【DESCRIPTION】

【Invention Title】

APPARATUS FOR ENCODING AN IMAGE

【Technical Field】

The present invention relates to an image processing apparatus and method, and more particularly, to an apparatus for reducing the amount of residual signals of an image and entropy-coding the residual signals.

【Background Art】

To efficiently transmit a moving picture signal at a low data rate while maintaining high image quality, various digital moving picture compression technologies have been proposed. These moving picture compression technologies include H.261, Motion Picture Experts Group (MPEG)-2/H.262, H.263, MPEG-4, Advanced Video Coding (AVC)/H.264, and so on. The compression technologies include a discrete cosine transform (DCT) scheme, a motion compensation (MC) scheme, a quantization scheme, an entropy coding scheme, and so on.

For image coding, each picture is divided into a plurality of slices, and each slice is divided into a plurality of coding blocks of a predetermined size. Since an image of a high-definition (HD) grade or above has many flat areas, an image compression can be improved by encoding the image with coding blocks that are larger than a macroblock (MB).

Therefore, new prediction technique is required and changes in transform coding, entropy coding, intra prediction and inter prediction is required as the size of the coding unit increases to increase image compression ratio without increase of the complexity of image compression.

【Disclosure】

【Technical Problem】

The present invention is directed to an apparatus for encoding a moving picture, and more particularly, to an apparatus for effectively encoding transformed residual signals of a moving picture having a predetermined size or more.

【Technical Solution】

One aspect of the present invention provides an apparatus for encoding an image, the apparatus comprising: a coding mode determiner configured to divide an input image into a plurality of coding units; an intra predictor configured to generate a prediction block using intra prediction; a transform/quantization unit configured to transform and quantize a residual block to generate a quantized transform block; an inverse quantization/transform unit configured to inversely quantize and inversely transform the quantized transform block; a deblocking filter configured to perform a deblocking filtering process to image data received from the inverse quantization/transform unit; and an entropy coder configured to entropy-code quantized transform coefficients of the quantized transform block, wherein the quantized transform coefficients are divided into a plurality of sub-blocks if it is determined that a size of a transform block is equal to or larger than 8x8 in an intra prediction, wherein the plurality of sub-blocks are scanned and non-zero coefficients of each sub-block are scanned according to a scan pattern, wherein said scan pattern for scanning the plurality of sub-blocks and for scanning the non-zero coefficients of

each sub-block is determined by an intra prediction mode of the prediction block to entropy-code the scanned non-zero coefficients, wherein, when the intra prediction mode is a horizontal mode, the scan pattern is a vertical scan pattern,

wherein a scan pattern for generating a plurality of flags is the same as the scan pattern for scanning the non-zero coefficients of each sub-block, wherein each flag indicates whether a corresponding transform coefficient is 0 or not,

wherein the intra prediction mode is coded based on an upper intra prediction mode of an upper block of a current block and a left intra prediction mode of a left block of the current block, and when the upper block or the left block is not coded in intra prediction mode, the upper intra prediction mode or the left intra prediction mode is set to a DC mode.

In an example, an image encoding apparatus may be provided, including: an intra predictor configured to determine an intra prediction mode and generate a prediction block according to the intra prediction mode; a transform/quantization unit configured to transform and quantize a residual block of the prediction block to generate a quantized block; and an entropy coder configured to entropy-code quantized coefficients of the quantized block, wherein, when a size of the quantized block is equal to 8x8, the quantized coefficients of the quantized block are divided into a plurality of subsets, and the quantized coefficients of each subset and the plurality of subsets are scanned according to a scan pattern determined by the intra prediction mode, and the quantized coefficients of each subset are scanned in a reverse direction from a last non-zero coefficient according to the scan pattern.

Preferably, the plurality of subsets are scanned in a reverse direction.

Preferably, the intra prediction mode is coded using an upper intra prediction mode and a left intra prediction mode, and when the upper intra prediction mode or the left intra prediction mode is unavailable, the upper intra prediction mode or the left intra prediction mode is set to a DC mode.

CLAIMS

1. An apparatus for encoding an image, the apparatus comprising:

a coding mode determiner configured to divide an input image into a plurality of coding units;

an intra predictor configured to generate a prediction block using intra prediction;

a transform/quantization unit configured to transform and quantize a residual block to generate a quantized transform block;

an inverse quantization/transform unit configured to inversely quantize and inversely transform the quantized transform block;

a deblocking filter configured to perform a deblocking filtering process to image data received from the inverse quantization/transform unit; and

an entropy coder configured to entropy-code quantized transform coefficients of the quantized transform block,

wherein the quantized transform coefficients are divided into a plurality of sub-blocks if it is determined that a size of a transform block is equal to or larger than 8x8 in an intra prediction,

wherein the plurality of sub-blocks are scanned and non-zero coefficients of each sub-block are scanned according to a scan pattern, wherein said scan pattern for scanning the plurality of sub-blocks and for scanning the non-zero coefficients of each sub-block is determined by an intra prediction mode of the prediction block to entropy-code the scanned non-zero coefficients, wherein, when the intra prediction mode is a horizontal mode, the scan pattern is a vertical scan pattern,

wherein a scan pattern for generating a plurality of flags is the same as the scan pattern for scanning the non-zero coefficients of each sub-block, wherein each flag indicates whether a corresponding transform coefficient is 0 or not,

wherein the intra prediction mode is coded based on an upper intra prediction mode of an upper block of a current block and a left intra prediction mode of a left block of the current block, and when the upper block or the left

block is not coded in intra prediction mode, the upper intra prediction mode or the left intra prediction mode is set to a DC mode.

2. The apparatus of claim 1, wherein the entropy coder scans the non-zero coefficients of each sub-block in a reverse direction from a last non-zero coefficient of each sub-block.

3. The apparatus of claim 1, wherein the entropy coder scans the plurality of sub-blocks in a reverse direction from a last sub-block.

4. The apparatus of claim 1, wherein the entropy coder encodes positions of the non-zero coefficients and information for identifying the non-zero coefficients of each sub-block.

5. The apparatus of claim 1, wherein when the intra prediction mode is a vertical mode, the scan pattern is a horizontal scan pattern.

6. The apparatus of claim 1, wherein the intra predictor generates reference pixels when unavailable reference pixels exist.