UNIFIED BLOCK VECTOR PREDICTION FOR INTRA PICTURE BLOCK COMPENSATION

[0001] This present disclosure claims the benefit of priority to U.S. Patent Application No. 16/531,827, "UNIFIED BLOCK VECTOR PREDICTION FOR INTRA PICTURE BLOCK COMPENSATION" filed on August 5, 2019, which claims the benefit of priority to U.S. Provisional Application No. 62/816,051, "UNIFIED BLOCK VECTOR PREDICTION FOR INTRA PICTURE BLOCK COMPENSATION" filed on March 8, 2019.

TECHNICAL FIELD

[0002] The present disclosure describes embodiments generally related to video coding.

BACKGROUND

[0003] The background description provided herein is for the purpose of generally presenting the context of the disclosure. Work of the presently named inventors, to the extent the work is described in this background section, as well as aspects of the description that may not otherwise qualify as prior art at the time of filing, are neither expressly nor impliedly admitted as prior art against the present disclosure.

[0004] Video coding and decoding can be performed using inter-picture prediction with motion compensation. Uncompressed digital video can include a series of pictures, each picture having a spatial dimension of, for example, 1920 x 1080 luminance samples and associated chrominance samples. The series of pictures can have a fixed or variable picture rate (informally also known as frame rate), of, for example 60 pictures per second or 60 Hz. Uncompressed video has significant bitrate requirements. For example, 1080p60 4:2:0 video at 8 bit per sample (1920x1080 luminance sample resolution at 60 Hz frame rate) requires close to 1.5 Gbit/s bandwidth. An hour of such video requires more than 600 GBytes of storage space.

[0005] One purpose of video coding and decoding can be the reduction of redundancy in the input video signal, through compression. Compression can help reduce the aforementioned bandwidth or storage space requirements, in some cases by two orders of magnitude or more. Both lossless and lossy compression, as well as a combination thereof can be employed. Lossless compression refers to techniques where an exact copy of the original signal can be reconstructed from the compressed original signal. When using lossy compression, the

averaged block vector included in the block vector predictor candidate list is less than the maximum allowed number, the processing circuitry inserts a default block vector into the block vector predictor candidate list.

[0031] In an embodiment, the default block vector is (0, 0).

[0032] In an embodiment, the selected block vector predictor candidate is not rounded when the non-zero residue exists for the current block.

[0033] In an embodiment, when one of the block vector predictor candidates included in the block vector predictor candidate list is invalid, the processing circuitry performs a pruning process or clipping process to the one of the block vector predictor candidates.

[0034] In an embodiment, the one of the block vector predictor candidates is determined to be invalid when a reference block predicted by the one of the block vector predictor candidates is out of an allowed search range for intra block copy (IBC) prediction mode.

[0035] Aspects of the disclosure also provide a non-transitory computer-readable medium storing instructions which when executed by a computer for video decoding cause the computer to perform the method for video decoding.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] Further features, the nature, and various advantages of the disclosed subject matter will be more apparent from the following detailed description and the accompanying drawings in which:

[0037] FIG. 1A is a schematic illustration of an exemplary subset of intra prediction modes.

[0038] FIG. 1B is an illustration of exemplary intra prediction directions.

[0039] FIG. 2 is a schematic illustration of a simplified block diagram of a communication system in accordance with an embodiment.

[0040] FIG. 3 is a schematic illustration of a simplified block diagram of a communication system in accordance with an embodiment.

[0041] FIG. 4 is a schematic illustration of a simplified block diagram of a decoder in accordance with an embodiment.

[0042] FIG. 5 is a schematic illustration of a simplified block diagram of an encoder in accordance with an embodiment.

[0043] FIG. 6 shows a block diagram of an encoder in accordance with another embodiment.

present, in substantially identical functional form, in a corresponding encoder. For this reason, the disclosed subject matter focuses on decoder operation. The description of encoder technologies can be abbreviated as they are the inverse of the comprehensively described decoder technologies. Only in certain areas a more detail description is required and provided below.

[0078] During operation, in some examples, the source coder (530) may perform motion compensated predictive coding, which codes an input picture predictively with reference to one or more previously-coded picture from the video sequence that were designated as "reference pictures". In this manner, the coding engine (532) codes differences between pixel blocks of an input picture and pixel blocks of reference picture(s) that may be selected as prediction reference(s) to the input picture.

[0079] The local video decoder (533) may decode coded video data of pictures that may be designated as reference pictures, based on symbols created by the source coder (530). Operations of the coding engine (532) may advantageously be lossy processes. When the coded video data may be decoded at a video decoder (not shown in FIG. 5), the reconstructed video sequence typically may be a replica of the source video sequence with some errors. The local video decoder (533) replicates decoding processes that may be performed by the video decoder on reference pictures and may cause reconstructed reference pictures to be stored in the reference memory (534). In this manner, the video encoder (503) may store copies of reconstructed reference pictures locally that have common content as the reconstructed reference pictures that will be obtained by a far-end video decoder (absent transmission errors).

[0080] The predictor (535) may perform prediction searches for the coding engine (532). That is, for a new picture to be coded, the predictor (535) may search the reference picture memory (534) for sample data (as candidate reference pixel blocks) or certain metadata such as reference picture motion vectors, block shapes, and so on, that may serve as an appropriate prediction reference for the new pictures. The predictor (535) may operate on a sample block-by-pixel block basis to find appropriate prediction references. In some cases, as determined by search results obtained by the predictor (535), an input picture may have prediction references drawn from multiple reference pictures stored in the reference picture memory (534).

[0081] The controller (550) may manage coding operations of the source coder (530), including, for example, setting of parameters and subgroup parameters used for encoding the video data.

form at least one averaged block vector. The process (1200) adds the at least one averaged block vector into the block vector predictor candidate list.

[0175] In one embodiment, when a total number of the block vectors of the plurality of spatial neighboring blocks, the block vectors of the previously coded blocks, and the at least one averaged block vector included in the block vector predictor candidate list is less than the maximum allowed number, the process (1200) adds one or more default block vectors into the block vector predictor candidate list.

[0176] After constructing the block vector predictor candidate list for the current block, the process (1200) proceeds to step (S1250).

[0177] At step (S1250), the process (1200) selects a block vector predictor candidate from the constructed block vector predictor candidate list, for example, based on an index indicated in the prediction information. The index may be signaled explicitly or implicitly.

[0178] After selecting the block vector predictor candidate, the process (1200) proceeds to step (S1260).

[0179] At step (S1260), the process (1200) reconstructs the current block according to the selected block vector predictor candidate.

[0180] After reconstructing the current block, the process (1200) terminates.

[0181] The techniques described above, can be implemented as computer software using computer-readable instructions and physically stored in one or more computer-readable media. For example, FIG. 13 shows a computer system (1300) suitable for implementing certain embodiments of the disclosed subject matter.

[0182] The computer software can be coded using any suitable machine code or computer language, that may be subject to assembly, compilation, linking, or like mechanisms to create code comprising instructions that can be executed directly, or through interpretation, micro-code execution, and the like, by one or more computer central processing units (CPUs), Graphics Processing Units (GPUs), and the like.

[0183] The instructions can be executed on various types of computers or components thereof, including, for example, personal computers, tablet computers, servers, smartphones, gaming devices, internet of things devices, and the like.

[0184] The components shown in FIG. 13 for computer system (1300) are exemplary in nature and are not intended to suggest any limitation as to the scope of use or functionality of the computer software implementing embodiments of the present disclosure. Neither should the

[0196] While this disclosure has described several exemplary embodiments, there are alterations, permutations, and various substitute equivalents, which fall within the scope of the disclosure.

Appendix A: Acronyms

AMVP: Advanced Motion Vector Prediction

ASIC: Application-Specific Integrated Circuit

BMS: Benchmark Set

BV: Block Vector

CANBus: Controller Area Network Bus

CD: Compact Disc

CPR: Current Picture Referencing

CPUs: Central Processing Units

CRT: Cathode Ray Tube

CTBs: Coding Tree Blocks

CTUs: Coding Tree Units

CU: Coding Unit

DPB: Decoder Picture Buffer

DVD: Digital Video Disc

FPGA: Field Programmable Gate Areas

GOPs: Groups of Pictures

GPUs: Graphics Processing Units

GSM: Global System for Mobile communications

HEVC: High Efficiency Video Coding

HRD: Hypothetical Reference Decoder

IBC: Intra Block Copy

IC: Integrated Circuit

JEM: Joint Exploration Model

LAN: Local Area Network

LCD: Liquid-Crystal Display

WHAT IS CLAIMED IS:

1. A method for video decoding in a decoder, comprising:

decoding prediction information for a current block in a current coded picture that is a part of a coded video sequence, the prediction information indicating an intra block copy (IBC) prediction mode used for the current block, and an index to select a block vector predictor candidate from a block vector predictor candidate list for the current block;

determining whether coding of the current block in the IBC prediction mode is performed in an explicit mode or an implicit mode based on whether the prediction information indicates that a difference exists between a block vector and a corresponding block vector predictor, the coding of the current block being determined to be in the implicit mode when the prediction information indicates that the difference does not exist and being determined to be in the explicit mode when the difference does exist;

constructing the block vector predictor candidate list for the current block based on a sequence of candidates, the block vector predictor candidate list having a first number of block vector predictor candidates in the implicit mode and having a second number of block vector predictor candidates in the explicit mode;

selecting the block vector predictor candidate from the constructed block vector predictor candidate list based on the index indicated in the prediction information; and

reconstructing the current block according to the selected block vector predictor candidate.

2. The method of claim 1, further comprising:

determining whether a first block vector of a first spatial neighboring block of a plurality of spatial neighboring blocks of the current block is available;

inserting the first block vector into the block vector predictor candidate list in response to the determination that the first block vector of the first spatial neighboring block of the plurality of spatial neighboring blocks of the current block is available;

determining whether a second block vector of a second spatial neighboring block of the plurality of spatial neighboring blocks of the current block is available and whether the second block vector of the second spatial neighboring block is the same as the first block vector of the first spatial neighboring block; and

inserting the second block vector into the block vector predictor candidate list in response to the determination that the second block vector of the second spatial neighboring block of the plurality of spatial neighboring blocks of the current block is available and that the second block vector of the second spatial neighboring block is not the same as the first block vector of the first spatial neighboring block.

3. The method of claim 2, wherein the first spatial neighboring block of the current block is adjacent to a lower-left corner of the current block and a bottom side of the first spatial neighboring block is aligned to a bottom side of the current block, and the second spatial neighboring block of the current block is adjacent to an upper-right corner of the current block and a right side of the second spatial neighboring block is aligned to a right side of the current block.

4. The method of claim 2, wherein the first spatial neighboring block of the current block is adjacent to the lower-left corner of the current block and a top side of the first spatial neighboring block is aligned to the bottom side of the current block, and the second spatial neighboring block of the current block is adjacent to the upper-right corner of the current block and a left side of the second spatial neighboring block is aligned to the right side of the current block.

5. The method of claim 2, wherein the first spatial neighboring block of the current block is adjacent to a left side of the current block and the second spatial neighboring block of the current block is adjacent to a top side of the current block.

6. The method of claim 2, further comprising:

when a total number of the block vectors of the plurality of spatial neighboring blocks included in the block vector predictor candidate list is less than a maximum allowed number that is based on whether the difference does exist between the block vector and the corresponding block vector predictor;

selecting a third block vector of a previously coded block from a plurality of block vectors of previously coded blocks;

determining whether the selected third block vector is different from the plurality of spatial neighboring blocks included in the block vector predictor candidate list; and

inserting the selected third block vector into the block vector predictor candidate list in response to the determination that the selected third block vector is different from the plurality of spatial neighboring blocks included in the block vector predictor candidate list.

7. The method of claim 6, further comprising:

when a total number of the block vectors of the plurality of spatial neighboring blocks and the previously coded blocks included in the block vector predictor candidate list is less than the maximum allowed number and is above one;

selecting a plurality of block vector predictor candidates from the block vector predictor candidate list;

averaging the selected plurality of block vector predictor candidates to form at least one averaged block vector; and

inserting the at least one averaged block vector into the block vector predictor candidate list.

8. The method of claim 7, further comprising:

when a total number of the block vectors of the plurality of spatial neighboring blocks, the block vectors of the previously coded blocks, and the at least one average block vector included in the block vector predictor candidate list is less than the maximum allowed number,

inserting a default block vector into the block vector predictor candidate list.

9. The method of claim 8, wherein the default block vector is (0, 0).

10. The method of claim 1, wherein the selected block vector predictor candidate is not rounded when the difference does exist between the block vector and the corresponding block vector predictor for the current block.

11. The method of claim 1, further comprising:

when one of the block vector predictor candidates included in the block vector predictor candidate list is invalid,

performing a pruning process or clipping process to the one of the block vector predictor candidates.

12. The method of claim 11, wherein the one of the block vector predictor candidates is determined to be invalid when a reference block predicted by the one of the block vector predictor candidates is out of an allowed search range for intra block copy (IBC) prediction mode.

13. The method of claim 1, wherein the prediction information indicates whether the difference exists between the block vector and the corresponding block vector predictor based on a flag that indicates that the current block is not being coded in implicit mode.

14. An apparatus, comprising a processing circuitry configured to perform the method according to any one of claims 1 to 13.

15. A non-transitory computer-readable storage medium storing a program executable by at least one processor to perform the method according to any one of claims 1 to 13.