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Abstract

Methods, systems, and computer readable media for
5 transcoding video data based on metadata are provided.
In some embodiments, methods for transcoding video data
using metadata are provided, the methods comprising:
receiving a first plurality of encoded images from a
storage device; decoding the first plurality of encoded
10 images based on a first coding scheme to generate a
plurality of decoded images; receiving a plurality of
encoding parameters from the storage device; and
encoding the plurality of decoded images into a second
plurality of encoded images based on a second coding
15 scheme and the plurality of encoding parameters.

What is claimed is:

1. A method for transcoding video data, the method comprising:

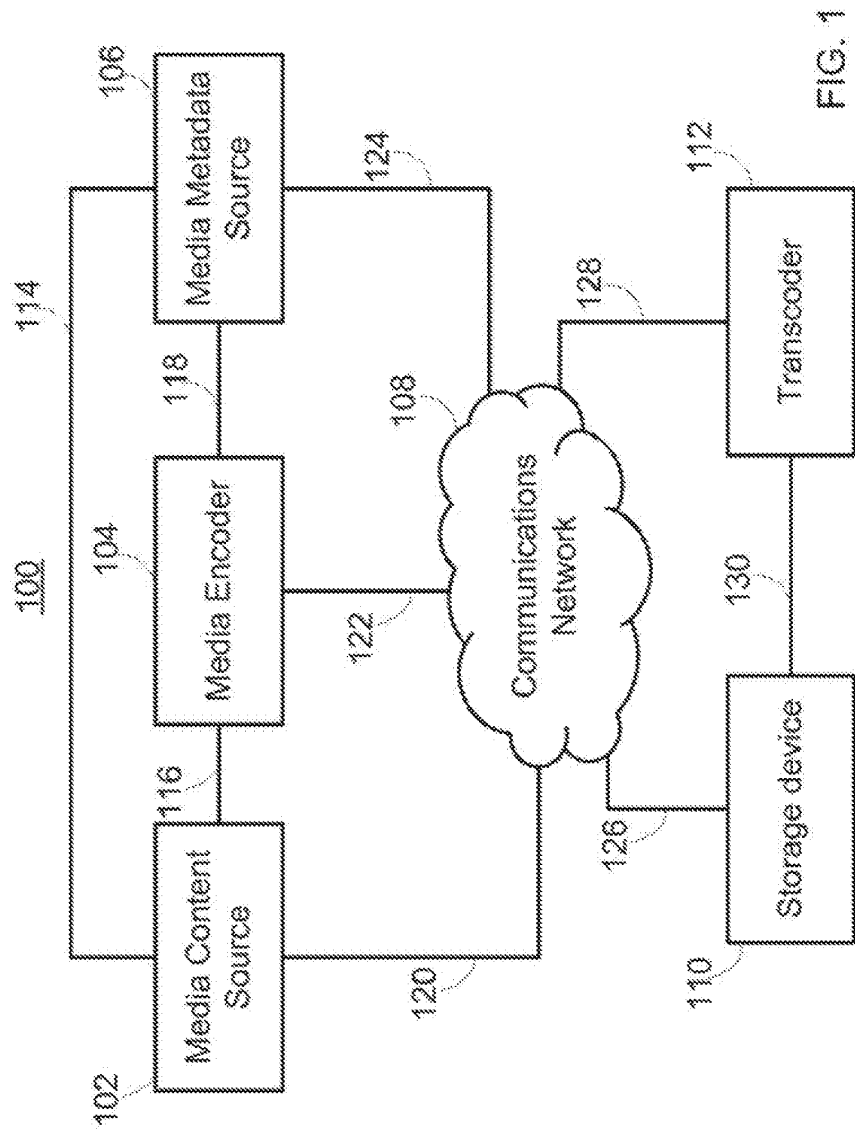
5 receiving a first plurality of encoded images from a storage device;

 decoding the first plurality of encoded images based on a first coding scheme to generate a plurality of decoded images;

10 receiving a plurality encoding parameters from the storage device; and

 encoding the plurality of decoded images into a second plurality of encoded images based on a second coding scheme and the plurality of encoding parameters.

15



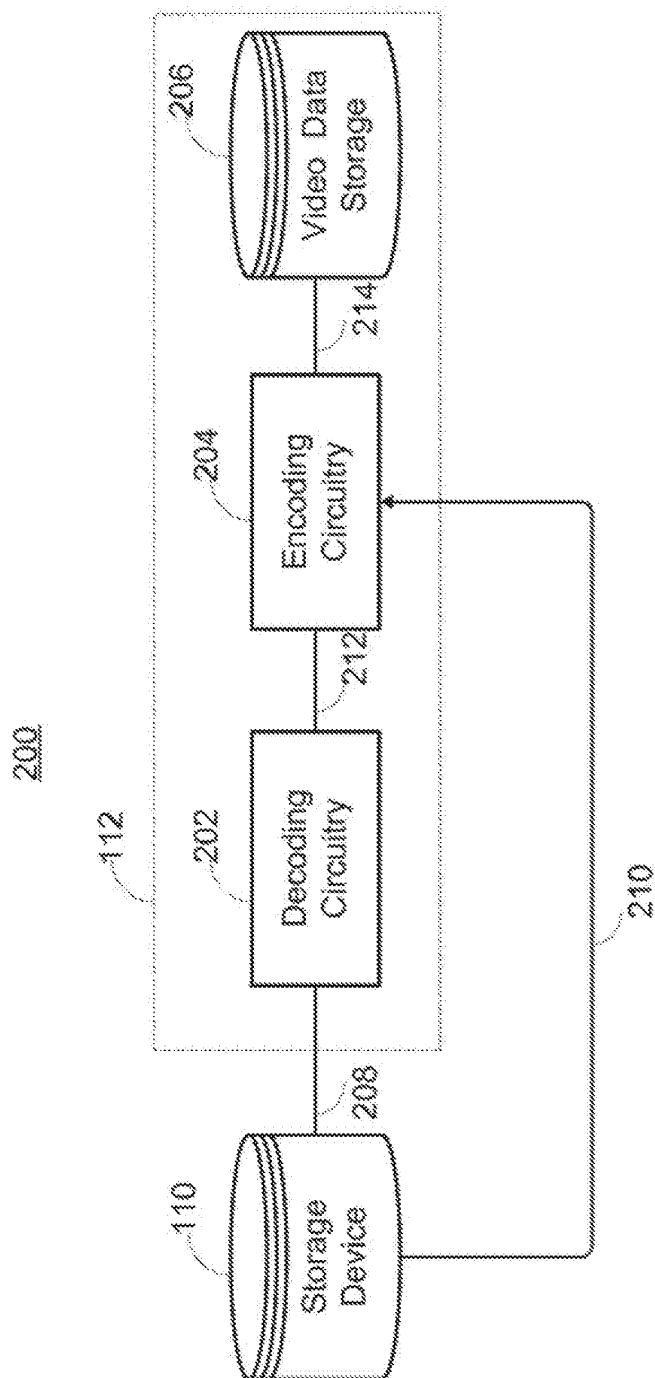


FIG. 2

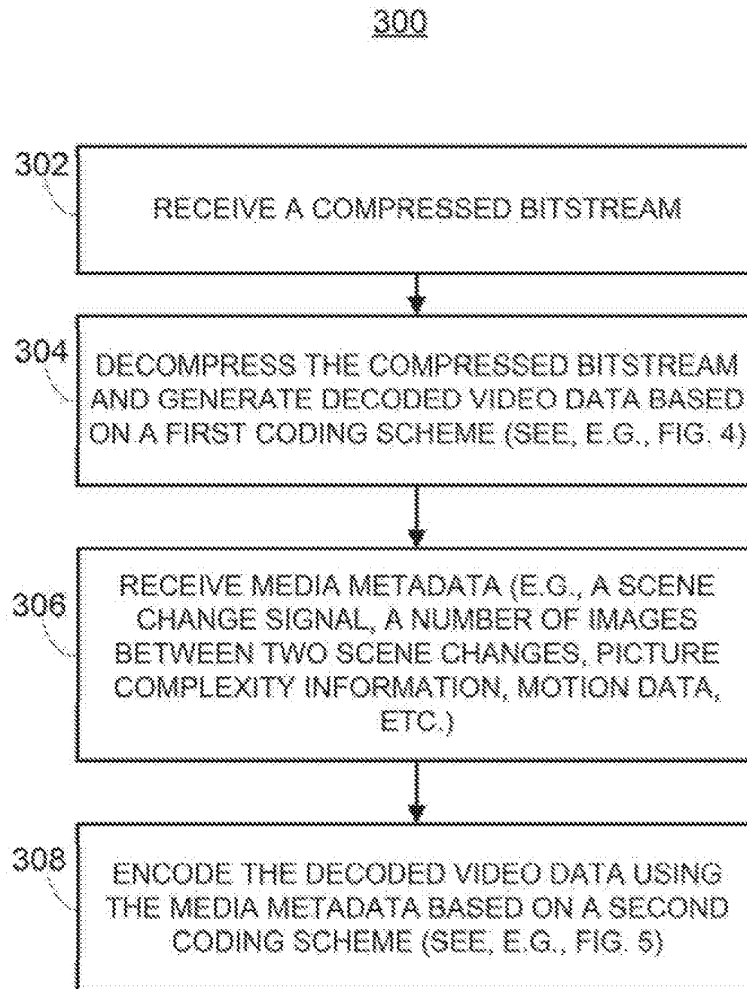


FIG. 3

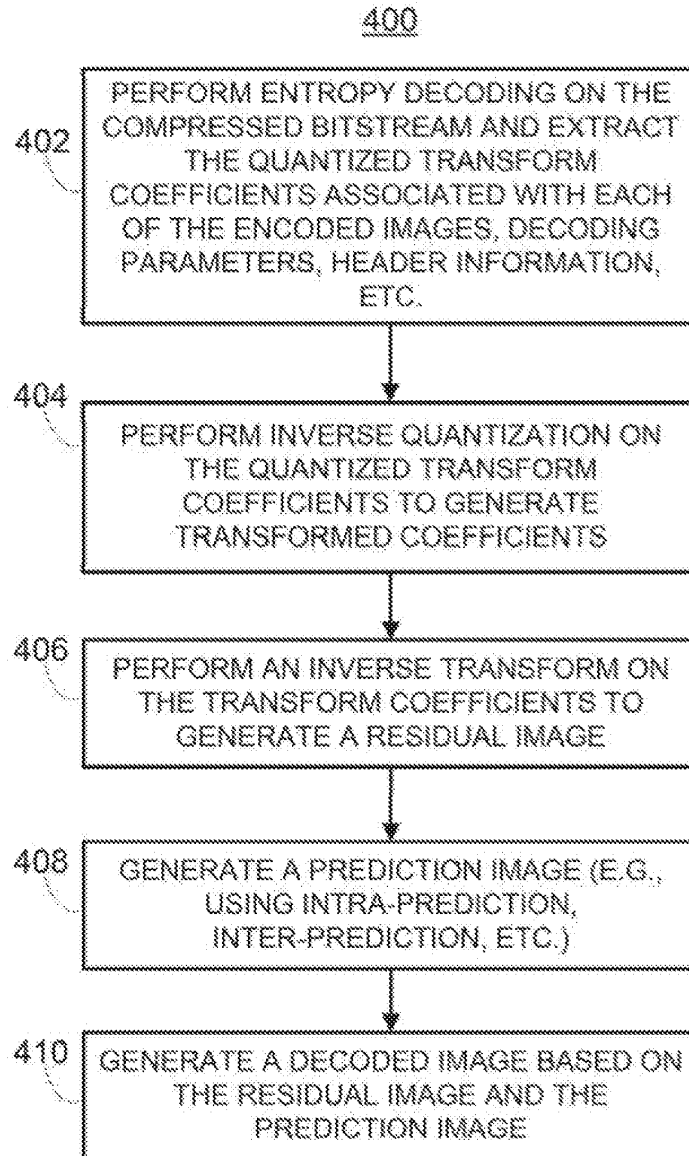


FIG. 4

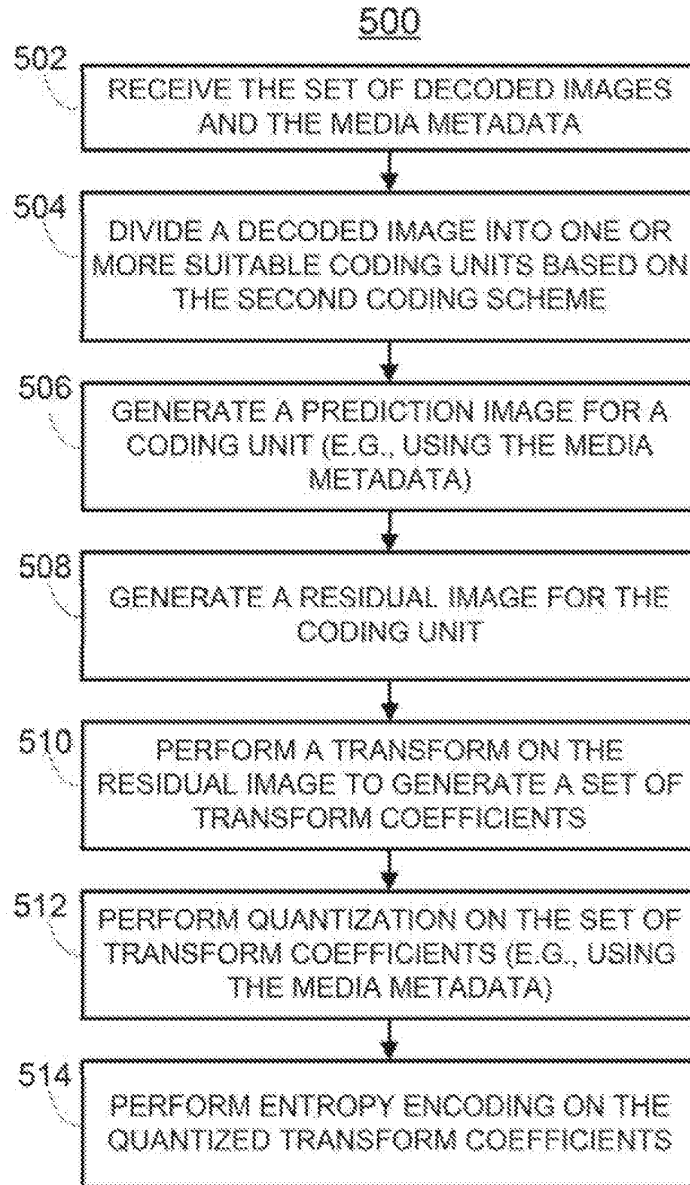


FIG. 5

5 **SYSTEMS, METHODS, AND MEDIA FOR TRANSCODING VIDEO DATA**

Cross-Reference to Related Applications

[0001] The current application is a continuation of
U.S. Patent Application Serial No. 15/905,695 entitled,
10 "Systems, Methods, and Media for Transcoding Video Data
According to Encoding Parameters Indicated by Received
Metadata" to Naletov et al., filed February 26, 2018,
which application is a continuation of U.S. Patent
Application Serial No. 13/841,943, entitled "Systems,
15 Methods, and Media for Transcoding Video Data According
to Encoding Parameters Indicated by Received Metadata"
to Naletov et al., filed March 15, 2013 and issued on
February 27, 2018 as U.S. Patent No. 9,906,785. The
disclosures of U.S. Patent Application Serial Nos.
20 15/905,695 and 13/841,943 are hereby incorporated by
reference in their entireties.

Background of the Invention

[2] Transcoding is an important task in video
25 distribution applications. For example, a transcoder
can receive input video data having a first format and
convert the input video data into video data having a
second format. More particularly, for example, the
first format and the second format can correspond to

different video coding standards, such as Motion JPEG, JPEG 2000, MPEG-2, MPEG-4, H.263, H.264, AVC, High Efficiency Video Coding (HEVC), etc. Alternatively or additionally, the first format and the second format
5 can have different bitrates and/or resolutions.

[3] There are many current approaches to transcoding video data. For example, a transcoder can decode video data compressed in a first format into raw video data and re-encode the raw video data into a second format.

10 More particularly, for example, the transcoder can estimate encoding parameters and re-encode the raw video data using the estimated encoding parameters. The estimation of encoding parameters within a transcoder is very time-consuming.

15 [4] Accordingly, new mechanisms for transcoding video data are desirable.

Summary of the Invention

[5] In view of the foregoing, systems, methods, and
20 media for transcoding video data using metadata are provided.

[6] In some embodiments, methods for transcoding video data using metadata are provided, the methods comprising: receiving a first plurality of encoded
25 images from a storage device; decoding the first plurality of encoded images based on a first coding scheme to generate a plurality of decoded images; receiving a plurality of encoding parameters from the storage device; and encoding the plurality of decoded
30 images into a second plurality of encoded images based on a second coding scheme and the plurality of encoding parameters.

[7] In some embodiments, systems for transcoding video data using metadata are provided, the systems comprising: processing circuitry configured to: receive a first plurality of encoded images from a storage device; decode the first plurality of encoded images based on a first coding scheme to generate a plurality of decoded images; receive a plurality of encoding parameters from the storage device; and encode the plurality of decoded images into a second plurality of encoded images based on a second coding scheme and the plurality of encoding parameters.

[8] In some embodiments, non-transitory media containing computer-executable instructions that, when executed by a processing circuitry, cause the processing circuitry to performing a method for transcoding video data are provided, the method comprising: receiving a first plurality of encoded images from a storage device; decoding the first plurality of encoded images based on a first coding scheme to generate a plurality of decoded images; receiving a plurality of encoding parameters from the storage device; and encoding the plurality of decoded images into a second plurality of encoded images based on a second coding scheme and the plurality of encoding parameters.

Brief Description of the Drawings

[9] The above and other objects and advantages of the invention will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

[10] FIG. 1 shows a generalized block diagram of an example of an architecture of hardware that can be used in accordance with some embodiments of the invention;

5 [11] FIG. 2 shows a block diagram of an example of storage device and transcoder in accordance with some embodiments of the invention;

[12] FIG. 3 shows a flow chart of an example of a process for transcoding video data in accordance with some embodiments of the invention;

10 [13] FIG. 4 shows a flow chart of an example of a process for decoding video data in accordance with some embodiments of the invention; and

[14] FIG. 5 shows a flow chart of an example of a process for encoding video data in accordance with some
15 embodiments of the invention.

Detailed Description of Embodiments

[15] This invention generally relates to mechanisms (which can be systems, methods, media, etc.) for
20 transcoding video data based on metadata. In some embodiments, the mechanisms can be used to transcode video data having a first format into video data having a second format.

[16] In some embodiments, the mechanisms can receive a
25 compressed bitstream and media metadata. The mechanisms can decompress the compressed bitstream and generate decoded video data based on a first coding scheme. The mechanisms can then encode the decoded video data based on a second coding scheme.

30 [17] In some embodiments, the media metadata can include any suitable data. For example, the media metadata can include a set of coding parameters that can be used to encoding video data. More particularly,

the media metadata can include information about one or more video scenes, such as a scene change indication signal, the number of frames between two scenes, the type of a video scene, etc. The media metadata can also include motion data, intra-prediction information, picture complexity information, etc. about video data. [18] In some embodiments, the mechanisms can encode the decoded video data using the media content data. For example, the mechanisms can generate a prediction image based on the motion data, the intra-prediction information, etc. As another example, the mechanisms can perform rate-control on the decoded video data based on the information about the video scenes, picture complexity information, etc.

[19] Turning to FIG. 1, a generalized block diagram of an example 100 of an architecture of hardware that can be used in accordance with some embodiments is shown. As illustrated, architecture 100 can include a media content source 102, a media encoder 104, a media metadata source 106, a communications network 108, a storage device 110, a transcoder 112, and communications paths 114, 116, 118, 120, 122, 124, 126, 128, and 130.

[20] Media content source 102 can include any suitable device that can provide media content. For example, media content source 102 can include one or more suitable cameras that can be configured to capture still images or moving images. As another example, media content source 102 can include one or more types of content distribution equipment for distributing any suitable media content, including television distribution facility equipment, cable system head-end equipment, satellite distribution facility equipment,

programming source equipment (e.g., equipment of television broadcasters, such as NBC, ABC, HBO, etc.), intermediate distribution facility equipment, Internet provider equipment, on-demand media server equipment, and/or any other suitable media content provider equipment. NBC is a trademark owned by the National Broadcasting Company, Inc., ABC is a trademark owned by the ABC, INC., and HBO is a trademark owned by the Home Box Office, Inc.

10 [21] Media content source 102 may be operated by the originator of content (e.g., a television broadcaster, a Webcast provider, etc.) or may be operated by a party other than the originator of content (e.g., an on-demand content provider, an Internet provider of content of broadcast programs for downloading, etc.).

15 [22] Media content source 102 may be operated by cable providers, satellite providers, on-demand providers, Internet providers, providers of over-the-top content, and/or any other suitable provider(s) of content.

20 [23] Media content source 102 may include a remote media server used to store different types of content (including video content selected by a user), in a location remote from any of the user equipment devices. Systems and methods for remote storage of content, and providing remotely stored content to user equipment are discussed in greater detail in connection with Ellis et al., U.S. Patent No. 7,761,892, issued July 20, 2010, which is hereby incorporated by reference herein in its entirety.

25 [24] As referred to herein, the term "media content" or "content" should be understood to mean one or more electronically consumable media assets, such as television programs, pay-per-view programs, on-demand

programs (e.g., as provided in video-on-demand (VOD) systems), Internet content (e.g., streaming content, downloadable content, Webcasts, etc.), movies, films, video clips, audio, audio books, and/or any other media or multimedia and/or combination of the same. As referred to herein, the term "multimedia" should be understood to mean media content that utilizes at least two different content forms described above, for example, text, audio, images, video, or interactivity content forms. Media content may be recorded, played, displayed or accessed by user equipment devices, but can also be part of a live performance. In some embodiments, media content can include over-the-top (OTT) content. Examples of OTT content providers include YOUTUBE, NETFLIX, and HULU, which provide audio and video via IP packets. Youtube is a trademark owned by Google Inc., Netflix is a trademark owned by Netflix Inc., and Hulu is a trademark owned by Hulu, LLC.

[25] Media content can be provided from any suitable source in some embodiments. In some embodiments, media content can be electronically delivered to a user's location from a remote location. For example, media content, such as a Video-On-Demand movie, can be delivered to a user's home from a cable system server. As another example, media content, such as a television program, can be delivered to a user's home from a streaming media provider over the Internet.

[26] Media encoder 104 can include any suitable circuitry that is capable of encoding media content. For example, media encoder 104 can include one or more suitable video encoders, audio encoders, video decoders, audio decoders, etc. More particularly, for example, media encoder 104 can include one or more

video encoders that can encode video data including a set of images in accordance with a suitable coding standard, such as Motion JPEG, JPEG 2000, MPEG-2, MPEG-4, H.263, H.264, AVC, High Efficiency Video Coding (HEVC), etc. As referred to herein, an image can have any suitable size and shape. For example, an image can be a frame, a field, or any suitable portion of a frame or a field, such as a slice, a block, a macroblock, a set of macroblocks, a coding tree unit (CTU), a coding tree block (CTB), etc.

[27] Media metadata source 106 can include any suitable circuitry that is capable of providing metadata for media content. The metadata for media content can include any suitable information about the media content. For example, the metadata can include one or more coding parameters that can be used by suitable encoding circuitry and/or suitable decoding circuitry to encode and/or decode video data including multiple video frames.

[28] In a more particular example, the metadata can include information about one or more video scenes, each of which can be composed of a set of images that have similar content. More particularly, for example, the metadata can include scene change information that can indicate the start and/or end of one or more scene changes in the video data. In some embodiments, the metadata can also include a set of parameters that can indicate the type of each of the scene changes, such as a shot change, a fading change, a dissolving change, etc. In some embodiments, the metadata can include the number of images between two scene changes. For example, the metadata can include the number of images between two consecutive scene changes, two scene

changes of a given type (e.g., such as two shot changes), etc.

[29] In another more particular example, the media metadata can include picture complexity information.

5 The picture complexity information can include any suitable information about the spatial and/or temporal complexity of an image, such as a frame, a field, a slice, a macroblock, a sub-macroblock, a CTU, a CTB, etc.

10 [30] In some embodiments, for example, the picture complexity information can include spatial complexity of an image that can indicate the amount of intra-distortion across the image. The amount of intra-distortion can be measured in any suitable manner. For
15 example, the amount of intra-distortion of the image can be measured based on the variances of pixel values, luminance, brightness, or other characteristics of the image using a suitable metric, such as the mean absolute difference (MAD), the mean square error (MSE),
20 etc. In some embodiments, the spatial complexity of a frame can be measured using the sum of the spatial complexity of the macroblocks and/or CTUs of the frame. In some embodiments, the picture complexity information can include a map of spatial complexity distribution
25 within a frame for each frame of the video data.

[31] In some embodiments, for example, the picture complexity information can include temporal complexity of an image that can indicate the amount of motion between the image and one or more reference images.

30 The amount of motion can be represented in any suitable manner. For example, the amount of motion between the image and a reference can be measured using a suitable difference metric, such as the sum of the absolute

difference (SAD), the sum of the squared difference (SSD), the mean absolute difference (MAD), the sum of absolute transformed differences (SATD), etc. More particularly, for example, the temporal complexity of a frame can be represented as the SAD, SSD, MAD, SATD, etc. between two consecutive frames. In some embodiments, the picture complexity information can include a map of temporal complexity distribution within a frame for each frame of the video data.

5

10 [32] In yet another more particular example, the metadata can include motion data about the video data. The motion data can be generated in any suitable manner and can include any suitable data about changes among video frames due to object motions, camera motions,

15 uncovered regions, lighting changes, etc. More particularly, for example, media metadata source 106 can generate a motion vector map for each video frame of the media content, motion characteristics (e.g., high motion, slow motion, etc.) of one or a set of

20 frames, the number of B-frames between two P-frames, etc. In some embodiments, the motion data can be generated based on a suitable motion estimation algorithm, such as a block matching algorithm, an optical flow algorithm, a sub-pixel motion estimation algorithm, a hierarchical block matching algorithm, etc.

25 For example, in some embodiments, the motion vector map can include a set of integer vectors corresponding to each integer pixel of a video frame. As another example, the motion vector map can include a set of

30 fractional motion vectors corresponding to each sub-pixel of the video frame (e.g., 1/2 pixel, 1/4 pixel, 1/8 pixel, etc.). In some embodiments, the media metadata can also include one or more reference lists

that can contain a set of frames that can serve as reference frames.

[33] As yet another example, the media metadata can include intra-prediction data about the media content.

5 The intra prediction data can include any suitable data that can be used for intra prediction under a suitable coding standard. For example, the intra-prediction data can include a set of candidate intra prediction modes, such as a vertical mode, a horizontal mode, a DC
10 mode, a diagonal down-left mode, a diagonal down-right mode, a vertical-right mode, a horizontal-down mode, a vertical-left mode, a horizontal-up mode, a plane mode, an intra-angular mode, etc. Additionally, the intra-prediction data can include a coding cost and/or
15 distortion corresponding to each intra-prediction mode.

[34] In some embodiments, the media metadata can be stored based on the play order of the video frames.

[35] Storage device 110 can be any suitable digital storage mechanism in some embodiments. For example,
20 storage 110 can include any device for storing electronic data, program instructions, computer software, firmware, register values, etc., such as random-access memory, read-only memory, hard drives, optical drives, digital video disc (DVD) recorders,
25 compact disc (CD) recorders, BLU-RAY disc (BD) recorders, BLU-RAY 3D disc recorders, digital video recorders (DVR, sometimes called a personal video recorder, or PVR), solid state devices, quantum storage devices, gaming consoles, gaming media, or any other
30 suitable fixed or removable storage devices, and/or any combination of the same. Storage 110 may be used to store media content, media metadata, media guidance data, executable instructions (e.g., programs,

software, scripts, etc.) for providing an interactive media guidance application, and for any other suitable functions, and/or any other suitable data or program code, in accordance with some embodiments. Nonvolatile
5 memory may also be used (e.g., to launch a boot-up routine and other instructions), in some embodiments. In some embodiments, storage 110 can store media content, encoded video data, and/or metadata provided by media content source 102, media encoder 104, and/or
10 media metadata source 106.

[36] Transcoder 112 can include any suitable circuitry that is capable of converting input media content having a first format into media content having a second format. For example, transcoder 112 can include
15 a suitable video transcoder that can convert a first set of images that are encoded in accordance with a first coding scheme into a second set of images that are encoded in accordance with a second coding scheme. In some embodiments, the first coding scheme and the
20 second coding scheme may have different target bitrates. In some embodiments, the first set of encoded images and the second set of encoded images may have different resolutions, such as spatial resolutions, temporal resolutions, quality resolutions,
25 etc. In some embodiments, the first coding scheme and the second coding scheme may correspond to different coding standards, such as Motion JPEG, JPEG 2000, MPEG-2, MPEG-4/AVC, H.263, H.264, High Efficiency Video Coding (HEVC), etc. More particularly, for example, in
30 some embodiments, transcoder 112 can convert a set of images encoded based on MPEG-2 standard into a set of images encoded based on HEVC standard.

[37] In some embodiments, communications network 108 may be any one or more networks including the Internet, a mobile phone network, a mobile voice, a mobile data network (e.g., a 3G, 4G, or LTE network), a cable network, a satellite network, a public switched telephone network, a local area network, a wide area network, a fiber-optic network, any other suitable type of communications network, and/or any suitable combination of communications networks.

10 [38] In some embodiments, media content source 102, media encoder 104, media metadata source 106, storage device 110, and transcoder 112 can be implemented in any suitable hardware. For example, each of media content source 102, media encoder 104, media metadata
15 source 106, storage device 110, and transcoder 112 can be implemented in any of a general purpose device such as a computer or a special purpose device such as a client, a server, mobile terminal (e.g., mobile phone), etc. Any of these general or special purpose devices
20 can include any suitable components such as a hardware processor (which can be a microprocessor, digital signal processor, a controller, etc.).

[39] In some embodiments, each of media content source 102, media encoder 104, media metadata source 106,
25 storage device 110, and transcoder 112 can be implemented as a stand-alone device or integrated with other components of architecture 100.

[40] In some embodiments, media content source 102 can be connected to media metadata source 106 through
30 communications path 114. In some embodiments, media encoder 104 can be connected to media content source 102 and media metadata source 106 through communications paths 116 and 118, respectively. In

some embodiments, communications network 108 can be connected to media content source 102, media encoder 104, media metadata source 106, storage device, and transcoder 112 through communications paths 120, 122, 124, 126, and 128, respectively. In some embodiments, storage device 110 can be connected to transcoder 112 through communications path 130.

[41] Communications paths 116, 118, 120, 122, 124, 126, 128, and 130 may separately or together include one or more communications paths, such as, a satellite path, a fiber-optic path, a cable path, a path that supports Internet communications (e.g., IPTV), free-space connections (e.g., for broadcast or other wireless signals), or any other suitable wired or wireless communications path or combination of such paths, in some embodiments.

[42] Turning to FIG. 2, a block diagram of an example 200 of storage device 110 and transcoder 112 of FIG. 1 in accordance with some embodiments of the disclosure is shown.

[43] As illustrated, transcoder 112 may include a decoding circuitry 202, an encoding circuitry 204, a video-data storage 206, and communication paths 208, 210, 212, and 214.

[44] Decoding circuitry 202 can include any suitable circuitry that is capable of performing video decoding. For example, decoding circuitry 202 can include one or more decoders that can decode a set of encoded images based on a suitable coding standard, such as MPEG-2, MPEG-4, AVC, H.263, H.264, HEVC, etc.

[45] Encoding circuitry 204 can include any suitable circuitry that is capable of performing video encoding. For example, encoding circuitry 204 can include one or

more suitable encoders that can encode a set of images based on a suitable coding standard, such as MPEG-2, MPEG-4, AVC, H.263, H.264, HEVC, etc. In some embodiments, encoding circuitry 204 can also include
5 scaler circuitry for upconverting and/or downconverting content into a preferred output format.

[46] Decoding circuitry 202 can be connected to encoding circuitry 204 through communication path 210. Encoding circuitry 204 can be connected to video
10 storage 206 through communication path 214. Transcoder 112 may be connected to media storage 110 through communication paths 208 and 212.

[47] Each of decoding circuitry 202 and encoding circuitry 204 can include any suitable processing
15 circuitry. As referred to herein, processing circuitry can be any suitable circuitry that includes one or more microprocessors, microcontrollers, digital signal processors, programmable logic devices, field-programmable gate arrays (FPGAs), application-specific
20 integrated circuits (ASICs), hardware processors, etc., and may include a multi-core processor (e.g., dual-core, quad-core, hexa-core, or any suitable number of cores) or a supercomputer, in some embodiments. In some embodiments, processing circuitry may be
25 distributed across multiple separate processors or processing units, such as, for example, multiple of the same type of processing units (e.g., two Intel Core i7 processors) or multiple different processors (e.g., an Intel Core i5 processor and an Intel Core i7
30 processor).

[48] Video data storage 206 can be any suitable digital storage mechanism in some embodiments. For example, video data storage 206 can include any device for

storing electronic data, program instructions, computer software, firmware, register values, etc., such as random-access memory, read-only memory, hard drives, optical drives, digital video disc (DVD) recorders, compact disc (CD) recorders, BLU-RAY disc (BD) recorders, BLU-RAY 3D disc recorders, digital video recorders (DVR, sometimes called a personal video recorder, or PVR), solid state devices, quantum storage devices, gaming consoles, gaming media, or any other suitable fixed or removable storage devices, and/or any combination of the same. Video data storage 206 may be used to store media content, media guidance data, executable instructions (e.g., programs, software, scripts, etc.) for providing an interactive media guidance application, and for any other suitable functions, and/or any other suitable data or program code, in accordance with some embodiments. Nonvolatile memory may also be used (e.g., to launch a boot-up routine and other instructions), in some embodiments.

[49] Each of storage device 110, decoding circuitry 202, encoding circuitry 204, and video-data storage 206 can be provided as a stand-alone device or integrated with other components of architecture 200.

[50] In some embodiments, storage device 110 can be connected to decoding circuitry 202 and encoding circuitry 204 through path paths 208 and 210, respectively. In some embodiments, decoding circuitry 202 can be connected to encoding circuitry 204 through communications path 212. In some embodiments, encoding circuitry 204 can be connected to video-data storage 206 through communications path 214.

[51] Communications paths 208, 210, 212, and 214 may separately or together include one or more

communications paths, such as, a satellite path, a fiber-optic path, a cable path, a path that supports Internet communications (e.g., IPTV), free-space connections (e.g., for broadcast or other wireless signals), or any other suitable wired or wireless communications path or combination of such paths, in some embodiments

[52] In some embodiments, transcoder 112 can also include a demultiplexer circuitry (not shown in FIG. 2). The demultiplexer circuitry can be any suitable circuitry that is capable of demultiplexing a media content transport stream (TS). For example, the demultiplexer circuitry can receive a TS from storage 110 and demultiplex the TS into a video stream, an audio stream, program and system information protocol data stream, etc. The demultiplexer circuitry can also pass the video stream to decoding circuitry 202.

[53] Turning to FIG. 3, a flow chart of an example 300 of a process for transcoding video data in accordance with some embodiments of the disclosure is shown. In some embodiments, process 300 can be implemented by transcoder 112 as illustrated in FIGS. 1 and 2.

[54] As illustrated, process 300 can start by receiving a compressed bitstream at 302. The compressed bitstream can include any suitable data and can be received in any suitable manner. For example, the compressed bitstream can include video data generated based on any suitable coding standard, such as Motion JPEG, JPEG, MPEG-2, MPEG-4, H.263, H.264, HEVC, etc. More particularly, for example, the video data can include encoded images, decoding parameters, header information, etc. In some embodiments, each of the

encoded images can include one or more quantized transform coefficients.

[55] In some embodiments, for example, the compressed bitstream can be received from storage 110 as

5 illustrated in FIGS. 1 and 2. Alternatively or additionally, the compressed bitstream can be received from media encoder 104 and/or media content source 102.

[56] Next, at 304, transcoder 112 can decompress the compressed bitstream and generate decoded video data.

10 The compressed bitstream can be decompressed and the decoded video data can be generated in any suitable manner. For example, transcoder 112 can decompress the compressed bitstream and generate multiple decoded images based on a suitable coding standard, such as
15 Motion JPEG, JPEG 2000, MPEG-2, MPEG-4, H.263, H.264, HEVC, etc. In some embodiments, the decoded images can have any suitable color format, such as RGB, YCrCb, YUV, etc.

[57] More particularly, for example, each of the
20 decoded images can be generated using a process 400 as illustrated in FIG. 4. In some embodiments, for example, process 400 can be implemented by decoding circuitry 202 of transcoder 112 (FIG. 2).

[58] As shown, at 402, decoding circuitry 202 can
25 perform entropy decoding on the compressed bitstream and extract the quantized transform coefficients associated with each of the encoded images, decoding parameters (e.g., quantization parameters, coding modes, macroblock partition information, motion
30 vectors, reference lists, etc.), header information, etc.

[59] At 404, decoding circuitry 202 can perform inverse quantization on the quantized transformed coefficients

associated with a current encoded image to generate one or more transform coefficients. The inverse quantization can be performed in any suitable manner. For example, decoding circuitry 202 can multiply each
5 of the quantized transform coefficients by a suitable quantization parameter. In some embodiments, for example, decoding circuitry 202 can obtain the quantization parameter from the decoding parameters.

[60] At 406, decoding circuitry 202 can perform an
10 inverse transform on the transform coefficients to generate a decoded residual image for the current encoded image. The inverse transform can be performed in any suitable manner. For example, the inverse transform can be an inverse Discrete Cosine Transform
15 (IDCT).

[61] Next, at 408, decoding circuitry 202 can generate a prediction image for the current encoded image. The prediction image can be calculated in any suitable manner. For example, decoding circuitry 202 can
20 generate the prediction image based on a suitable inter-prediction method by referring to one or more previously decoded frames. More particularly, for example, decoding circuitry 202 can perform motion compensation on one or more previously decoded frames
25 and produce a motion compensated reference image as the prediction image. In a more particular example, decoding circuitry 202 can locate a previously decoded image or a portion of the previously decoded image as a reference image for the current encoded image using a
30 motion vector. The reference image can then be used as the motion compensated prediction for the current image. In another more particular example, decoding circuitry 202 can locate two reference images for the

current encoded image using one or more motion vectors. Decoding circuitry 202 can then calculate a prediction image for the current encoded image based on the reference images. More particularly, for example, the prediction image can be a weighted prediction of the two reference images.

[62] As another example, decoding circuitry 202 can generate the prediction image based on a suitable intra-prediction method by referring to one or more previously decoded pixels in the same frame. More particularly, for example, decoding circuitry 202 can perform spatial extrapolation to produce an intra-prediction image for the current encoded image. In some embodiments, one or more prediction images can be formed by extrapolating previously decoded pixels of the current frame in any suitable direction, such as vertical, horizontal, diagonal down-left, diagonal down-right, vertical-left, horizontal-down, vertical right, horizontal-up, etc.

[63] At 410, decoding circuitry 202 can generate a decoded image for the current encoded image based on the residual image and the prediction image. The decoded image can be generated in any suitable manner. For example, decoding circuitry 202 can add the prediction image to the decoded residual image to produce the decoded image.

[64] Turning back to FIG. 3, at 306, transcoder 112 can receive media metadata. The media metadata can include any suitable data and can be received in any suitable manner. For example, the media metadata can be the metadata produced by media metadata source 106, as described above in connection with FIG. 1. More particularly, for example, the media metadata can

include information about video scenes (e.g., scene change information, the number of the frames between scene changes, the type of a scene change, the number of B-frames between two P-frames, picture complexity information, etc.), motion data about the media content (e.g., motion vector maps, reference lists, etc.), intra-prediction data (e.g., a set of candidate intra-prediction modes, the coding cost and/or distortion corresponding to each candidate intra-prediction mode, etc.), etc.

[65] In some embodiments, for example, encoding circuitry 204 (FIG. 2) can receive the media metadata from storage 110. In some embodiments, encoding circuitry 204 can receive the media metadata from media metadata source 106 through communications network 108 as illustrated in FIG. 1.

[66] At 308, transcoder 112 can encode the decoded video data using the media metadata based on a second coding scheme. The decoded video data can be encoded in any suitable manner. For example, transcoder 112 can encode the decoded images into a set of encoded images based on any suitable coding standard, such as MPEG-2, MPEG-4, H.263, H.264, HEVC, etc. As another example, transcoder 112 can encode the decoded video data into a compressed bitstream including a set of encoded images that has a given bitrate. As yet another example, encoding circuitry 204 can encode the decoded images into a set of encoded images that has a given resolution, such as a spatial resolution, a temporal resolution, a quality resolution, etc.

[67] More particularly, for example, transcoder 112 can generate each of the encoded images using a process 500 as illustrated in FIG. 5. In some embodiments, process

500 can be implemented by encoding circuitry 204 of transcoder 112.

5 [68] At 502, encoding circuitry 204 can receive the set of decoded images and the media metadata. The set of decoded images and the media metadata can be received in any suitable manner. For example, encoding circuitry 204 can receive the set of decoded images from the decoding circuitry 202 and receive the media metadata from storage device 110.

10 [69] At 504, encoding circuitry 204 can divide a decoded image into one or more suitable coding units based on the second coding scheme. Each of the coding units can have any suitable size and shape and can be obtained in any suitable manner. In some embodiments, 15 for example, the second coding scheme can include the HEVC coding standard. Encoding circuitry 204 can divide a video frame into multiple coding tree units (CTU), each of which can have a size of 8x8, 16x16, 32x32, 64x64, etc. In some embodiments, each of the 20 CTUs can be partitioned into multiple coding tree blocks (CTBs), each of which can have a size of 4x4, 8x8, 16x16, etc. based on the size of the CTU. In some embodiments, each of the CTBs can be further partitioned into multiple coding blocks (CBs) and 25 coding units (CUs).

[70] At 506, encoding circuitry 204 can generate a prediction image for a coding unit. The prediction image can be generated in any suitable way. For example, encoding circuitry 204 can generate the 30 prediction image based on the media metadata such as scene change information, motion data, picture complexity information, intra-prediction information, etc.

[71] In some embodiments, for example, encoding circuitry 204 can generate the prediction image based on a suitable inter-prediction method by referring to one or more reference images. More particularly, for example, encoding circuitry 204 can calculate one or more suitable motion vectors for the coding unit based on the motion vector map corresponding to the coding unit. Encoding circuitry 204 can then generate a motion compensated prediction image for the coding unit based on the motion vectors by referring to one or more reference images. In some embodiments, the motion compensated prediction image can be generated based on one reference frame that can be located using the reference frame lists. For example, encoding circuitry 204 can locate a region in the reference frame as a reference image for the coding unit based on a motion vector. The reference image can then be used as a prediction image for the coding unit. In some embodiments, the motion compensated prediction image can be generated based on two reference frames that can be located using the reference frame lists. For example, encoding circuitry 204 can generate two reference images by locating a region in each of the two reference frames, respectively, based on one or more motion vectors. Encoding circuitry 204 can then produce a prediction for the coding unit using the two reference images. More particularly, for example, the prediction for the coding unit can be a weighted prediction of the two reference images.

[72] In some embodiments, encoding circuitry 204 can generate the predicted image based on a suitable intra-prediction method. The intra-prediction can be performed in any suitable manner. For example,

encoding circuitry 204 can generate an intra-prediction image for the coding unit based on the media metadata, such as the intra-prediction data including the set of candidate intra-prediction modes, the coding cost and/or distortion corresponding to each intra-prediction mode, etc. More particularly, for example, encoding circuitry 204 can determine a sub-set of the candidate intra-prediction modes that can be used in accordance with the second coding scheme.

10 Additionally, encoding circuitry 204 can select an intra-prediction mode from the sub-set of candidate intra-prediction modes based on the coding costs and/or distortion corresponding to each of the sub-set of candidate intra-prediction modes. Encoding circuitry

15 204 can then generate a prediction image for the coding unit based on the selected intra-prediction mode. More particularly, for example, encoding circuitry 204 can predict each pixel of the coding unit by extrapolating pixel samples in a direction defined by the intra-

20 prediction mode.

[73] At 508, encoding circuitry 204 can generate a residual image for the coding unit. The residual image can be generated in any suitable manner. For example, the residual image can be generated at 506 by

25 subtracting the prediction image generated at from the original image of the coding unit.

[74] At 510, encoding circuitry 204 can perform a transform on the residual image and generate a set of transform coefficients. The set of transform

30 coefficients can be generated in any suitable manner. For example, encoding circuitry 204 can perform a Discrete Cosine Transform (DCT) on the residual image and generate a set of DCT coefficients.

[75] At 512, encoding circuitry 204 can perform quantization on the set of transform coefficients. The quantization can be performed in any suitable manner. For example, encoding circuitry 204 can determine a
5 suitable quantization parameter (QP) for a coding unit based on a target bitrate of the second coding scheme. Encoding circuitry 204 can then quantize the transform coefficients using the QP. The target bitrate can be any suitable bitrate, such as a constant bitrate, a
10 variable bitrate, etc. A QP can be determined in any suitable manner. In some embodiments, for example, encoding circuitry 204 can reduce the bitrate of a compressed bitstream by increasing QP or increase the bitrate of a compressed bitstream by decreasing QP. In
15 some embodiments, for example, an I-frame can be encoded using most bits, followed by a P-frame and a B-frame.

[76] In some embodiments, encoding circuitry 204 can determine a QP based on the media metadata (e.g., scene
20 change information, the number of frames between two scenes, the type of each scene change, picture complexity information, etc.), the target bitrate in accordance with the second coding scheme, etc.

[77] For example, encoding circuitry 204 can determine
25 a QP for a group of pictures (GOP) based on the media metadata. The QP can be determined for the GOP in any suitable manner. More particularly, for example, encoding circuitry 204 can determine the structure of a GOP (e.g., the length of the GOP, the distance between
30 P-frames, the distance between I-frames, etc.) based on the media metadata and determine the QP for the GOP based on the structure of the GOP.

[78] In some embodiments, encoding circuitry 204 can calculate the number of bits available to encode the GOP based on the structure of a GOP, the frame rate of the video data, the target rate, etc. Encoding circuitry 204 can then calculate a QP for the GOP based on the number of bits available to encode the GOP. More particularly, for example, the QP can be calculated based on a suitable model that can define the relation between the QP and the target rate, such as a rate-distortion model, a rate-distortion optimization model, etc.

[79] In some embodiments, encoding circuitry 204 can determine the structure of GOP based on the media metadata, such as scene information, the number of frames between two scene changes, the number of B-frames between two P-frames, etc.

[80] In a more particular example, the first frame of the GOP can be an I-frame that can be located using the scene change information. More particularly, for example, the first frame of the GOP can correspond to the start of a video scene.

[81] In another more particular example, the length of the GOP, i.e., the number of frames in the GOP, can be determined based on the number of frames between two scene changes. In some embodiments, the length of the GOP can be equal to the number of frames between two adjacent scene changes. In some embodiments, the length of the GOP can be equal to the number of frames between two given scene changes, e.g., two shot changes, etc.

[82] In yet another more particular example, the distance between P-frames in the GOP can be determined based on the number of B-frames between two P-frames

included in the media metadata. In a more particular example, the GOP can include a set of frames IBBPBBP... where the distance between P-frames is three.

[83] As another example, encoding circuitry 204 can
5 determine a QP for the coding unit based on the media metadata. More particularly, for example, encoding circuitry 204 can determine the complexity of the coding unit using the picture complexity information (e.g., the maps of spatial complexity, the maps of
10 motion complexity, etc.). Encoding circuitry 204 can then calculate a target number of bits that are available to encode the coding unit based on the complexity of the coding unit. In some embodiments, for example, more bits can be allocated to a coding
15 unit having relatively high complexity while fewer bits can be allocated to a coding unit having relatively lower complexity.

[84] Additionally, encoding circuitry 204 can determine
a QP for the coding unit to produce the target number
20 of bits. More particularly, for example, the QP can be calculated based on a suitable model that can define the relation between the QP and the target rate, such as a rate-distortion model, a rate-distortion optimization model, etc.

[85] Next, at 514, encoding circuitry 204 can perform
25 entropy encoding on the quantized transform coefficients. The entropy encoding can be performed in any suitable manner. For example, encoding circuitry 204 can perform the entropy encoding using a suitable
30 variable length encoding method.

[86] It should be noted that the above steps of the flow diagrams of FIGS. 3-5 may be executed or performed in any order or sequence not limited to the order and

sequence shown and described in the figures.

Furthermore, it should be noted, some of the above steps of the flow diagrams of FIGS. 3-5 may be executed or performed substantially simultaneously where
5 appropriate or in parallel to reduce latency and processing times. And still furthermore, it should be noted, some of the above steps of the flow diagrams of FIGS. 3-5 may be omitted.

[87] In some embodiments, any suitable computer
10 readable media can be used for storing instructions for performing the mechanisms and/or processes described herein. For example, in some embodiments, computer readable media can be transitory or non-transitory. For example, non-transitory computer readable media can
15 include media such as magnetic media (such as hard disks, floppy disks, etc.), optical media (such as compact discs, digital video discs, Blu-ray discs, etc.), semiconductor media (such as flash memory, electrically programmable read only memory (EPROM),
20 electrically erasable programmable read only memory (EEPROM), etc.), any suitable media that is not fleeting or devoid of any semblance of permanence during transmission, and/or any suitable tangible media. As another example, transitory computer
25 readable media can include signals on networks, in wires, conductors, optical fibers, circuits, any suitable media that is fleeting and devoid of any semblance of permanence during transmission, and/or any suitable intangible media.

30 [88] The above described embodiments of the present disclosure are presented for purposes of illustration and not of limitation, and the present disclosure is limited only by the claims which follow.

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	Filing Date	March 11, 2019
	First Named Inventor	Ivan Vladimirovich Naletov
	Art Unit	2668
	Examiner Name	Unassigned
	Attorney Docket Number	D1-03337.CON2

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16/298,345
	Filing Date	March 11, 2019
	First Named Inventor	Ivan Vladimirovich Naletov
	Art Unit	2668
	Examiner Name	Unassigned
	Attorney Docket Number	D1-03337.CON2

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16/298,345
	Filing Date	March 11, 2019
	First Named Inventor	Ivan Vladimirovich Naletov
	Art Unit	2668
	Examiner Name	Unassigned
	Attorney Docket Number	D1-03337.CON2

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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16/298,345
	Filing Date	March 11, 2019
	First Named Inventor	Ivan Vladimirovich Naletov
	Art Unit	2668
	Examiner Name	Unassigned
	Attorney Docket Number	D1-03337.CON2

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.

⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF EFS WEB TRANSMISSION

I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on November 12, 2019 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.

/Tess Langseth-DePaolis/
Tess Langseth-DePaolis

Appl No. : 16/298,345 Confirmation No. 1097
Applicant : DIVX, LLC
Filed : March 11, 2019
Title : Systems, Methods, and Media for Transcoding Video Data
TC/A.U. : 2487
Examiner : Leron Beck
Docket No. : D1-03337.CON2
Customer No. : 71897

AMENDMENT

Mail Stop Amendment
Commissioner for Patents 2190 S. Towne Centre Place, Suite 300
P.O. Box 1450 Anaheim, CA 92806
Alexandria, VA 22313-1450 November 12, 2019

Commissioner:

In response to the Office Action mailed July 9, 2019, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 9 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method for transcoding a source video file into a set of multiple alternate video streams~~video data~~, the method comprising:
 - generating, at a computer system configured as a media metadata generation device, media metadata related to the source video file prior to decoding, during a transcoding of, at least a portion of the source video file, where the media metadata comprises scene complexity information;
 - providing information based on the media metadata from the computer system to a plurality of transcoding devices; and
 - performing the following at each of the plurality of transcoding devices in parallel:
 - receiving the at least a portion of the source video file, including a first plurality of encoded images encoded according to a source format, from a media content source~~from a storage device;~~
 - decoding the at least a portion of the source video file~~the first plurality of encoded images~~ based on [[a]]the source format first coding scheme~~first coding scheme~~ to generate a decoded portion of video including a plurality of decoded images;
 - receiving the information based on the media metadata from the computer system~~a plurality encoding parameters from the storage device;~~ and
 - encoding the plurality of decoded images of the decoded portion of video into an alternate video stream including a second plurality of encoded images based on a target format~~second coding scheme~~ and the plurality of encoding parameters~~information based on the media metadata, the alternate video stream being one of the set of multiple alternate video streams.~~

2. (New) The method of claim 1, wherein a group of the plurality of transcoding devices perform processes in parallel for the same alternate video stream from the set of multiple alternate video streams.

3. (New) The method of claim 1, wherein a group of the plurality of transcoding devices perform processes in parallel for different alternate video streams in the set of multiple alternate video streams.

4. (New) The method of claim 1, wherein the media metadata further comprises scene change information indicating the start and end of a scene.

5. (New) The method of claim 1, wherein the encoding of the plurality of decoded images of the decoded portion of video into an alternate video stream includes performing at least the following operations for images in the plurality of decoded images:

- generating a prediction image for each of a plurality of coding units of an image in the plurality of decoded images using the scene change information and the scene complexity information within the information based on the media metadata according to the target format;

- performing transforms on residual images of the plurality of coding units to generate sets of transform coefficients based on the target format; and

- performing entropy encoding on the sets of transform coefficients to generate images for the second plurality of encoded images.

6. (New) The method of claim 1, by further performing the following at each of the plurality of transcoding devices in parallel:

- performing quantization on the sets of transform coefficients for an image in the plurality of decoded images based at least in part on the scene complexity information within the information based on the media metadata; and

- quantizing the generated set of transform coefficients according to the target format.

7. (New) The method of claim 4, by further performing the following at each of the plurality of transcoding devices in parallel:

determining a number of bits to encode a group of pictures (GOP) based at least in part on a number of frames between the start and end of a scene as indicated by the information based on the media metadata.

8. (New) The method of claim 1, wherein the source format and the target format have different resolutions.

9. (New) The method of claim 1, wherein the source format and the target format correspond to different video encoding standards.

10. (New) The method of claim 1, by further performing the following at each of the plurality of transcoding devices in parallel:

dividing an image in the plurality of decoded images into a plurality of coding units based on the target format.

11. (New) A system for transcoding video data, the system comprising:

a computer system configured as a media metadata generation device, wherein the computer system is configured to:

generate media metadata related to the source video file prior to decoding, during a transcoding of, at least a portion of the source video file, where the media metadata comprises scene complexity information; and

provide information based on the media metadata to a plurality of transcoding devices; and

the plurality of transcoding devices, configured to perform the following at each of the plurality of transcoding devices in parallel:

receive the at least a portion of the source video file, including a first plurality of encoded images encoded according to a source format, from a media content source;

decode the at least a portion of the source video file based on the source format to generate a decoded portion of video including a plurality of decoded images;

receive the information based on the media metadata from the computer system; and

encode the plurality of decoded images of the decoded portion of video into an alternate video stream including a second plurality of encoded images based on a target format and the information based on the media metadata, the alternate video stream being one of the set of multiple alternate video streams.

12. (New) The system of claim 11, wherein a group of the plurality of transcoding devices perform processes in parallel for the same alternate video stream from the set of multiple alternate video streams.

13. (New) The system of claim 11, wherein a group of the plurality of transcoding devices perform processes in parallel for different alternate video streams in the set of multiple alternate video streams.

14. (New) The system of claim 11, wherein the media metadata further comprises scene change information indicating the start and end of a scene.

15. (New) The system of claim 11, wherein encoding the plurality of decoded images of the decoded portion of video into an alternate video stream is performed using at least the following operations for images in the plurality of decoded images:

generating a prediction image for each of a plurality of coding units of an image in the plurality of decoded images using the scene change information and the scene

complexity information within the information based on the media metadata according to the target format;

performing transforms on residual images of the plurality of coding units to generate sets of transform coefficients based on the target format; and

performing entropy encoding on the sets of transform coefficients to generate images for the second plurality of encoded images.

16. (New) The system of claim 11, wherein the plurality of transcoding devices are configured to further perform the following at each of the plurality of transcoding devices in parallel:

performing quantization on the sets of transform coefficients for an image in the plurality of decoded images based at least in part on the scene complexity information within the information based on the media metadata; and

quantizing the generated set of transform coefficients according to the target format.

17. (New) The system of claim 14, wherein the plurality of transcoding devices are configured to further perform the following at each of the plurality of transcoding devices in parallel:

determining a number of bits to encode a group of pictures (GOP) based at least in part on a number of frames between the start and end of a scene as indicated by the information based on the media metadata.

18. (New) The system of claim 11, wherein the plurality of transcoding devices are configured to further perform the following at each of the plurality of transcoding devices in parallel:

dividing an image in the plurality of decoded images into a plurality of coding units based on the target format.

19. (New) The system of claim 11, wherein the source format and the target format have different resolutions.

20. (New) The system of claim 11, wherein the source format and the target format correspond to different video encoding standards.

21. (New) A method for transcoding a source video file into a set of multiple alternate video streams, the method comprising:

- generating, at a computer system configured as a media metadata generation device, media metadata related to the source video file prior to decoding, during a transcoding of, at least a portion of the source video file, where the media metadata comprises scene change information indicating the start and end of a scene, and scene complexity information;

- providing information based on the media metadata from the computer system to a plurality of transcoding devices; and

- performing the following at each of the plurality of transcoding devices in parallel:

- receiving the at least a portion of the source video file, including a first plurality of encoded images encoded according to a source format, from a media content source;

- decoding the at least a portion of the source video file based on the source format to generate a decoded portion of video including a plurality of decoded images;

- receiving the information based on the media metadata from the computer system;

- dividing an image in the plurality of decoded images into a plurality of coding units based on a target format, wherein the source format and the target format have different resolutions;

- determining a number of bits to encode a group of pictures (GOP) based at least in part on a number of frames between the start and end of a scene as indicated by the information based on the media metadata; and

encoding the plurality of decoded images of the decoded portion of video into an alternate video stream including a second plurality of encoded images based on the target format and the information based on the media metadata, the alternate video stream being one of the set of multiple alternate video streams.

REMARKS/ARGUMENTS

SUMMARY OF THE AMENDMENTS

Claims 1-21 are currently pending in this application. Claim 1 has been amended in this response. New claims 2-21 have been added. Support for the amendments can be found throughout the specification, and at least at paragraphs 5, 17, 18, 24, 25, 27-34, 36, 39, 53, 54, 56, 64-66, 70, 74, 85 and 86. Applicant submits that no new matter is introduced in this response.

SUMMARY OF THE OFFICE ACTION

The Office Action dated July 9, 2019 (hereinafter "Office Action") contains the following objections and rejections:

- The title of the invention is alleged to not be descriptive;
- Claim 1 is rejected under 35 U.S.C. § 102 as being anticipated by US 20110002381 A1 to Yang et al. (hereinafter "Yang").

SPECIFICATION (TITLE OF THE INVENTION)

The title of the invention is alleged to not be descriptive. Applicant has amended and added new claims, such that the title is now clearly indicative of the invention to which the currently pending claims are directed. Therefore, Applicant respectfully requests that the title be accepted.

35 U.S.C. § 102 REJECTION

REJECTION OF CLAIM 1

With respect to claim 1, the Office Action states the claim is anticipated by Yang. As discussed below, Applicant respectfully submits that Yang fails to anticipate claim 1 as amended.

The Proposed Combination Fails to Teach all Aspects of Claim 1

Claim 1 amendments recite language including but not limited to:

generating, at a computer system configured as a media metadata generation device, media metadata related to the source video file prior to decoding at least a portion

of the source video file, where the media metadata comprises scene change information indicating the start and end of a scene, and scene complexity information;

providing the media metadata from the computer system to a plurality of transcoding devices; and

performing the following at each of the plurality of transcoding devices in parallel:

...

receiving the media metadata from the computer system; and

encoding the plurality of decoded images of the decoded portion of video into an alternate video stream including a second plurality of encoded images based on a target format and the media metadata

The Office Action does not assert, and Applicant has not found, any teaching of these newly added limitations in the cited reference. Specifically, Yang is cited in the Office Action to disclose the elements of claim 1. Yang discloses a video transcoding system in which an intermediate video data generator 108 serves as an intermediate module between video decoder 106 and video encoder 110. (Yang, FIG. 1 and para. 0023.) The video decoder 106 “provide[s] . . . decoded video frame bitstreams to the intermediate video data generator 108.” The intermediate video data generator 108 “generate[s] intermediate video data . . . and extracts information from the decoded frame bitstreams,” which it then provides to the video encoder 110. The intermediate video data is therefore generated only after the bitstreams are decoded. Thus, Yang fails to disclose at least the elements of “generating . . . media metadata related to the source video file prior to decoding at least a portion of the source video file” as provided by amended claim 1.

Generating the media metadata to be used in the encoding process, and then providing this metadata to each of a plurality of transcoders which then perform decode and encode processes, allows for improved efficiency as compared to the system of Yang, as the metadata is generated only once and can then be used during each of the parallel transcodes. Transcoding in parallel also allows for higher efficiency in general as compared to a conventional single-encoder system.

Therefore, Applicant respectfully submits that Yang fails to teach each and every limitation of claim 1. Accordingly, Applicant respectfully submits that claim 1 is patentable due to the failure of the cited reference to disclose the limitations of claim 1 as amended.

Conclusion

For reasons including those stated above, Applicant respectfully submits that the cited reference fails to anticipate claim 1. Accordingly, Applicant respectfully requests that the rejection of claim 1 be withdrawn.

PATENTABILITY OF NEW CLAIMS 11 AND 21

Claims 11 and 21 include limitations similar to those of amended claim 1. Thus, Applicant respectfully submits that these claims are allowable for reasons similar to those discussed above with regard to claim 1. Accordingly, Applicant respectfully requests that these claims be allowed.

PATENTABILITY OF NEW CLAIMS 2-10 AND 12-20

Claims 2-10 depend from claim 1, and claims 12-20 depend from claim 11. Applicant respectfully submits that these claims are allowable for reasons including those outlined above with respect to claim 1. Accordingly, Applicant respectfully requests that these claims be allowed.

CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that this application is in condition for allowance. Accordingly, reconsideration of the application and allowance of the claims are respectfully requested. Although the present paper may include a combination of alterations to the application or claims, or characterizations of claim scope or referenced art, Applicants are not conceding that previously pending claims in this application are not patentable over the cited references. Rather, any alterations and/or characterizations are made to strictly facilitate prosecution of this application. As such, reviewers of this or any parent, child, or related prosecution history shall not reasonably infer that Applicants have made any disclaimers or disavowals of any subject matter supported by the present application.

Applicants have submitted amendments and arguments believed to be sufficient to overcome all of the outstanding rejections. Consequently, Applicants have not

APPLN No. 16/298,345
REPLY TO OFFICE ACTION OF JULY 9, 2019

advanced every argument for the allowability of the claims over the references of record. As such, Applicants do not acquiesce to any of the Examiner's statements or characterizations not specifically traversed. If the Examiner should have any remaining questions or objections, a telephone interview to discuss and resolve these issues is respectfully requested.

The Commissioner is authorized to charge any fee under 37 CFR 1.16 and 1.17 that may be required during the **entire pendency** of the application to Deposit Account No. 50-4407. Please show our docket number with any transaction to the Deposit Account.

Respectfully submitted,
KPPB LLP

By /Faye H. Teng/
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949.852.0000

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Anaheim, CA 92806

EXAMINER

BECK, LERON

ART UNIT

PAPER NUMBER

2487

DATE MAILED: 04/27/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/298,345	03/11/2019	Ivan Vladimirovich Naletov	D1-03337.CON2	1097

TITLE OF INVENTION: Systems, Methods, and Media for Transcoding Video Data

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	07/27/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

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III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/298,345	03/11/2019	Ivan Vladimirovich Naletov	D1-03337.CON2	1097

TITLE OF INVENTION: Systems, Methods, and Media for Transcoding Video Data

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	07/27/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
BECK, LERON	2487	375-240180

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/298,345	03/11/2019	Ivan Vladimirovich Naletov	D1-03337.CON2	1097
71897	7590	04/27/2020	EXAMINER	
KPPB LLP			BECK, LERON	
2190 S. Towne Centre Place			ART UNIT	
Suite 300			PAPER NUMBER	
Anaheim, CA 92806			2487	

DATE MAILED: 04/27/2020

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.** Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b) (2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/298,345	Applicant(s) Naletov et al.	
	Examiner LERON BECK	Art Unit 2487	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 4/14/2020.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-21. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a) ☐ All b) ☐ Some *c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	

/LERON BECK/ Primary Examiner, Art Unit 2487	
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Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Reasons for Allowance

2. The prior art of record (in particular, US 20110002381 A1-Yang et al (Hereinafter referred to as "Yang") does not disclose, with respect to claim 1, a method for transcoding a source video file into a set of multiple alternate video streams, the method comprising: generating, at a computer system configured as a media metadata generation device, media metadata related to the source video file prior to decoding, during a transcoding of, at least a portion of the source video file, where the media metadata comprises scene complexity information; providing information based on the media metadata from the computer system to a plurality of transcoding devices; and performing the following at each of the plurality of transcoding devices in parallel: receiving the at least a portion of the source video file, including a first plurality of encoded images encoded according to a source format, from a media content source; decoding the at least a portion of the source video file based on the source format to generate a decoded portion of video including a plurality of decoded images; receiving the information based on the media metadata from the computer system; and encoding the plurality of decoded images of the decoded portion of video into an alternate video stream including a second plurality of encoded images based on a target format and the information based on the media metadata, the alternate video stream being one of the set of multiple alternate video streams.as claimed. Rather, Yang '381 discloses a method for transcoding video data (Fig 2), the method comprising: receiving a first

plurality of encoded images from a storage device (Fig 1, [0023], wherein Video decoder receives compressed video frame bitstreams from the video decoder buffer (storage device) as shown in Fig 1); decoding the first plurality of encoded images based on a first coding scheme to generate a plurality of decoded images (Fig 1, [0023], wherein decoder decode video frame bitstream in a first coding format); receiving a plurality encoding parameters from the storage device (Fig 1, [0023], wherein complexity information is an encoding parameter. In addition, the examiner would like to note that these encoding parameters are located within the bitstream that is sent to the buffer); and encoding the plurality of decoded images into a second plurality of encoded images based on a second coding scheme and the plurality of encoding parameters (Fig 1, [0023], encoding bitstreams with parameters according to a second coding format. The examiner would like to note that transcoded data means that images have been taking and encoded for a second time (hence second encoded images)). The same reasoning applies to claim 11 and 21 *mutatis mutandis*. Accordingly, **claims 1-21** are allowed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LERON BECK whose telephone number is (571)270-1175. The examiner can normally be reached on M-F 8 am-5pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Czekaj can be reached on (571) 272-7327. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <https://ppair-my.uspto.gov/pair/PrivatePair>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

LERON . BECK
Examiner
Art Unit 2487

/LERON BECK/
Primary Examiner, Art Unit 2487