method according to claims 21 or 22, further comprising the step of determining a refinement of the initial motion vector based on a search space of candidate motion vectors, wherein the refined motion vector is determined based on the initial motion vector and the refinement.

24. The method according to claim 23, wherein the search space is located on a position defined by the initial motion vector.

25. The method according to any of claims 21 to 24, further comprising the step of obtaining a difference between the block and the predictor.

26. The method according to claim 25, further comprising the step of reconstructing the block based on the predictor and the difference between the block and the predictor.

27. The method according to any of claims 21 to 26, wherein the padded sample value is determined by mirroring with respect to the axis of the interpolation filter the value of the corresponding assessed integer sample position.

28. The method according to any of claims 21 to 27, wherein the interpolation filter is a one-dimensional filter or a separable two-dimensional filter.

29. The method according to any of claims 21 to 28, wherein the window is formed by all integer sample positions accessible for obtaining the predictor in a position specified by the initial motion vector.

30. The method according to any of claims 21 to 29, wherein the window is defined by its vertical and/or horizontal size with respect to at least one of:

- a block with a size of the block located on the initial motion vector position,

- the initial motion vector position, and
- the vertical and horizontal length of the interpolation filter that is used for determining the predictor.

31. The method according to any of claims 21 to 26 or 28 to 30, wherein the padded sample value for the integer sample position outside of the window is determined to be equal to the sample value of the at least one used integer sample position located inside the window, which is closest to the integer sample position located outside the window.

32. The method according to any of claims 21 to 31, wherein the number of sample values to be padded depends on the difference between the initial motion vector and the refined motion vector.

33. The method according to any of claims 21 to 32, wherein said step (1320, 1330, 1340, 1720; 2115, 2120, 2130, 2140, 2150, 2160) of obtaining a refinement determines the refinement of the initial motion vector by template matching with a template or bilateral matching, wherein

- said template or bilateral matching:
  - accesses sample values at integer sample positions within a further window, the further window including said search space and further integer sample positions accessible for the template or bilateral matching,
  - pads (1440) at least one sample value at an integer sample position located out of the further window by a padded sample value which is based on at least one sample within said further window, and
  - uses (1450) the accessed integer sample position values as well as the padded sample values to perform the template or bilateral matching.

34. The method according to claim 33, wherein
said search space includes at least one fractional sample position with a value obtained by interpolation filtering with a filter of a predefined tap-size;

and the interpolation filtering uses said accessed integer sample position values and the at least one padded sample value to obtain said at least one fractional sample position value.

35. The method according to claim 34, wherein the padded sample value used in the template or bilateral matching is determined by mirroring with respect to the axis of the filter the value of the corresponding assessed integer sample position.

36. The method according to claim 34 or 35, wherein the padded sample value used in the template or bilateral matching is determined to be equal to the value on a closest of the accessed integer sample positions.

37. The method according to any of claims 33 to 36, wherein the further window is defined by its vertical and/or horizontal size with respect to at least one of:

- the search space,
- a block with a size of the block located on the initial motion vector position,
- the initial motion vector position.

38. The method according to any of claims 33 to 37, wherein said further window is the same as said window.

39. The method according to any of claims 21 to 38, wherein said refinement is determined by bilateral matching and said obtaining step obtaining at least two initial motion vectors pointing to positions in different reference pictures and forming a pair of initial motion vectors.

40. The method according to any of claims 21 to 39, wherein said refinement is determined by template matching and said step of determining a motion vector further including

obtaining (1330; 2130) a template for the block and

determining (1340; 2140) the refinement of the initial motion vector by template matching with said template in said search space.

~~41.~~ ~~A~~23. A non-transitory computer readable medium storing instructions which when executed on a processor cause the processor to perform the method according to ~~any of claims 23 to 40~~claim 4.