~~**WHAT IS CLAIMED IS:**~~

CLAIMS

1. A method of decoding video data, the method comprising:

determining a prediction block for inter-predicting a current block;

determining horizontal and vertical displacements for gradient-based prediction refinement of one or more samples of the prediction block;

rounding the horizontal and vertical displacements to a precision level that is the same for different inter-prediction modes including an affine mode and a bi-directional optical flow (BDOF) mode;

~~determining one or more refinement offsets based on the rounded horizontal and vertical displacements;~~

determining a first gradient based on a first set of samples of the one or more samples of the prediction block;

determining a second gradient based on a second set of samples of the one or more samples of the prediction block;

determining one or more refinement offsets based on: the rounded horizontal and vertical displacements, and the first and second gradients, wherein determining the one or more refinement offsets comprises determining: $g_x(i,j) * \Delta v_x(i,j) + g_y(i,j) * \Delta v_y(i,j)$, wherein $g_x(i,j)$ is the first gradient for a sample of the one or more samples located at (i,j), $\Delta v_x(i,j)$ is the rounded horizontal displacement for the sample of the one or more samples located at (i,j), $g_y(i,j)$ is the second gradient for the sample of the one or more samples located at (i,j), and $\Delta v_y(i,j)$ is the rounded vertical displacement for the sample of the one or more samples located at (i,j);

performing gradient-based prediction refinement by at least modifying the one or more samples of the prediction block based on the determined one or more refinement offsets to generate a modified prediction block; and

reconstructing the current block based on the modified prediction block.

2. The method of claim 1, further comprising:

clipping the one or more refinement offsets,

wherein modifying the one or more samples of the prediction block comprises modifying

the one or more samples of the prediction block based on the clipped one or more refinement offsets.

3. The method of claim 1, further comprising:

determining an inter-prediction mode for inter-predicting the current block,

wherein determining the horizontal and vertical displacements comprises determining the horizontal and vertical displacements based on the determined inter-prediction mode.

4. The method of claim 1, wherein the precision level is 1/64.

~~5. The method of claim 1, further comprising:~~

~~determining a first gradient based on a first set of samples of the one or more samples of the prediction block; and~~

~~determining a second gradient based on a second set of samples of the one or more samples of the prediction block,~~

~~wherein determining the one or more refinement offsets comprises determining the one or more refinement offsets based on the rounded horizontal and vertical displacements and the first and second gradients.~~

~~6. The method of claim 5, wherein determining the one or more refinement offsets comprises determining: $g_x(i,j) * \Delta v_x(i,j) + g_y(i,j) * \Delta v_y(i,j)$, wherein $g_x(i,j)$ is the first gradient for a sample of the one or more samples located at (i,j), $\Delta v_x(i,j)$ is the rounded horizontal displacement for the sample of the one or more samples located at (i,j), $g_y(i,j)$ is the second gradient for the sample of the one or more samples located at (i,j), and $\Delta v_y(i,j)$ is the rounded vertical displacement for the sample of the one or more samples located at (i,j).~~

~~7~~5. The method of claim 1, wherein the prediction block is a first prediction block, the current block is a first current block, the horizontal and vertical displacements are first horizontal and vertical displacements, the one or more refinement offsets are first one or more refinement offsets, the rounded horizontal and vertical displacements are first rounded horizontal and vertical displacements, and the modified prediction block is a first modified prediction block, the

method further comprising:

determining a second prediction block for inter-predicting a second current block;

determining second horizontal and vertical displacements for gradient-based prediction refinement of one or more samples of the second prediction block;

rounding the second horizontal and vertical displacements to the same precision level to which the first horizontal and vertical displacements were rounded to generate second rounded horizontal and vertical displacements;

determining second one or more refinement offsets based on the second rounded horizontal and vertical displacements;

modifying the one or more samples of the second prediction block based on the determined second one or more refinement offsets to generate a second modified prediction block; and

reconstructing the second current block based on the second modified prediction block.

~~8~~6. A method of encoding video data, the method comprising:

determining a prediction block for inter-predicting a current block;

determining horizontal and vertical displacements for gradient-based prediction refinement of one or more samples of the prediction block;

rounding the horizontal and vertical displacements to a precision level that is the same for different inter-prediction modes including an affine mode and a bi-directional optical flow (BDOF) mode~~-~~;

~~determining one or more refinement offsets based on the rounded horizontal and vertical displacements;~~

~~—~~determining a first gradient based on a first set of samples of the one or more samples of the prediction block;

determining a second gradient based on a second set of samples of the one or more samples of the prediction block;

determining one or more refinement offsets based on: the rounded horizontal and vertical displacements, and the first and second gradients, wherein determining the one or more refinement offsets comprises determining: $g_x(i,j) * \Delta v_x(i,j) + g_y(i,j) * \Delta v_y(i,j)$, wherein $g_x(i,j)$ is the first gradient for a sample of the one or more samples located at (i,j), $\Delta v_x(i,j)$ is the

rounded horizontal displacement for the sample of the one or more samples located at (i,j), $g_y(i,j)$ is the second gradient for the sample of the one or more samples located at (i,j), and $\Delta v_y(i,j)$ is the rounded vertical displacement for the sample of the one or more samples located at (i,j);

performing gradient-based prediction refinement by at least modifying the one or more samples of the prediction block based on the determined one or more refinement offsets to generate a modified prediction block;

determining residual values indicative of a difference between the current block and the modified prediction block; and

signaling information indicative of the residual values.

~~9~~7. The method of claim ~~8~~6, further comprising:

clipping the one or more refinement offsets,

wherein modifying the one or more samples of the prediction block comprises modifying the one or more samples of the prediction block based on the clipped one or more refinement offsets.

~~10~~8. The method of claim ~~8~~6, further comprising:

determining an inter-prediction mode for inter-predicting the current block,

wherein determining the horizontal and vertical displacements comprises determining the horizontal and vertical displacements based on the determined inter-prediction mode.

~~11~~9. The method of claim ~~8~~6, wherein the precision level is 1/64.

~~12~~10. The method of claim ~~8, further comprising:~~

~~determining a first gradient based on a first set of samples of the one or more samples of the prediction block; and~~

~~determining a second gradient based on a second set of samples of the one or more samples of the prediction block,~~

~~wherein determining the one or more refinement offsets comprises determining the one or more refinement offsets based on the rounded horizontal and vertical displacements and the first and second gradients.~~

~~13. The method of claim 12, wherein determining the one or more refinement offsets comprises determining: $g_x(i,j) * \Delta v_x(i,j) + g_y(i,j) * \Delta v_y(i,j)$, wherein $g_x(i,j)$ is the first gradient for a sample of the one or more samples located at (i,j), $\Delta v_x(i,j)$ is the rounded horizontal displacement for the sample of the one or more samples located at (i,j), $g_y(i,j)$ is the second gradient for the sample of the one or more samples located at (i,j), and $\Delta v_y(i,j)$ is the rounded vertical displacement for the sample of the one or more samples located at (i,j).~~

~~14. The method of claim 8~~6, wherein the prediction block is a first prediction block, the current block is a first current block, the horizontal and vertical displacements are first horizontal and vertical displacements, the one or more refinement offsets are first one or more refinement offsets, the rounded horizontal and vertical displacements are first rounded horizontal and vertical displacements, the modified prediction block is a first modified prediction block, and the residual values comprise first residual values, the method further comprising:

determining a second prediction block for inter-predicting a second current block;

determining second horizontal and vertical displacements for gradient-based prediction refinement of one or more samples of the second prediction block;

rounding the second horizontal and vertical displacements to the same precision level to which the first horizontal and vertical displacements were rounded to generate second rounded horizontal and vertical displacements;

determining second one or more refinement offsets based on the second rounded horizontal and vertical displacements;

modifying the one or more samples of the second prediction block based on the determined second one or more refinement offsets to generate a second modified prediction block;

determining second residual values indicative of a difference between the second current block and the second modified prediction block; and

signaling information indicative of the second residual values.

~~15~~11. A device for coding video data, the device comprising:

a memory configured to store one or more samples of a prediction block; and

processing circuitry configured to:

determine the prediction block for inter-predicting a current block;

determine horizontal and vertical displacements for gradient-based prediction refinement of the one or more samples of the prediction block;

round the horizontal and vertical displacements to a precision level that is the same for different inter-prediction modes including an affine mode and a bi-directional optical flow (BDOF) mode;

~~determine one or more refinement offsets based on the rounded horizontal and vertical displacements;~~

determine a first gradient based on a first set of samples of the one or more samples of the prediction block;

determine a second gradient based on a second set of samples of the one or more samples of the prediction block;

perform gradient-based prediction refinement, wherein to perform gradient-based prediction refinement, the processing circuitry is configured to at least determine one or more refinement offsets based: on the rounded horizontal and vertical displacements, and the first and second gradients, wherein, to determine, the one or more refinement offsets the processing circuitry is configured to determine: $g_x(i,j) * \Delta v_x(i,j) + g_y(i,j) * \Delta v_y(i,j)$, wherein $g_x(i,j)$ is the first gradient for a sample of the one or more samples located at (i,j), $\Delta v_x(i,j)$ is the rounded horizontal displacement for the sample of the one or more samples located at (i,j), $g_y(i,j)$ is the second gradient for the sample of the one or more samples located at (i,j), and $\Delta v_y(i,j)$ is the rounded vertical displacement for the sample of the one or more samples located at (i,j);

modify the one or more samples of the prediction block based on the determined one or more refinement offsets to generate a modified prediction block; and

code the current block based on the modified prediction block.

~~16~~12. The device of claim ~~15~~11, wherein to code the current block, the processing circuitry is configured to reconstruct the current block based on the modified prediction block.

~~17~~13. The device of claim ~~15~~11, wherein to code the current block, the processing circuitry is

configured to:

determine residual values indicative of a difference between the current block and the modified prediction block; and

signal information indicative of the residual values.

~~18~~14. The device of claim ~~15~~11, wherein the processing circuitry is configured to:

clip the one or more refinement offsets,

wherein to modify the one or more samples of the prediction block, the processing circuitry is configured to modify the one or more samples of the prediction block based on the clipped one or more refinement offsets.

~~19~~15. The device of claim ~~15~~11, wherein the processing circuitry is configured to:

determine an inter-prediction mode for inter-predicting the current block,

wherein to determine the horizontal and vertical displacements, the processing circuitry is configured to determine the horizontal and vertical displacements based on the determined inter-prediction mode.

~~20~~16. The device of claim ~~15~~11, wherein the precision level is 1/64.

~~21~~17. The device of claim ~~15, wherein the processing circuitry is configured to:~~

~~determine a first gradient based on a first set of samples of the one or more samples of the prediction block; and~~

~~determine a second gradient based on a second set of samples of the one or more samples of the prediction block,~~

~~wherein to determine the one or more refinement offsets, the processing circuitry is configured to determine the one or more refinement offsets based on the rounded horizontal and vertical displacements and the first and second gradients.~~

~~22. The device of claim 21, wherein to determine the one or more refinement offsets, the processing circuitry is configured to determine: $g_x(i,j) * \Delta v_x(i,j) + g_y(i,j) * \Delta v_y(i,j)$, wherein g_x(i,j) is the first gradient for a sample of the one or more samples located at (i,j), Δv_x(i,j) is the~~

~~rounded horizontal displacement for the sample of the one or more samples located at (i,j), g_y(i,j) is the second gradient for the sample of the one or more samples located at (i,j), and Δv_y(i,j) is the rounded vertical displacement for the sample of the one or more samples located at (i,j).~~

~~23. The device of claim 15~~11, wherein the prediction block is a first prediction block, the current block is a first current block, the horizontal and vertical displacements are first horizontal and vertical displacements, the one or more refinement offsets are first one or more refinement offsets, the rounded horizontal and vertical displacements are first rounded horizontal and vertical displacements, and the modified prediction block is a first modified prediction block, and wherein the processing circuitry is configured to:

determine a second prediction block for inter-predicting a second current block;

determine second horizontal and vertical displacements for gradient-based prediction refinement of one or more samples of the second prediction block;

round the second horizontal and vertical displacements to the same precision level to which the first horizontal and vertical displacements were rounded to generate second rounded horizontal and vertical displacements;

determine second one or more refinement offsets based on the second rounded horizontal and vertical displacements;

modify the one or more samples of the second prediction block based on the determined second one or more refinement offsets to generate a second modified prediction block; and

code the second current block based on the second modified prediction block.

~~24~~18. The device of claim ~~15~~11, further comprising a display configured to display decoded video data.

~~25~~19. The device of claim ~~15~~11, further comprising a camera configured to capture the video data to be encoded.

~~26~~20. The device of claim ~~15~~11, wherein the device comprises one or more of a camera, a computer, a wireless communication device, a broadcast receiver device, or a set-top box.

~~27~~21. A non-transitory computer-readable storage medium storing instructions thereon that when executed cause one or more processors to:

determine a prediction block for inter-predicting a current block;

determine horizontal and vertical displacements for gradient-based prediction refinement of one or more samples of the prediction block;

round the horizontal and vertical displacements to a precision level that is the same for different inter-prediction modes including an affine mode and a bi-directional optical flow (BDOF) mode;

~~determine one or more refinement offsets based on the rounded horizontal and vertical displacements;~~

determine a first gradient based on a first set of samples of the one or more samples of the prediction block;

determine a second gradient based on a second set of samples of the one or more samples of the prediction block;

determine one or more refinement offsets based on: the rounded horizontal and vertical displacements, and the first and second gradients, wherein the instructions that cause the one or more processors to determine the one or more refinement offsets comprise instructions that cause the one or more processors to determine: $g_x(i,j) * \Delta v_x(i,j) + g_y(i,j) * \Delta v_y(i,j)$, wherein $g_x(i,j)$ is the first gradient for a sample of the one or more samples located at (i,j), $\Delta v_x(i,j)$ is the rounded horizontal displacement for the sample of the one or more samples located at (i,j), $g_y(i,j)$ is the second gradient for the sample of the one or more samples located at (i,j), and $\Delta v_y(i,j)$ is the rounded vertical displacement for the sample of the one or more samples located at (i,j);

perform gradient-based prediction refinement, wherein the instructions that cause the one or more processors to perform gradient-based prediction refinement comprises instructions that cause the one or more processors to at least modify the one or more samples of the prediction block based on the determined one or more refinement offsets to generate a modified prediction block; and

code the current block based on the modified prediction block.

~~28~~22. A device for coding video data, the device comprising:

means for determining a prediction block for inter-predicting a current block;

means for determining horizontal and vertical displacements for gradient-based prediction refinement of one or more samples of the prediction block;

means for rounding the horizontal and vertical displacements to a precision level that is the same for different inter-prediction modes including an affine mode and a bi-directional optical flow (BDOF) mode;

means for determining ~~one or more refinement offsets~~a first gradient based on a first set of samples of the ~~rounded horizontal and vertical displacements~~one or more samples of the prediction block;

means for determining a second gradient based on a second set of samples of the one or more samples of the prediction block;

means for determining one or more refinement offsets based on: the rounded horizontal and vertical displacements, and the first and second gradients, wherein the means for determining the one or more refinement offsets comprise means for determining: $g_x(i,j) * \Delta v_x(i,j) + g_y(i,j) * \Delta v_y(i,j)$, wherein $g_x(i,j)$ is the first gradient for a sample of the one or more samples located at (i,j), $\Delta v_x(i,j)$ is the rounded horizontal displacement for the sample of the one or more samples located at (i,j), $g_y(i,j)$ is the second gradient for the sample of the one or more samples located at (i,j), and $\Delta v_y(i,j)$ is the rounded vertical displacement for the sample of the one or more samples located at (i,j);

means for performing gradient-based prediction refinement, wherein the means for performing gradient-based prediction refinement comprise means for modifying the one or more samples of the prediction block based on the determined one or more refinement offsets to generate a modified prediction block; and

means for coding the current block based on the modified prediction block.