CLAIMS

1. An encoder comprising:

a memory; and

a processor connected to the memory and configured to generate a prediction image in order to encode a current block based on a first parameter, a second parameter, a third parameter, a fourth parameter, and a fifth parameter that are derived in a bi-directional optical flow (BDOF) process, wherein

the first parameter is derived based on the following expression:

[Math. 1]

$$\sum_{[i,j]\in\Omega} \mathrm{abs}\left(I_x^{\,1} + I_x^{\,0}\right);$$

the second parameter is derived based on the following expression:

[Math. 2]

$$\sum_{[i,j]\in\Omega} \mathrm{abs}\left(I_y^{\,1} + I_y^{\,0}\right);$$

the third parameter is derived based on the following expression:

[Math. 3]

$$\sum_{[i,j]\in\Omega} \left(-\mathrm{sign}\left(I_x^{\,1} + I_x^{\,0}\right) \times \left(I^0 - I^1\right)\right);$$

the fourth parameter is derived based on the following expression:

[Math. 4]

$$\sum_{[i,j]\in\Omega} \left(-\mathrm{sign}\left(I_y^{\,1} + I_y^{\,0}\right) \times \left(I^0 - I^1\right)\right);$$ and

the fifth parameter is derived based on the following expression,

[Math. 5]

$$\sum_{[i,j]\in\Omega} \left(\mathrm{sign}\left(I_y^{\,1} + I_y^{\,0}\right) \times \left(I_x^{\,1} + I_x^{\,0}\right)\right),$$

where:

Ω indicates a set of relative pixel positions;

[i, j] indicates a relative pixel position in the set Ω defined by a horizontal position i and a vertical position j;

I_x^0 indicates a horizontal gradient value at a first pixel position in a first gradient image, and I_x^1 denotes a horizontal gradient value at the first pixel position in a second gradient image, the first pixel position being determined based on a relative pixel position [i, j], the first gradient image and the second gradient image corresponding to the current block;

I_y^0 indicates a vertical gradient value at the first pixel position in the first gradient image, and I_y^1 denotes a vertical gradient value at the first pixel position in the second gradient image;

I^0 indicates a pixel value at the first pixel position in a first interpolated image corresponding to the current block;

I^1 indicates a pixel value at the first pixel position in a second interpolated image corresponding to the current block;

the abs function outputs an absolute value of an argument; and

the sign function outputs a sign of an argument which is -1, 0, or 1.