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Schweid et al.

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(54) **SYSTEM AND METHOD FOR IDENTIFYING UNIQUE PORTIONS OF VIDEOS WITH VALIDATION AND PREDICTIVE SCENE CHANGES**

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H04N 21/234	(2011.01)
H04N 21/845	(2011.01)
H04N 21/8541	(2011.01)

(52) **U.S. Cl.**

CPC ... ***H04N 21/23412*** (2013.01); ***H04N 21/23418*** (2013.01); ***H04N 21/8455*** (2013.01); ***H04N 21/8541*** (2013.01)

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See application file for complete search history.

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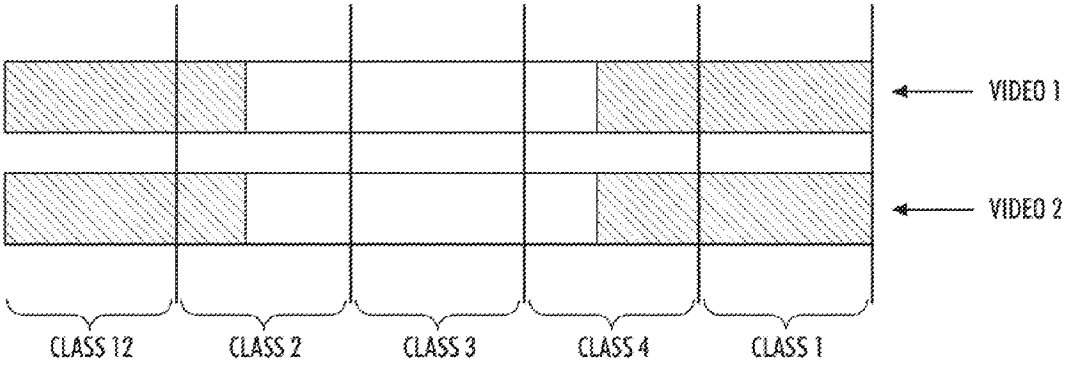
(57) **ABSTRACT**

A computer-based method for generating a compressed data stream, including using a specially programmed computer to: access a first compressed data stream including a first plurality of sequentially arranged frames including respective compressed frame data; access a second compressed data stream including a second plurality of sequentially arranged frames including respective compressed frame data; compare respective compressed data for sequentially matched pairs of frames in the first and second pluralities of frames; select, based on the comparison, common and unique portions in the first data stream; and select, based on the comparison, first and second portions in the second data stream, matched with the common and unique portions, respectively, in the sequence. The first portion has respective compressed frame data equal to the respective compressed frame data for the common portion. The second portion has respective compressed frame data unequal to the respective compressed frame data for the common portion.

32 Claims, 6 Drawing Sheets



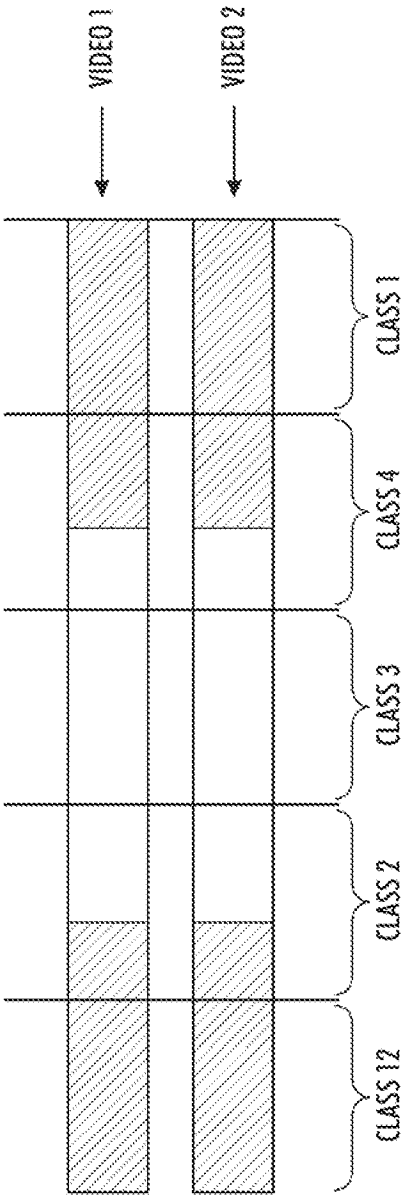


FIG. 1

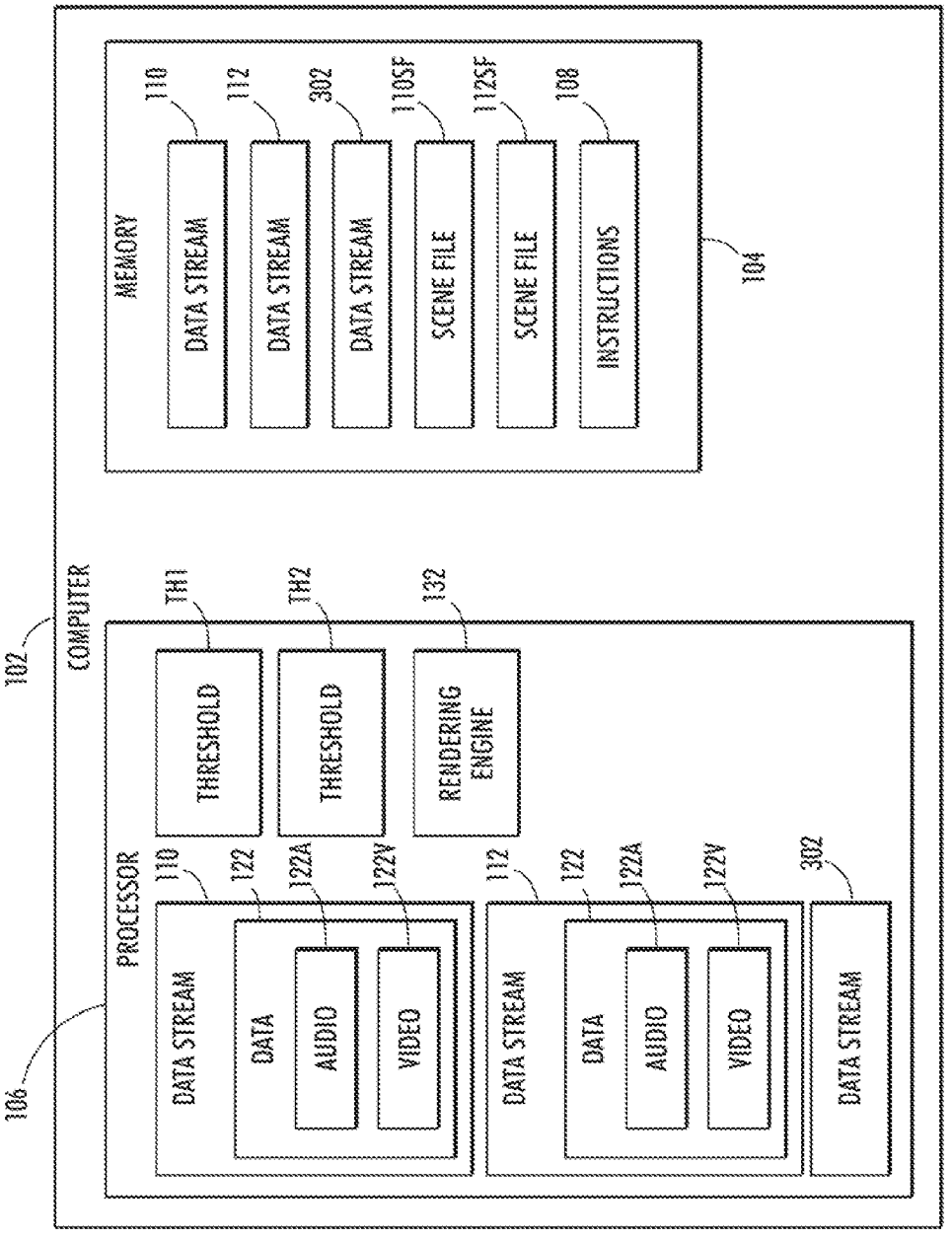

102
COMPUTER
MEMORY
110
DATA STREAM
112
DATA STREAM
302
DATA STREAM
110SF
SCENE FILE
112SF
SCENE FILE
108
INSTRUCTIONS
104
TH1
THRESHOLD
TH2
THRESHOLD
132
RENDERING ENGINE
PROCESSOR
110
DATA STREAM
122
DATA
122A
AUDIO
122V
VIDEO
112
DATA STREAM
122
DATA
122A
AUDIO
122V
VIDEO
302
DATA STREAM
106

FIG. 2

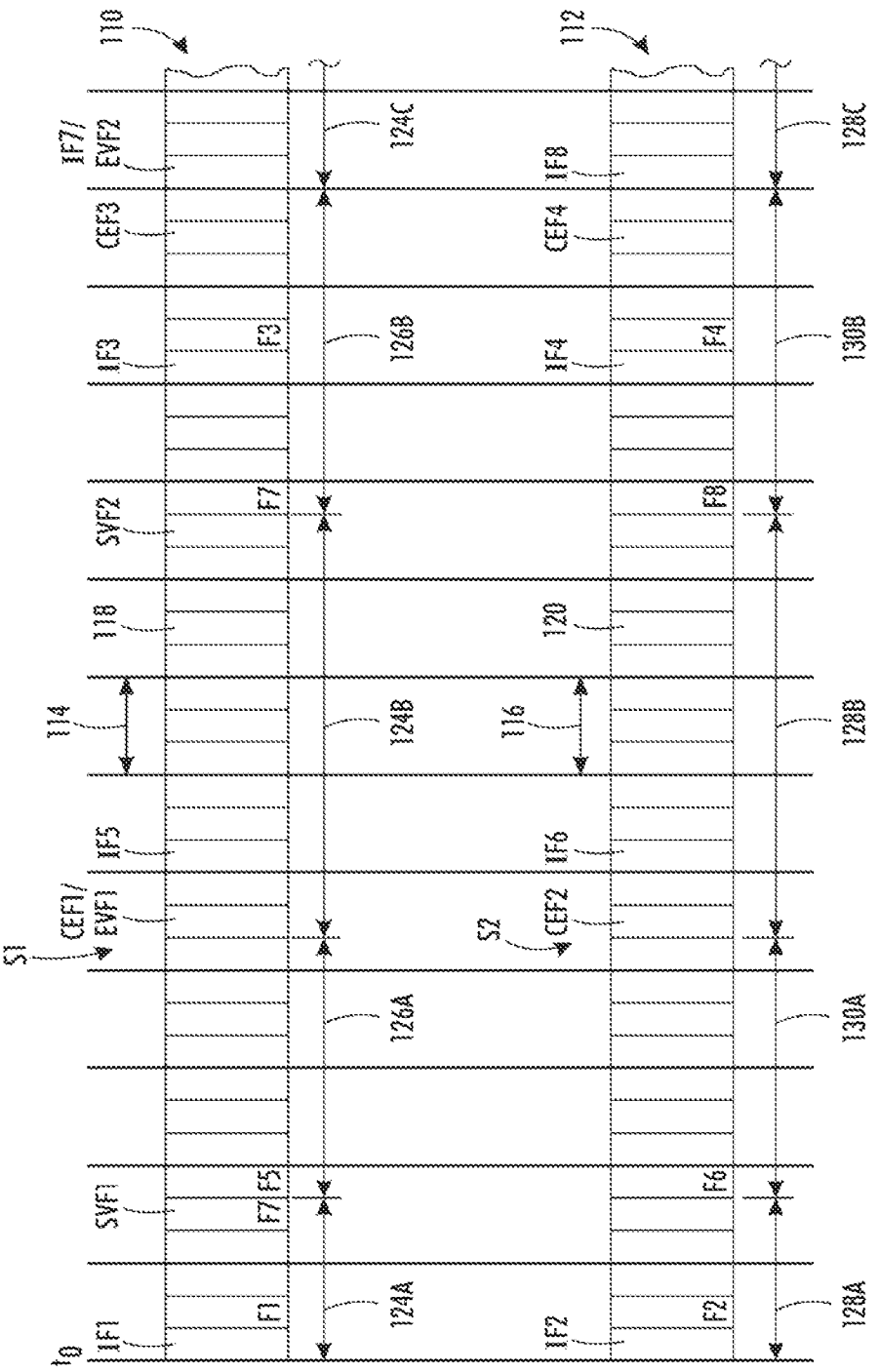

110
112
IF7/
EVF2
CEF3
IF3
SVF2
118
114
IF5
CEF1/
EVF1
S1
SVF1
IF1
t_0
124C
126B
F3
F7
124B
126A
F5
F7
124A
F1
IF8
CEF4
IF4
120
116
IF6
CEF2
S2
IF2
128C
130B
F4
F8
128B
130A
F6
128A
F2

FIG. 3

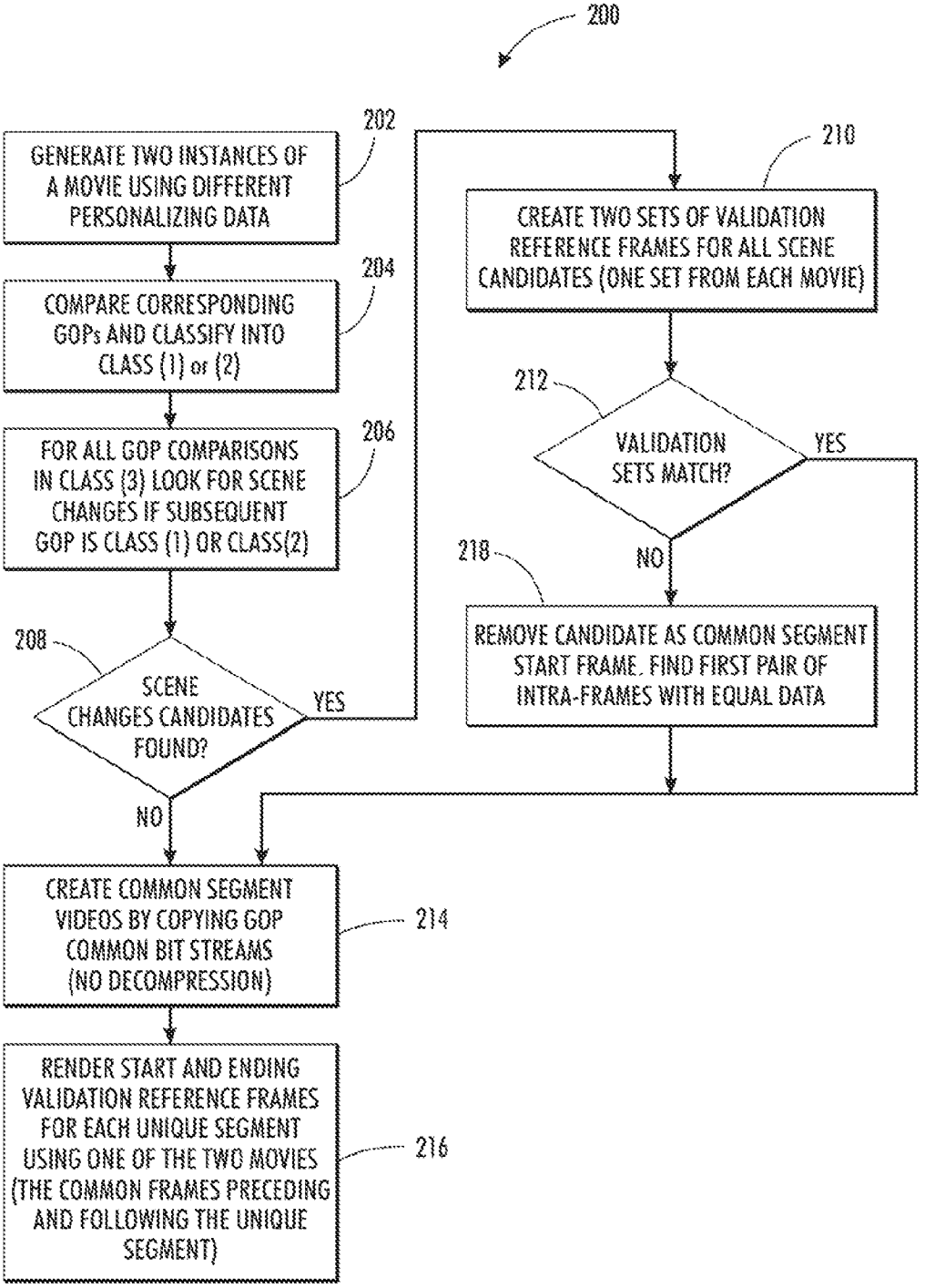

200
202
GENERATE TWO INSTANCES OF A MOVIE USING DIFFERENT PERSONALIZING DATA
204
COMPARE CORRESPONDING GOPs AND CLASSIFY INTO CLASS (1) or (2)
206
FOR ALL GOP COMPARISONS IN CLASS (3) LOOK FOR SCENE CHANGES IF SUBSEQUENT GOP IS CLASS (1) OR CLASS(2)
208
SCENE CHANGES CANDIDATES FOUND?
YES
NO
210
CREATE TWO SETS OF VALIDATION REFERENCE FRAMES FOR ALL SCENE CANDIDATES (ONE SET FROM EACH MOVIE)
212
VALIDATION SETS MATCH?
YES
NO
218
REMOVE CANDIDATE AS COMMON SEGMENT START FRAME, FIND FIRST PAIR OF INTRA-FRAMES WITH EQUAL DATA
214
CREATE COMMON SEGMENT VIDEOS BY COPYING GOP COMMON BIT STREAMS (NO DECOMPRESSION)
216
RENDER START AND ENDING VALIDATION REFERENCE FRAMES FOR EACH UNIQUE SEGMENT USING ONE OF THE TWO MOVIES (THE COMMON FRAMES PRECEDING AND FOLLOWING THE UNIQUE SEGMENT)

FIG. 4

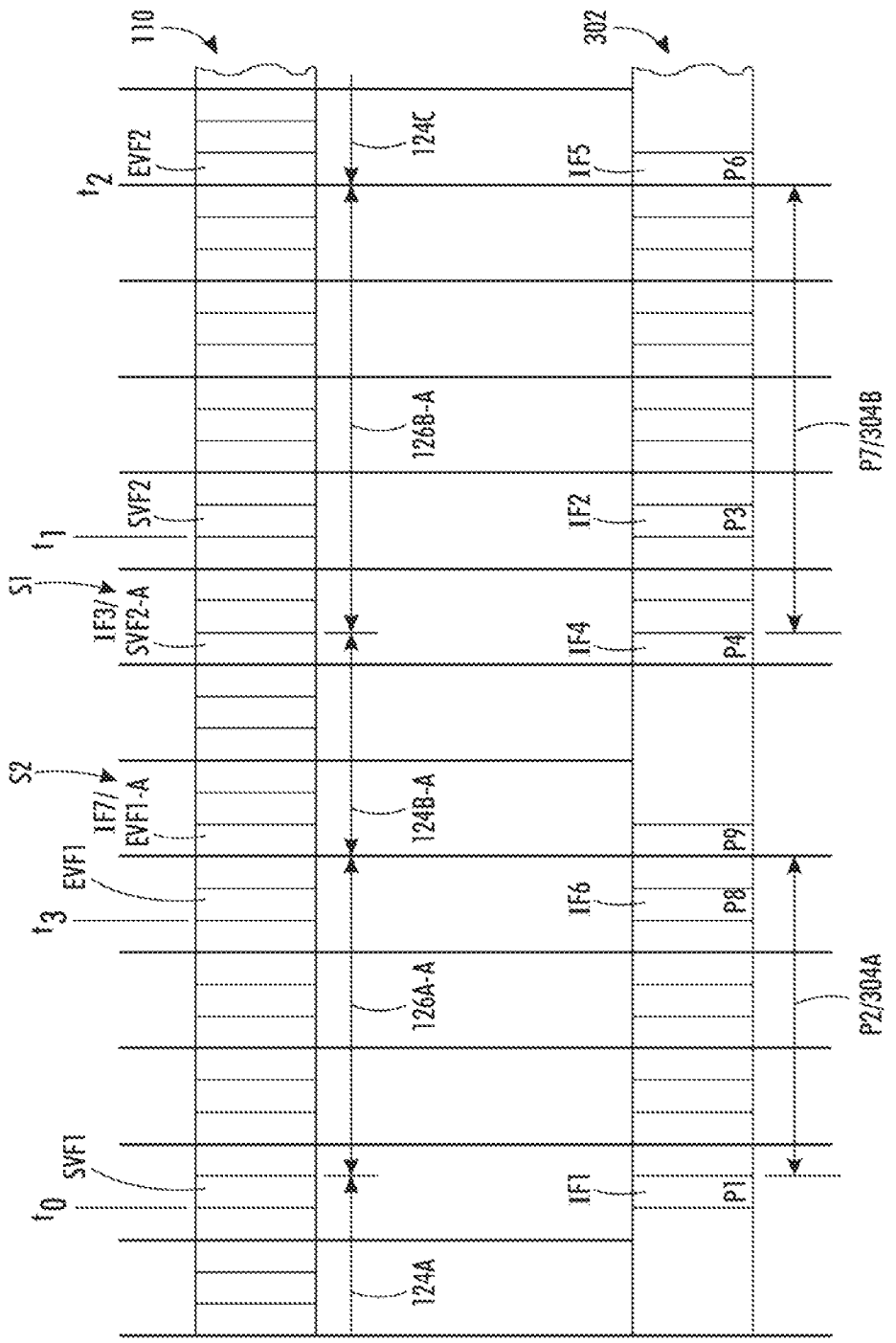

110
302
t_0
t_1
t_2
t_3
S1
S2
SVF1
SVF2
IF3/
SVF2-A
IF7/
EVF1-A
EVF1
EVF2
124A
126A-A
124B-A
126B-A
124C
IF1
IF2
IF4
IF6
IF5
P1
P3
P4
P8
P9
P6
P2/304A
P7/304B

FIG. 5

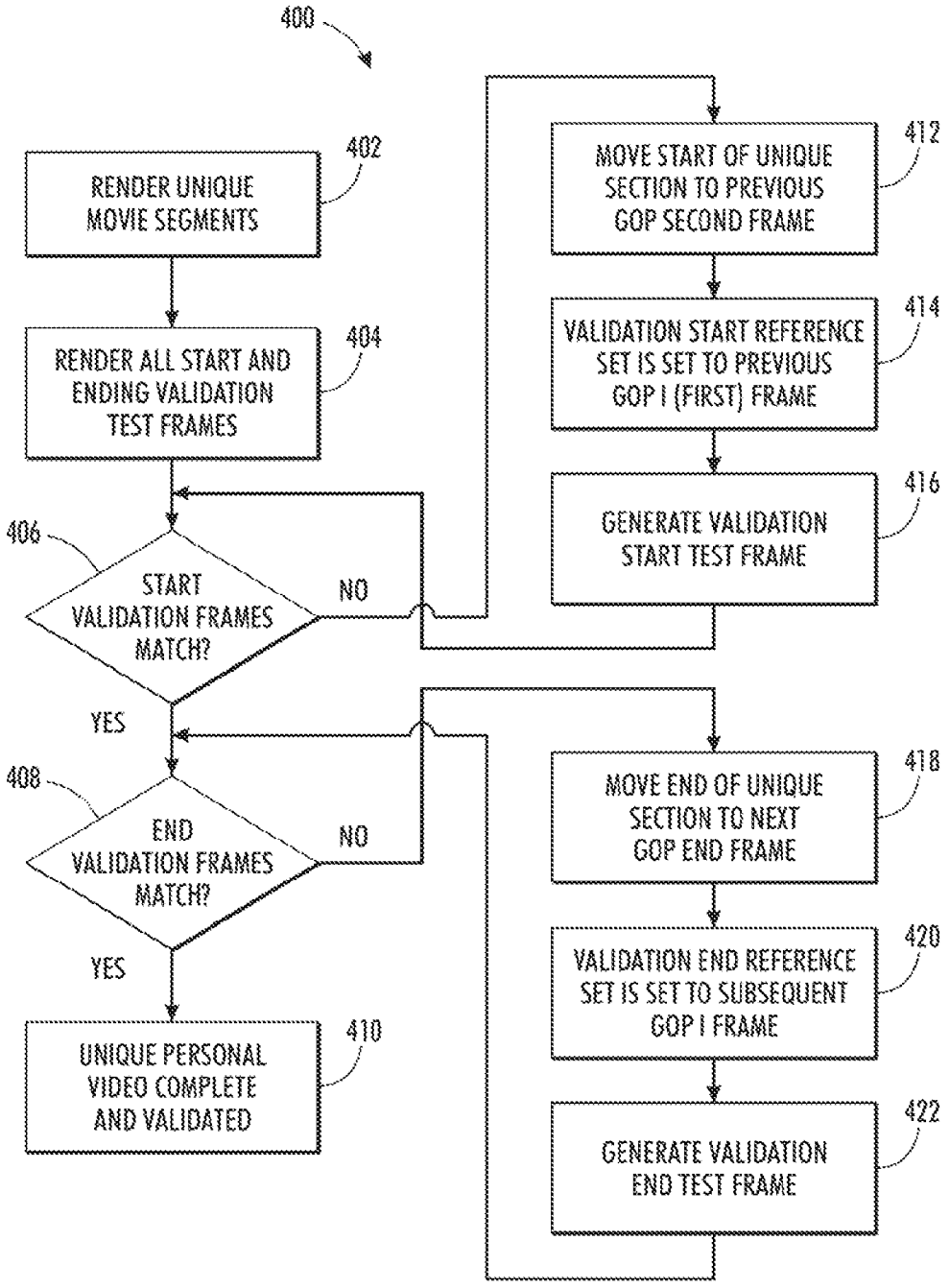

400
RENDER UNIQUE MOVIE SEGMENTS
402
RENDER ALL START AND ENDING VALIDATION TEST FRAMES
404
406
START VALIDATION FRAMES MATCH?
NO
YES
408
END VALIDATION FRAMES MATCH?
NO
YES
UNIQUE PERSONAL VIDEO COMPLETE AND VALIDATED
410
MOVE START OF UNIQUE SECTION TO PREVIOUS GOP SECOND FRAME
412
VALIDATION START REFERENCE SET IS SET TO PREVIOUS GOP I (FIRST) FRAME
414
GENERATE VALIDATION START TEST FRAME
416
MOVE END OF UNIQUE SECTION TO NEXT GOP END FRAME
418
VALIDATION END REFERENCE SET IS SET TO SUBSEQUENT GOP I FRAME
420
GENERATE VALIDATION END TEST FRAME
422

FIG. 6

SYSTEM AND METHOD FOR IDENTIFYING UNIQUE PORTIONS OF VIDEOS WITH VALIDATION AND PREDICTIVE SCENE CHANGES

TECHNICAL FIELD

The presently disclosed embodiments are directed to a system and method for identifying unique and common portions of videos, using compressed data, and creating personalized videos by using common portions in a template video and rendering and compressing only unique portions for insertion in the template video.

BACKGROUND

Personalization or customization of videos is a growing field as video processing becomes less inexpensive and more ubiquitous. Known software can perform large scale customization of videos by modifying a template video with personalizing information found in a database; however, the process is very time consuming. For example, data for a video is typically in a compressed format, and the software requires that every database entry be rendered, that is, converted from compressed to decompressed format. It is known to only render the unique parts of movie and then create a composite video using a playlist of the common and unique parts. However, this is not an automated process and requires significant input from a user of the software. For example, the determination of unique parts is provided manually in Adobe After Effects by the user/programmer. The reliance on user input is very time consuming and is prone to both user data entry error as well as accuracy errors, for example, the user must estimate unique areas and as a result can easily overestimate or underestimate unique areas. These estimate errors can result in the loss of portions of the unique areas, or can result in needless operations on areas that are actually common.

It is known to identify scene changes in a single video through complex operations on compressed data for the video, for example, analysis of the data in the coefficient space.

SUMMARY

According to aspects illustrated herein, there is provided a computer-based method for generating a compressed template data stream, including using at least one specially programmed computer to access a first compressed data stream for a first movie, the first compressed data stream including a first plurality of frames arranged in a sequence, each frame in the first plurality including respective compressed frame data; access a second compressed data stream for a second movie, the second compressed data stream including a second plurality of frames arranged in a sequence, each frame in the second plurality including respective compressed frame data; compare respective compressed frame data for respective pairs of frames in the first and second pluralities of frames, matched according to the sequence; select, based on the comparison, a common portion and a unique portion in the first compressed data stream; and select, based on the comparison, first and second portions in the second compressed data stream, matched with the common and unique portions, respectively, in the sequence. The first portion has respective compressed frame data equal to the respective compressed frame data for the common portion. The second portion has respective compressed frame data unequal to the respective compressed frame data for the common portion.

According to other aspects illustrated herein, there is provided a computer-based method for generating a video, including using at least one specially programmed computer to: access a compressed data stream, for a first video, the compressed data stream including: a first plurality of frames arranged in a sequence, each frame in the first plurality of frames including respective compressed frame data; and in the first plurality of frames: a start validation intra-frame, and an end validation intra-frame following the start validation intra-frame in the sequence. The method includes using the at least one specially programmed computer to: access an unrendered data stream; identify first and second portions in the unrendered data stream matched with the start validation frame and the end validation frame, respectively, in the sequence; render and compress the first and second portions such that the first and second portions are first and second intra-frames, respectively; and compare respective compressed frame data for the start validation intra-frame and the first intra-frame, respectively. When respective compressed frame data for the start validation intra-frame and the first intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the start validation frame and the first intra-frame. When respective compressed frame data for the start validation intra-frame and the first intra-frame are unequal: select a third intra-frame, from the first compressed data stream, preceding the start validation frame in the sequence as an adjusted start validation frame; select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence; render and compress the third portion as a fourth intra-frame; and compare the respective compressed frame data for the adjusted start validation frame and the fourth intra-frame. The method includes using the at least one specially programmed computer to: compare respective compressed frame data for the end validation intra-frame and the second intra-frame, respectively. When respective compressed frame data for the end validation intra-frame and the second intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the end validation frame and the second intra-frame. When respective compressed frame data for the end validation intra-frame and the second intra-frame are unequal: select a third intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame; select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence; render and compress the third portion as a fourth intra-frame; and compare the respective compressed frame data for the adjusted end validation frame and the fourth intra-frame.

According to aspects illustrated herein, there is provided a computer-based system for generating a compressed template data stream, including: a memory element for at least one specially programmed computer arranged to store computer executable instructions; and at least one processor for the at least one specially programmed computer. The at least one specially programmed computer is arranged to execute the computer executable instructions to: access a first compressed data stream for a first movie, the first compressed data stream including a first plurality of frames arranged in a sequence, each frame in the first plurality including respective compressed frame data; access a second compressed data stream for a second movie, the second compressed data stream including a second plurality of frames arranged in a sequence, each frame in the second plurality including respective compressed frame data; compare respective compressed frame data for respective pairs of frames in the first

and second pluralities of frames, matched according to the sequence; select, based on the comparison, a common portion and a unique portion in the first compressed data stream; and select, based on the comparison, first and second portions in the second compressed data stream, matched with the common and unique portions, respectively, in the sequence. The first portion has respective compressed frame data equal to the respective compressed frame data for the common portion; and the second portion has respective compressed frame data unequal to the respective compressed frame data for the common portion.

According to aspects illustrated herein, there is provided a computer-based system for generating a video, including: a memory element for at least one specially programmed computer arranged to store computer executable instructions; and at least one processor for the at least one specially programmed computer. The at least one processor is arranged to execute the computer executable instructions to: access a compressed data stream, for a first video, the compressed data stream including: a first plurality of frames arranged in a sequence, each frame in the first plurality of frames including respective compressed frame data; and in the first plurality of frames: a start validation intra-frame, and an end validation intra-frame following the start validation intra-frame in the sequence. The at least one processor is arranged to execute the computer executable instructions to: access an unrendered data stream; identify first and second portions in the unrendered data stream matched with the start validation frame and the end validation frame, respectively, in the sequence; render and compress the first and second portions such that the first and second portions are first and second intra-frames, respectively; compare respective compressed frame data for the start validation intra-frame and the first intra-frame, respectively. When respective compressed frame data for the start validation intra-frame and the first intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the start validation frame and the first intra-frame. When respective compressed frame data for the start validation intra-frame and the first intra-frame are unequal: select a third intra-frame, from the first compressed data stream, preceding the start validation frame in the sequence as an adjusted start validation frame; select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence; render and compress the third portion as a fourth intra-frame; and compare the respective compressed frame data for the adjusted start validation frame and the fourth intra-frame. The at least one processor is arranged to execute the computer executable instructions to: compare respective compressed frame data for the end validation intra-frame and the second intra-frame, respectively. When respective compressed frame data for the end validation intra-frame and the second intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the end validation frame and the second intra-frame. When respective compressed frame data for the end validation intra-frame and the second intra-frame are unequal: select a third intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame; select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence; render and compress the third portion as a fourth intra-frame; and compare the respective compressed frame data for the adjusted end validation frame and the fourth intra-frame.

According to other aspects illustrated herein, there is provided a computer-based method for generating a video, including using at least one specially programmed computer to: access a compressed data stream, for a first video, the compressed data stream including: a first plurality of frames arranged in a sequence, each frame in the first plurality of frames including respective compressed frame data; and in the first plurality of frames: a start validation intra-frame, and an end validation intra-frame following the start validation intra-frame in the sequence. The at least one specially programmed computer is arranged to: render the start and end validation frames such that the start and validation frames include first and second rendered frame data, respectively; access an unrendered data stream; identify first and second portions in the unrendered data stream matched with the start validation frame and the end validation frame, respectively, in the sequence; render the first and second portions such that the first and second portions include third and fourth rendered frame data, respectively; and compare the first and third rendered frame data. When the first and third rendered data are no more different than a threshold: render and compress a third portion of the unrendered data stream immediately following the first portion in the sequence; and insert the third portion into the first compressed data stream such that the third portion immediately follows the start validation frame. When the first and third rendered data are more different than a threshold: select an intra-frame, from the first compressed data stream, preceding the validation frame in the sequence as an adjusted start validation frame; select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence; render the intra-frame and the third portion to include respective rendered frame data; and compare a difference between the respective rendered frame data to the threshold. The at least one specially programmed computer is arranged to: compare the second and fourth rendered frame data; and when the second and fourth rendered data are no more different than a threshold: render and compress a third portion of the unrendered data stream immediately preceding the second portion in the sequence; and insert the third portion into the first compressed data stream such that the third portion immediately precedes the end validation frame. When the second and fourth rendered data are more different than a threshold: select an intra-frame, from the first compressed data stream, following the validation frame in the sequence as an adjusted end validation frame; select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence; render the intra-frame and the third portion to include respective rendered frame data; and compare a difference between the respective rendered frame data to the threshold.

According to aspects illustrated herein, there is provided a computer-based system for generating a video, including: a memory element for at least one specially programmed computer arranged to store computer executable instructions; and at least one processor for the at least one specially programmed computer. The at least one processor is arranged to execute the computer executable instructions to: access a compressed data stream, for a first video, the compressed data stream including: a first plurality of frames arranged in a sequence, each frame in the first plurality of frames including respective compressed frame data; and in the first plurality of frames: a start validation intra-frame, and an end validation intra-frame following the start validation intra-frame in the sequence. The at least one processor is arranged to execute the computer executable instructions to: render the start and end validation frames such that the start and validation frames include first and second rendered frame data, respectively; access an unrendered data stream; identify first and second portions in the unrendered data stream matched with the start

validation frame and the end validation frame, respectively, in the sequence; render the first and second portions such that the first and second portions include third and fourth rendered frame data, respectively; and compare the first and third rendered frame data. When the first and third rendered data are no more different than a threshold: render and compress a third portion of the unrendered data stream immediately following the first portion in the sequence; and insert the third portion into the first compressed data stream such that the third portion immediately follows the start validation frame. When the first and third rendered data are more different than a threshold: select an intra-frame, from the first compressed data stream, preceding the validation frame in the sequence as an adjusted start validation frame; select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence; render the intra-frame and the third portion to include respective rendered frame data; and compare a difference between the respective rendered frame data to the threshold. The at least one processor is arranged to execute the computer executable instructions to: compare the second and fourth rendered frame data. When the second and fourth rendered data are no more different than a threshold: render and compress a third portion of the unrendered data stream immediately preceding the second portion in the sequence; and insert the third portion into the first compressed data stream such that the third portion immediately precedes the end validation frame. When the second and fourth rendered data are more different than a threshold: select an intra-frame, from the first compressed data stream, following the validation frame in the sequence as an adjusted end validation frame; select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence; render the intra-frame and the third portion to include respective rendered frame data; and compare a difference between the respective rendered frame data to the threshold.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments are disclosed, by way of example only, with reference to the accompanying drawings in which corresponding reference symbols indicate corresponding parts, in which:

FIG. **1** is a block diagram showing classes of two compressed data streams;

FIG. **2** is a block diagram of a computer-based system for identifying unique portions of videos with validation and predictive scene changes;

FIG. **3** is a diagrammatic illustration of two compressed data streams operated upon according to the system of FIG. **2**;

FIG. **4** is a flow chart illustrating a method of identifying unique portions of videos with validation and predictive scene changes; and,

FIG. **5** is a diagrammatic illustration of the use of a template data stream; and,

FIG. **6** is a flow chart illustrating a method of creating a new video.

DETAILED DESCRIPTION

At the outset, it should be appreciated that like drawing numbers on different drawing views identify identical, or functionally similar, structural elements of the embodiments set forth herein. Furthermore, it is understood that these embodiments are not limited to the particular methodology, materials and modifications described and as such may, of course, vary. It is also understood that the terminology used herein is for the purpose of describing particular aspects only, and is not intended to limit the scope of the disclosed embodiments, which are limited only by the appended claims.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which these to embodiments belong. The following definitions and considerations are applicable:

A. Scene file: Data produced, for example, by a video recording device, to represent a scene or scenes. A scene file contains objects in a strictly defined language or data structure; it would contain geometry, viewpoint, texture, lighting, and shading information as a description of the virtual scene.

B. Rendering: The process of using computer programs to generate an image based on an existing objects or models, for example, a scene file. A rendering program processes the data contained in a scene file to generate an output to a digital image or raster graphics image file. For example, the output is video data usable by a display device to reproduce the images in the scene file.

C. Rendering Engine: Software/firmware for rendering scene files.

D. Video data compression: A combination of spatial image compression and temporal motion compensation of rendered video data

1. Video compression typically operates on square-shaped groups of neighboring pixels, often called macroblocks. These pixel groups or blocks of pixels are compared from one frame to the next and, after adjusting for estimated motion, the video compression codec (encode/decode scheme) sends only the differences within those blocks. This works extremely well if the video has no motion. A still frame of text, for example, can be repeated with very little transmitted data. In areas of video with more motion, more pixels change from one frame to the next. When more pixels change, the video compression scheme must send more data to keep up with the larger number of pixels that are changing. Thus, compressed data for a frame including a scene change with respect a preceding frame typically is much larger than the compressed data for the preceding frame.

Video data contains spatial and temporal redundancy. Similarities can thus be encoded by merely registering differences within a frame (spatial), and/or between frames (temporal). With temporal compression only the changes from one frame to the next are encoded as often a large number of the pixels will be the same or be similar in a neighborhood on a series of frames.

2. Intra-frame versus interframe compression: Interframe compression uses one or more earlier or later frames in a sequence to compress the current frame, referred to as an "interframe." Intra-frame compression uses only the current frame, referred to as an "intra-frame" or "I frame," which is effectively image compression. The most commonly used method works by comparing each frame in the video with the previous one. If the frame contains areas where nothing has moved, the system simply issues a short command that copies that part of the previous frame, bit-for-bit, into the next one. If sections of the frame move in a simple manner, the compressor emits a (slightly longer) command that tells the decompresser to shift, rotate, lighten, or darken the copy: a longer command, but still much shorter than intra-frame compression.

One difference between intra-frame and interframe compression is that with intra-frame systems, each frame compressed data size is a function of the complexity of only that

frame. In most interframe systems, certain frames (such as "I frames" or "intra-frames" in MPEG-2) aren't allowed to utilize data from other frames, and so require much more data than other frames nearby that can.

3. Applicable standards: The following is a list of standard applicable to video data compression. This list is not exhaustive: H.262/MPEG-2 Part 2; H.263; MPEG-4 Part 2; H.264/MPEG-4 AVC; and, VC-2 (Dirac).

E. Audio compression:

Audio data compression is designed to reduce the transmission bandwidth requirement of digital audio streams and the storage size of audio files. Audio compression algorithms are implemented in software as audio codecs. Lossless and lossy algorithms optimized for audio files have been created. In both lossy and lossless compression, information redundancy is reduced, using methods such as coding, pattern recognition and linear prediction to reduce the amount of information used to represent the uncompressed data.

F. Intra-frame coding: Intra-frame coding is used in video coding (compression). It is part of an intra-frame codec like prores or a group of pictures codec with interframes. The term intra-frame coding refers to the fact that the various compression techniques are performed relative to information that is contained only within the current frame, and not relative to any other frame in the video sequence. In other words, no temporal processing is performed outside of the current picture or frame.

G. Intra-frame data: Data included in an intra-frame and sufficient to reproduce the image and audio for a portion of a movie associated with the intra-frame and without reliance on or use of data from other frames.

Moreover, although any methods, devices or materials similar or equivalent to those described herein can be used in the practice or testing of these embodiments, some embodiments of methods, devices, and materials are now described.

The following is a summary overview of a method and system for generating a video. The present disclosure is direct to a method and system that automatically determine the unique and common parts of movies that will be produced by creating modified versions of a template movie using a database. The technique has several components described in detail infra. The components are: comparison of two instantiations of the movie using differing personalizing information, generation of common movie segments from the instantiated pair, determination of transition points within movie sequences and labeling of validation frames for validating subsequently generated unique instances of the movie.

The method and system start with two unique movies being generated using differing personalized information as input. Respective compressed data streams are generated from the movies and comparison of these movies is then done in the compressed domain. This has several major advantages. First, the method is not dependent on the presence of any codec. There is no need to know or understand the video/audio content or compression format. All that is needed is to know where the two movies are similar and where they differ. Secondly, comparison in the compressed domain is much faster. The compressed data length of a movie is much less than the full movie data length. As long as the movie and compression parameters of the two sample movies generated are identical (e.g. frame-rate, quality factor, motion estimation method) identical movie segments will, map to identical compressed data.

The comparison between movies is subdivided into comparison of video and audio. For two movie segments to be considered identical both their video and audio segments must be the same. If either the respective video or audio segments differ the two movie segments are considered to be unique. The comparison of video is further divided in comparisons of segments, or groups of pictures (GOPs). A GOP is an independently decodable section. A GOP does not require information from other frames to decompress. A GOP starts with an I-frame, independent frame, or intra-frame, that is, a self contained description of the first frame. It is followed by other frames (P or B frames) that use motion estimation and interframe data in the compression.

The file format for the compressed data streams, for example, H.264/MPEG-4 AVC, contains structural information that describes where the data for each GOP and audio compressed segments reside in the file. Using this structural information, temporally corresponding segments of two movies, that is two movies matched in sequence, which do not necessarily reside in similar locations in their respective files are compared. The comparison is done using a memory compare. As long as the data compares the two movies are identical. Once the data no longer is identical (a common to unique transition) the point at which the data differs corresponds to a differing frame.

The converse, however, is not true. If two bit streams of two GOPs do not match after a given frame the reconstructed frames may or may not be identical. Although potential unique to common transition frames can be identified in the compressed domain, it is necessary to at least partially decompress the respective bit streams and compare the two frames. For example, as noted above, frames following an intra-frame in a segment consist of differences from the previous frame (the frame does not include all the data necessary to produce the image/audio for the frame). Also, in the compressed domain, all that is known is the quantity of the data (data length). A frame must be decompressed to determine actual data content. Therefore, even if the compressed frame data for the two frames noted above are equal (have the same quantity of data), the rendered data could still be different, hence the need to at least partially decompress data for a comparison.

FIG. **1** is a block diagram showing classes of two compressed data streams. The heavy vertical lines denote segment or GOP boundaries. The various classes in FIG. **1**, where common segments are shown hatched, and unique segments are not hatched, are as follows:

Class 1: The two GOP bit streams (and thus movie segments) are identical. This class is known to be the result of identical movie segments;

Class 2: The two GOPs start with identical bit streams and then have one or more differing frames. This class is known to be identical for the beginning frames and assumed to be different for all frames after the first difference. At most one transition from common to unique or unique to common is assumed in each GOP (typically a 1-3 second interval); and,

Class 3: The two GOPs have different intra-frames (first frame data streams). Techniques for analyzing this class are described infra. We assume that the two movie segments are different. Techniques for analyzing this class are described infra.

The above classes are further addressed below.

It can be assumed that a transition from unique to common segments will produce a scene change, and frames that are part of a scene change will not compress well. Namely the prediction of the frame given the previous frame will be poor, as the new scene frame is not a small variation of its predecessor frame. The result is that a large number of bits are needed to encode the scene change frame. If only one of the frames in respective GOPs in the two data streams requires significantly more bits than all the other frames in the respec-

tive GOPs and the frames in the two data streams have the same frame number in the two GOPs being compared, it is assumed the frame might be a scene change, and thus a transition from unique to common segments. Further detail regarding such "outliers" is provided below.

It is then determined if the scene change corresponds to a transition in the GOP from a unique segment to a common segment in the next GOP. If the start of the next GOP corresponds to a common video segment, for example, Class 1 or Class 2 in FIG. **1**, then the candidate scene change is presumed to be a unique to common transition, Class 4 in FIG. **1**, since it is the only know transition prior to a know common segment. Validation steps are described below regarding the above process.

Once common movie segments are determined, the generation of common movie segments can be accomplished with file manipulation. No computation is required. There is no need to re-render the common segments or to decompress the video and crop it. Sets and subsets of GOPs can be copied in the compressed form to a new file as a common video segment.

The methodology above allows a simple method to compare two movies without decompression and to mark, with high accuracy, common and unique segments. In order to assure that a personalization of a movie is created correctly, a set of validation reference frames (video and audio) are generated for every unique time segment in the two sample movies during the unique/common determination process, that is, the comparison of the two sample movies. The validation reference frames "sandwich" the unique movie segments. The start validation frame of a unique movie segment is the last common frame preceding the first unique frame and the end validation frame is the first common frame following the last unique frame.

For every subsequently generated movie, a pair of start and end validation test frames are created for every unique movie segment. These frames have a time stamp identical to the validation reference frames created during the unique/common segment determination. If a personalization movie is correct its validation test frames match the validation reference frames. If such a match occurs then it can be deduced that the unique part of the new movie created is not larger Than the unique parts of the first two instantiations. If the validation frames do not match then the unique time segment of the movie must be grown, since the new movie unique times are not a subset of the first two instantiations. The growing process can be done one GOP at a time. At this point new validation frames can be created using the new larger unique segment times for future validations.

Further detail regarding the method and system described above is provided infra.

FIG. **2** is a block diagram of computer-based system **100** for identifying unique portions of videos with validation and predictive scene changes. System **100** includes at least one specially programmed computer **102** with at least one memory element **104** and at least one processor **106**. The memory element is arranged to store computer executable instructions **108** and the processor is arranged to execute the computer-executable instructions. For the sake of brevity in the discussion that follows, it is understood that the phrases "the processor is arranged to" is synonymous with the phrase "the at least one processor is arranged to, or configured to, execute the computer executable instructions to."

FIG. **3** is a diagrammatic illustration of two compressed data streams operated upon according to the system of FIG. **2**. The following should be viewed in light of FIGS. **1** through **3**. The processor is arranged to access compressed data streams **110** and **112** for respective videos. In an example embodiment, the data steams are stored in the memory element. Data streams **110** and **112** include pluralities of segments, or groups of pictures, **114** and **116**, respectively, arranged in a sequence. Each segment **114** includes a plurality of frames **118** arranged in sequence and each segment **116** includes a plurality of frames **120** arranged in sequence. By "arranged in a sequence" we mean that segments **114** and **116**, and frames **118** and **120** are in a sequential, or temporal, order. Data streams **110** and **112** are not limited to any particular number of segments **114** or **116**, respectively. Segments **114** and **116** are not limited to any particular number of frames **118** or **120**, respectively. Each segment **114** and **116** has a same number of frames. Each frame **118** or **120** occupies a same span in the sequence. In the examples that follow, three frames are shown in each segment to simplify the presentation; however, it should be understood that the segments are not limited to having five frames only.

Each segment **114** or **116** includes an intra-frame located in an initial position, according to the sequence, in the segment, for example, IF**1** and IF**2**. Positions of various segments and frames in data streams **110** and **112** can be correlated to each other according to the sequence. For example, using time t_0 as a common starting point for each of the data streams (in this case, to marks the first frame in the sequence of the data streams) frames F**1** and F**2** are matched "according to the sequence." Hereinafter, "matched frames" means that the frames are in the same relative position in the sequence, for example, have the same time stamp.

Data streams **110** and **112** include respective compressed frame data **122** for each frame **118** or **120**. That is, data **122** is the video and audio data necessary to replicate a portion of the respective movie associated with a particular frame. The processor is arranged to compare respective compressed frame data for respective pairs of frames in streams **110** and **112**, matched according to the sequence, for example IF**1** and IF**2**, or F**1** and F**2**. Based on the comparison, the processor is further arranged to select at least one common portion **124**, for example, **124**A-**124**C, and at least one unique portion **126**, for example, **126**A-**126**B, in data stream **110**. Data stream **112** includes portions **128**, for example, **128**A-**128**C, having respective data **122** equal to respective data **122** for the common portions. Thus, the portions of the videos in data streams **110** and **112** included in respective portions **124** and **128** are the same and are interchangeable. Data stream **112** includes portions **130**, for example, **130**A-**130**B, having respective data **122** unequal to respective data **122** for the unique portions. Thus, the videos for respective portions **126** and **130** are different and are not interchangeable. As further described below, the delineation of the common and unique portions enables insertion of unique portions from other videos without requiring changes to the common portions and with a minimal amount of rendering of the other videos.

It should be understood that unless stated otherwise, that by "equal data **122**" we mean that the respective sizes, for example respective numbers of bits, of the data **122** are equal. However, two frames having equal data **122** in this context does not necessarily mean that the respective bit streams for the data **122** are identical. By identical we mean that when rendered, the two frames would reproduce the same images and audio. For example, two frames can have the same number of bit in respective data **122** but with at least some pairs of matched bits being different, which would result in different images and/or audio when rendered. It is understood that a certain amount of lossiness is typically inherent in a decompression process and "equality" for decompressed data takes

this lossiness into account. That is, there is a tolerance or range for this equality. Thus, equal data **122** can result in unequal rendered data.

If two matched intra-frames have equal data **122**, we assume the intra-frames have equal rendered data (common portion). If the two frames in question are interframes generated from respective intra-frames having equal data **122**, we assume the rendered data for the two frames are equal (common portion). For example, in FIG. **3**, data **122** for intra-frames IF**1** and IF**2** are equal and we assume that decompressed data for frames F**1** and F**2**, interframes generated from IF**1** and IF**2**, respectively, are equal.

If two matched intra-frames have unequal data **122**, we assume the intra-frames have unequal rendered data (unique portion). If two matched frames are inter-frames generated from respective intra-frames having unequal data **122**, we cannot make a determination regarding the frames without further analysis, which is described below. For example, data for intra-frames IF**3** and IF**4** are unequal and we are unable to evaluate the equality of the decompressed data for frames F**3** and F**4**. For example, even if data **122** for F**3** and F**4** are equal, since data **122** for F**3** and F**4** are generated from respective intra-frames having unequal data **122**; we cannot predict the status of the rendered data for F**3** and F**4**.

In an example embodiment, data **122** includes video compressed data **122**V and audio compressed data **122**A. For portions **124** and **128**, respective data **122**V are equal and respective data **122**A are equal. For portions **126** and **130**, rendered data for respective data **122**V are unequal and/or rendered data for respective data **122**A are unequal.

In an example embodiment, a process of identifying common and unique portions of compressed data streams **110** and **112** begins with identifying respective starting points for unique portions. The processor is arranged to select a pair of intra-frames from the compressed data streams **110** and **112**, respectively, matched according to the sequence and having equal respective compressed frame data. The matched pair is part of a common portion. In the example, of FIG. **3**, the process begins at t_0. The processor is arranged to identify an initial occurrence of a pair of matched frames from compressed data streams **110** and **112**, following the pair of intra-frames in the sequence and having unequal respective compressed frame data. By "initial occurrence" we mean the first time such a pair of frames is encountered in the sequence. For example, intra-frames IF**1** an IF**2** are pair of intra-frames in a common portion, and frames F**5** and F**6** are the first pair of frames encountered in the sequence with unequal data **122**. This initial occurrence marks a transition from a common portion to a unique portion.

The processor is arranged to identify a frame in data stream **110**, immediately preceding frame F**5** in the sequence, for example, F**7**, as a start validation frame, in this case SVF**1**. Thus, a transition from common portion **124**A to unique portion **126**A occurs at SVF**1**. That is, SVF**1** is the last frame in common portion **124**A.

To identify the next common portion, the processor selects the next occurrence of matched intra-frames from compressed data streams **110** and **112** following the start validation frame in the sequence and having equal data **122**. In the example of FIG. **3**, the next such pair is IF**5** and IF**6**. As described above, the processor is arranged to identify an initial occurrence of a pair of frames from compressed data streams **110** and **112** following IF**5** and IF**6** in the sequence, matched according to the sequence, and having unequal respective compressed frame data, for example, frames F**7** and F**8**. As described above, the frame preceding F**7** in the sequence is selected as SVF**2** for unique portion **126**B. It should be understood that a start validation frame can be an intra-frame or an interframe.

In an example embodiment, if the start validation frame is an interframe, the processor is arranged to operate on the start validation frame such that the start validation frame is an intra-frame. For example, the processor accesses scene file **110**SF for compressed data stream **110**, for example, stored in the memory element, and uses rendering engine **132** to generate rendered data for the start validation frame. The processor then compresses the rendered data to generate an intra-frame.

Advantageously, the selection of a start validation frame is accomplished automatically (no user input required) and using only compressed data **122**. That is, there is no need to go through a time consuming process of decompressing and re-rendering data for the videos. Also, there is no need for manual input from a user of the system. For example, in FIG. **3**, system **100** began analyzing frames at the beginning of compressed data streams **110** and **112**, without input or guidance from the user, to identify start validation frames. As described below, the same automatic operation is used to define the end points of unique portions.

As further described below, start validation frames are used as reference points for using data stream **110** as a template into which unique portions of other videos can be substituted for unique portions in data stream **110**.

An end point for a unique portion is defined by a unique to common transition. Unlike the detection of a common to unique transition, a simple comparison of the size of data **122** in data streams **110** and **112** cannot be used to verify a unique to common transition.

In an example embodiment, to identify a unique to common transition for a particular unique portion, the processor is arranged to identify an initial occurrence of matched intra-frames from data streams **110** and **112** following the start validation frame, for the particular unique portion, in the sequence having equal respective compressed frame data. By "initial occurrence" we mean the first time such a pair of frames is encountered in the sequence. For example, intra-frames IF**5** an IF**6** are the pair of intra-frames noted above following unique portion **126**A.

An end validation frame is the first common frame following a unique portion. As noted above, data **122** for a particular frame consists of changes to data **122** in an immediately preceding frame. Thus, when a scene changes, which could indicate the start of a common portion (a unique to common transition), there is typically a great deal of data and compression is poor. That is, data **122** in the frame including the scene change is large. Thus, data **122** for the frame including a scene change is typically greater than preceding or following frames and is an outlier with respect to data **122** for those frames. To identify possible outliers and possible scene changes, the processor is arranged to compare respective compressed frame data for segments preceding the matched pair of intra-frames noted above, for example S**1** and S**2**, to select respective candidate frames from the segments, for example, CEF**1** and CEF**2**. CEF**1** and CEF**2** precede IF**5** and IF**6**, respectively, in the sequence and are matched in position according to the sequence. Based on the comparison, the processor is arranged to determine if CEF**1** and CEF**2** have respective compressed frame data **122** different by more than a threshold, for example TH**1**, from remaining frames in S**1** and S**2**, respectively. That is, the processor is arranged to determine if the data for the candidate frames are outliers with respect to the segments including the candidate frames.

In an example, embodiment, to determine if a segment has an outlier with respect to encoded bit length, two tests are employed: relative ratio of t-scores and a relative ratio of max values. The tests verify that only a single outlier of encoded bit exists using the following logic below:

1. Let B_0 be the set of encoded bit lengths of a segment, i.e. B_0={frame 0 bit length, frame 1 bit length, . . .)
   a. $M_0=\max(B_0)$, $k_{max}=\arg\max(B_0)$
2. Create the set $B_1=B_0\backslash M_0 \rightarrow B_1$ is the set of all encoded bit lengths except the largest one
   a. Set $M_1=\max(B_1)$, $m_1=E\{B_1\}$, $s_1^2=E\{(B_1-m_1)^2\}$, $t_1(M_0-m_1)/s_1$(t score)
3. Create the set $B_2=B_1\backslash M_1 \rightarrow B_2$ is the set of all encoded bit lengths except the largest 2
   a. Set $M_2=\max(B_2)$, $m_2=E\{B_2\}$, $s_2^2=E\{(B_2-m_2)^2\}$, $t_2=(M_1-m_2)/s_2$(t score)
4. Predict frame k_{max} to a scene change frame if all of the following are true:
   a. $t_1>4$, $t_2<3$, $t_1/t_2>2$ (one and only value has a large t-score and its much larger than all others); and
   b. $M_0/M_1>2$, $M_1/M_2<1.5$ (the ratio of the 1st to 2nd largest encoded bit lengths is large and the ratio of 2nd to 3rd largest is small)

It is understood that the constants in step (4) above are initial estimates based up observed data and can be modified as more segments are analyzed.

In an example, embodiment, to determine if the candidate frames are end validation frames, the candidate frames are rendered and compressed as respective intra-frames and respective bit streams for the respective intra-frames are compared. For example, using scene file **110**SF and scene file **112**SF, the processor is arranged to render the candidate frames and then compress the rendered frames to generate respective intra-files. If the respective lengths of the bit streams for the candidate frames are equal and respective bits (matched in sequence) in the respective bit streams for the candidate frames are equal, the processor is arranged to designate the candidate frame in data stream **110**, for example CEF**1**, respectfully, as an end validation frame for unique portion **126**A, for example, EVF**1**.

When candidate frames are identified as outliers and rendered as intra-frames, but respective bit steams are not equal, for example, CEF**3** and CEF**4**, the processor is arranged to select an intra-frame, following the candidate frame in data stream **110** as the end validation frame. For example, as noted above, to identify a unique to common transition for a particular unique portion, the processor is arranged to identify an initial occurrence of matched intra-frames from data streams **110** and **112** following the start validation frame, for the particular unique portion, in the sequence having equal respective compressed frame data. In the example of FIG. **3**, for portion **126**B, the matched intra-frames are IF**7** and IF**8**, respective bit steams for CEF**3** and CEF**4** are not equal, and IF**7** is then selected as the end validation frame for **126**B.

In an example embodiment, a comparison of potential end validation frames is made using at least partially decompressed data. For example, outliers are identified as described above and selected as matched candidate frames, for example, if CEF**1** and CEF**2**. The processor is arranged to at least partially decompress respective compressed frame data for the candidate frames and compare the at least partially decompressed data. For example, the processor is arranged to access scene files **110**SF and **112**SF to render CEF**1** and CEF**2**. When the at least partially decompressed data are no more different than a second threshold, for example, TH**2**, the candidate frames are identified as unique to common transitions. The processor is arranged operate on the candidate frame in data stream **110** such that the candidate frame is an intra-frame. For example, as noted above, using scene file **110**SF, the processor is arranged to render CEF**1** and then compress the rendered frame to generate an intra-file. The intra-frame is selected as an end validation frame, for example, EVF**1**. As noted above, some lossiness is associated with decompression, and TH**2** is used to account for such lossiness. TH**2** is not limited to a particular value.

When the respective at least partially decompressed data are more different than a threshold, for example, TH**2**, the processor is arranged to select an intra-frame, following the candidate frame in data stream **110** as the end validation frame. For example, at least partially decompressed data for CEF**3** and CEF**4** fail the threshold test and IF**7** is selected as EVF**2**.

It should be understood that if data streams **110** and **112** begin with unique portions, there are no start validation frames for these unique portions. Similarly, if data streams **110** and **112** end with unique portions, there are no end validation frames for these unique portions.

FIG. **4** is flow chart **200** illustrating a method of identifying unique portions of videos with validation and predictive scene changes, for example, using system **100**. In the discussion that follows, system **100** is used as an example of implementing the flow chart; however, it should be understood that flow chart **200** is not limited to use with system **100**. In FIG. **4**, step **202** generates compressed data streams **110** and **112**. Steps **204**, **206**, **208**, and **210** include the identification of candidate matched pairs of start validation frames and end validation frames in data streams **110** and **112** as described above. In step **212**, the candidate start and end validation frames are analyzed to determine if the pairs meet the requirements noted above. For example, equal data **122** for start validation frames; and comparison of data for end validation frames using the outlier, and bit stream or decompression operations noted above. Once start and end validation frame sets (bracketing respective unique portions) are confirmed, common portions are created in step **214**. As noted above, the creation of common portions advantageously is performed using compressed data. In step **216** start and end validation frames are rendered and compressed to form intra-frames. If candidate end validation pairs fail the test or tests of step **212**, in step **218**, the first matched intra-frames with equal data **122** are identified and the intra-frame from data stream **110** is selected as the end validation frame. For example, this process was described for EVF**2** in FIG. **3**. Once an end validation frame is selected in step **218**, the method moves to step **214**.

FIG. **5** is diagrammatic illustration of the use of a template data stream. The following should be viewed in light of FIGS. **1** through **5**. Following the determination of common and unique portions, stream **110** becomes usable as a template data stream into which portions of other data streams are inserted. For example, portions of the other data streams matched with common segments in stream **110** do not need to be rendered (the common portion of data stream **110** is used) and only the unique portions of the other data streams need to be rendered and inserted into data stream **110**.

In an example embodiment, the processor is arranged to access an uncompressed data stream, for example data stream **302**, arranged in the sequence of data stream **110**. In an example embodiment, data stream **302** is a, scene file. The processor is arranged to identify possible unique portions in data stream **302** that could be inserted into data stream **110** using start and end validation frames in data stream **110** as reference points.

The processor is arranged to select respective portions of data stream **302** matched, in the sequence, with respective start and end validation frames in data stream **110**. The processor then is arranged to determine if the data for the respective portions of data stream **302** are sufficiently close to the data for start and end validation frames in data stream **110**. That is, the processor determines if the respective portions represent transition points in data stream **302**. If the end validation frames were selected using the bit stream analysis described above, the processor applies a bit stream analysis to the end validation frames and the portions of data stream **302** matched with the end validation frames. The same approach is used for the start validation frames and the portions of data stream **302** matched with the start validation frames. If the end validation frames were selected using the decompression and lossy comparison analysis described above, the processor applies the same type of analysis to the end validation frames and the portions of data stream **302** matched with the end validation frames.

The following is directed to the start validation frames. For example, SVF**1** occurs at time t_0 and the processor selects portion P**1** from stream **302**. The processor is arranged to render and compress P**1** such that P**1** is an intra-frame (IF**1**) and compare the respective compressed frame data for SVF**1** and IF**1**. In this case, the respective compressed frame data for SVF**1** and IF**1** are equal. As described above, the processor is arranged to compare respective pairs of bits, matched according to the sequence, in respective bit streams for SVF**1** and IF**1**. If all respective pairs of bits are equal, which is the case in this example, the processor is arranged to render and compress a second portion of the unrendered data stream immediately following the first portion in the sequence, for example, P**2**/**304**A. The processor is arranged to insert the second portion into data stream **110** such that the second portion, for example, **304**A, immediately follows the start validation frame in data stream **110**, for example, SVF**1**.

If one or more respective pairs of bits for SVF**1** and IF**1** are not equal, the processor is arranged select an intra-frame, from data stream **110**, preceding the start validation frame in the sequence as an adjusted start validation frame and repeats the comparison process described above. The process of adjusting the start validation frame is described in more detail below.

As another example, SVF**2** occurs at time t_1 and the processor selects portion P**3** from stream **302**. The processor is arranged to render and compress P**3** such that P**3** is an intra-frame (IF**2**) and compare the respective compressed frame data for SVF**2** and IF**2**. In this example, the respective compressed frame data for SVF**2** and IF**2** are not equal; or the respective compressed frame data for SVF**2** and IF**2** are equal, but SVF**2** and IF**2** failed the bit stream analysis described above. Then, the processor is arranged select an intra-frame, from data stream **110**, preceding the start validation frame in the sequence as an adjusted start validation frame. For example, the processor is arranged to select IF**3** from segment S**1** preceding the segment including SVF**2**, as SVF**2**-A. The processor is arranged to select a portion from data stream **302**, matched to SVF**2**-A according to the sequence, for example, P**4**.

The processor is arranged to render and compress P**4** such that P**4** is an intra-frame (IF**4**) and compare the respective compressed frame data for SVF**2**-A and IF**4** and bit streams for SVF**2** and IF**2**, as described above. When the respective compressed frame data for SVF**2**-A and IF**4** are equal and SVF**2** and IF**2** pass the bit stream comparison, which is the case in this example, the processor is arranged to render and compress portion P**5** immediately following P**4** in the sequence, and insert P**5** into data stream **110** such that P**5** immediately follows SVF**2**-A. Thus, the processor is arranged to "grow" the unique portion of data stream **110**. As a result, in data stream **110**, portion **126**B has been expanded to portion **126**B-A and common portion **124**B has been contracted to **124**B-A.

If the respective compressed frame data or the respective bit streams for an adjusted start validation frame and the matching portion in data stream **302** are not equal, the processor is arranged to repeat the process described above by selecting the intra-frame preceding the adjusted start validation until an adjusted start validation frame and a matching portion in data stream **302** have equal respective compressed frame data and respective bit streams.

The following is directed to a bit stream comparison of end validation frames and matched portions of data stream **302**. The processor is arranged to select respective portions of data stream **302** matched, in the sequence, with respective end validation frames in data stream **110**. For example, EVF**2** occurs at time t_2 and the processor selects portion P**6** from stream **302**. The processor is arranged to render and compress P**6** such that P**6** is an intra-frame (IF**5**) and compare the respective compressed frame data for EVF**2** and IF**5**. In this case, the respective compressed frame data for EVF**2** and IF**5** are equal. As described above, the processor is arranged to compare respective pairs of bits, matched according to the sequence, in respective bit streams for EVF**2** and IF**5**. If all respective pairs of bits are equal, which is the case in this example, the processor is arranged to render and compress a second portion of the unrendered data stream immediately preceding the first portion in the sequence, for example, P**7**/**304**B. The processor is arranged to insert the second portion into data stream **110** such that the second portion, for example, **304**B, immediately precedes the end validation frame in data stream **110**, for example, EVF**2**.

If one or more respective pairs of bits for EVF**2** and IF**5** are not equal, the processor is arranged select an intra-frame, from data stream **110**, following the end validation frame in the sequence as an adjusted end validation frame and repeats the comparison process described above. The process of adjusting the end validation frame is described in more detail below.

As another example, EVF**1** occurs at time t_3 and the processor selects portion P**8** from stream **302**. The processor is arranged to render and compress P**8** such that P**8** is an intra-frame (IF**6**) and compare the respective compressed frame data for EVF**1** and IF**6**. In this example, the respective compressed frame data for EVF**1** and IF**6** are not equal; or the respective compressed frame data for EVF**1** and IF**6** are equal, but EVF**1** and IF**6** failed the bit stream analysis described above. Then, the processor is arranged select an intra-frame, from data stream **110**, following the end validation frame in the sequence as an adjusted end validation frame. For example, the processor is arranged to select IF**7** from segment S**2** following the segment including EVF**1**, as EVF**1**-A. The processor is arranged to select a portion from data stream **302**, matched to EVF**1**-A according to the sequence, for example, P**9**.

The processor is arranged to render and compress P**9** such that P**9** is an intra-frame (IF**8**) and compare the respective compressed frame data for EVF**1**-A and IF**7** and bit streams for EVF**1**-A and IF**7**, as described above. When the respective compressed frame data for EVF**1**-A and IF**7** are equal and EVF**1**-A and IF**7** pass the bit stream comparison, which is the case in this example, the processor is arranged to render and compress portion P**10** immediately following P**9** in the sequence, and insert P**10** into data stream **110** such that P**10**

immediately follows EVF1-A. Thus, the processor is arranged to "grow" the unique portion of data stream **110**. As a result, in data stream **110**, portion **126**A has been expanded to portion **126**A-A and common portion **124**B has been contracted to **124**B-A.

If the respective compressed frame data or respective bit streams for an adjusted end validation frame and the matching portion in data stream **302** are not equal, the processor is arranged to repeat the process described above by selecting the intra-frame following the adjusted end validation frame until an adjusted end validation frame and matching portion in data stream **302** have equal respective compressed frame data and respective bit streams.

The following is directed to a decompression and lossy comparison of end validation frames and matched portions of data stream **302**. Using EVF**2** as an example, the processor is arranged to at least partially decompress respective compressed frame data for EVF**2** and P**6** and compare the at least partially decompressed data. For example, the processor is arranged to access scene file **110**SF and data stream **302** to render EVF**2** and P**6** such that the EVF**2** and P**6** include respective rendered frame data. The processor compares a difference between the respective rendered frame data for EVF**2** and P**6**. When the rendered frame data are no more different than threshold, for example, TH**2**, which is the case in this example, the processor is arranged to render and compress a second portion of the unrendered data stream immediately preceding the first portion in the sequence, for example, P**7**/**304**B. The processor is arranged to insert the second portion into data stream **110** such that the second portion, for example, **304**B, immediately precedes the end validation frame in data stream **110**, for example, EVF**2**.

If the respective rendered frame data for an end validation frame and the matching portion in data stream **302** are more different than a threshold, the processor is arranged to repeat the process described above by selecting the intra-frame following the end validation frame as an adjusted end validation frame and repeating the rendered frame data comparison described above until an adjusted end validation frame and matching portion in data stream **302** are no more different than the threshold.

FIG. **6** is flow chart **400** illustrating a method of creating a new video. In the discussion that follows, system **100** is used as an example of implementing the flow chart; however, it should be understood that flow chart **400** is not limited to use with system **100**. In FIG. **6**, steps **402** and **404** result in the matching of start and end validation frames for a template data stream with matching intra-frames in an unrendered data stream, as described above. In step **406**, respective compressed frame data for start validation frames and matching intra-frames in the unrendered data stream are compared. If the respective compressed frame data match, step **408** compares the respective compressed frame data for end validation frames and matching intra-frames in the unrendered data stream. If the respective compressed frame data match, the method proceeds to step **410** in which the unique portions of the unrendered data stream are rendered, compressed, and inserted into the unique portions of the template to create a new personalized data stream using the common portions of the template data stream.

If the start validation frame and the matching intra-frame fail at step **404**, steps **412**-**416** implement the process of growing a unique portion and selecting an adjusted start validation frame as described above. Step **412** grows the unique portion as described above, step **414** selects the adjusted start validation frame for the expanded unique portion of the template data stream, and step **416** generates the matching infra-frame from the unrendered data stream. Step **406** compares the respective compressed frame data for the adjusted start validation frame and the matching inter-frame. If the intra-frames pass step **406**, the process moves to step **408**. If the intra-frames fail step **406**, steps **412**-**416** are repeated as necessary.

If the end validation frame and the matching intra-frame fail at step **408**, steps **418**-**422** implement the process of growing a unique portion and selecting an adjusted end validation frame as described above. Step **418** grows the unique portion as described above, step **420** selects the adjusted end validation frame for the expanded unique portion of the template data stream, and step **422** generates the matching infra-frame from the unrendered data stream. Step **408** compares the respective compressed frame data for the adjusted end validation frame and the matching inter-frame. If the intra-frames pass step **408**, the process moves to step **410**. If the intra-frames fail step **408**, steps **418**-**422** are repeated as necessary.

The following describes an example application of the system and method of the present disclosure. A company provides a service in which a template video is modified to include personalized information. For example, the template video could be for a Professional Gold Association (PGA) tournament or for a celebration, such as a birthday party. To generate the template video, the company performs operations on two data streams, for example, as described for data streams **110** and **112**, to generate common and unique portions. In the PGA example, the template video could show the gold course, various well-known players, and then show the leader board (a listing of players leading in the tournament) and a name of the player in the lead being erased. Up to this point, this would be a common portion of the template video.

In general, the template video is personalized, for example, unique portions are being added to the template video as described for data streams **110** and **302** above. In this example, the template video is being personalized for client John Golfer, such that after the name on the leader board is erased, the name of the client is shown being written on the leader board. The company populates the appropriate segments of a data stream, such as data stream **302**, with the client's personal data and these segments form the unique portions to be added to the template video, for example, John Golfer's name being written on the leader board. Thus, only the unique portion of the personalized template video needs to be rendered, that is, the common portion of the template video does not need to be rendered. It should be understood that any number of additional unique portions could be added to the template video in this example.

It will be appreciated that various aspects of the above-disclosed embodiments and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Various presently unforeseen or unanticipated alternatives, modifications, variations or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

What is claimed is:

1. A computer-based method for generating a compressed template Data stream, comprising using at least one specially programmed computer to:

access a first compressed data stream for a first movie, the first compressed data stream including a first plurality of frames arranged in a sequence, each frame in the first plurality including respective compressed frame data;

access a second compressed data stream for a second movie, the second compressed data stream including a

second plurality of frames arranged in a sequence, each frame in the second plurality including respective compressed frame data;

compare respective compressed frame data for respective pairs of frames in the first and second pluralities of frames, matched according to the sequence;

select, based on the comparison, a common portion and a unique portion in the first compressed data stream; and,

select, based on the comparison, first and second portions in the second compressed data stream, matched with the common and unique portions, respectively, in the sequence, wherein:

the first portion has respective compressed frame data equal to the respective compressed frame data for the common portion; and,

the second portion has respective compressed frame data unequal to the respective compressed frame data for the common portion.

2. The computer-based method of claim **1**, wherein:

each respective compressed frame data includes respective compressed video data and respective compressed audio data;

for respective pairs of frames in the common and first portions, matched according to the sequence, sizes for respective compressed frame data are substantially equal; and,

for respective pairs of frames in the unique and second portions, matched according to the sequence, sizes for respective compressed frame data are substantially unequal.

3. The computer-based method of claim **1**, wherein:

the first and second compressed data streams include first and second pluralities of segments, respectively, including the first and second pluralities of frames, respectively;

each segment in the first and second pluralities of segments includes a respective intra-frame, in a starting position according to the sequence in said each segment; and,

the respective intra-frame includes all data necessary to replicate images and audio for a scene associated with the respective intra-frame, the method further comprising using the at least one specially programmed computer to:

select first and second intra-frames from the first and second data streams, respectively, matched according to the sequence and having equal respective compressed frame data;

identify an initial occurrence of a pair of frames from the first and second data streams following the first and second intra-frames, matched according to the sequence, and having unequal respective compressed frame data; and,

identify a first frame, in the first data stream, immediately preceding the pair of frames in the sequence, as a start validation frame for the unique portion, wherein the start validation frame is a third intra-frame or the start validation frame is not a third intra-frame.

4. The computer-based method of claim **3**, further comprising, when the start validation frame is not the third intra-frame, using the at least one specially programmed computer to:

access an unrendered data stream for the first compressed data stream;

select a portion of the unrendered data stream matched with the start validation frame in the sequence;

render and compress the portion such that the portion is the third intra-frame; and,

replace the start validation frame with the third intra-frame.

5. The computer-based method of claim **4**, wherein the start validation frame occurs at a first time in the sequence, the method further comprising using the at least one specially programmed computer to:

access a first unrendered data stream;

select a first portion, in the first unrendered data stream, matched with the start validation frame in the sequence;

render and compress the first portion such that the first portion is a fourth intra-frame;

compare the respective compressed frame data for the start validation frame and the fourth intra-frame; and

when the respective compressed frame data for the start validation frame and the fourth intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the end validation frame and the fourth intra-frame; or,

when the respective compressed frame data for the start validation frame and the fourth intra-frame are unequal:

select a fifth intra-frame, from the first compressed data stream, preceding the start validation frame in the sequence as an adjusted start validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render and compress the second portion as a sixth intra-frame; and,

compare the respective compressed frame data for the adjusted start validation frame and the sixth intra-frame.

6. The computer-based method of claim **5**, wherein:

comparing respective pairs of bits includes determining that all respective pairs of bits are equal, the method further comprising using the at least one specially programmed computer to:

render and compress a second portion of the unrendered data stream immediately following the first portion in the sequence; and,

insert the second portion into the first compressed data stream such that the second portion immediately follows the start validation frame; or,

comparing respective pairs of bits includes determining that one respective pair of bits is unequal, the method further comprising using the at least one specially programmed computer to:

select a fifth intra-frame, from the first compressed data stream, preceding the start validation frame in the sequence as an adjusted start validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render and compress the second portion as a sixth intra-frame; and,

compare the respective compressed frame data for the adjusted start validation frame and the fifth intra-frame.

7. The computer-based method of claim **3**, further comprising, using the at least one specially programmed computer to:

identify an initial occurrence of fourth and fifth intra-frames from the first and second compressed data streams, respectively: following the start validation frame in the sequence; matched according to the sequence; and having equal respective compressed frame data;

compare respective compressed frame data for first and second segments, preceding the fourth and fifth intra-frames, respectively, in the sequence, to select first and second candidate frames from the first and second compressed data streams, respectively, the first and second candidate frames: having respective compressed frame data different by more than a threshold from remaining frames in the first and second segments, respectively; and matched in position according to the sequence;

access an unrendered data stream used to generate the first compressed data stream;

select first and second portions, in the first unrendered data stream, matched with the first and second candidate frames, respectively, in the sequence;

render and compress the first and second portions such that the first and second portions are sixth and seventh intra-frames; and,

determine that all respective pairs of bits, matched according to the sequence, in first and second bit streams for the sixth and seventh intra-frames, respectively, are equal, and select the sixth intra-frame as an end validation frame; or,

determine that at least one respective pair of bits, matched according to the sequence, in first and second bit streams for the sixth and seventh intra-frames, respectively, is unequal, select the fourth intra-frame as an end validation frame.

8. The computer-based method of claim **7**, wherein the end validation frame occurs at a first time in the sequence, the method further comprising using the at least one specially programmed computer to:

access a first unrendered data stream;

select a first portion, in the first unrendered data stream, matched with the end validation frame in the sequence;

render and compress the first portion such that the first portion is an eighth intra-frame;

compare the respective compressed frame data for the end validation frame and the eighth intra-frame; and

when the respective compressed frame data for the end validation frame and the eighth intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the end validation frame and the eighth intra-frame; or,

when the respective compressed frame data for the end validation frame and the eighth intra-frame are unequal:

select a ninth intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render and compress the second portion as a tenth intra-frame; and,

compare the respective compressed frame data for the adjusted end validation frame and the tenth intra-frame.

9. The computer-based method of claim **8**, wherein:

comparing respective pairs of bits includes determining that all respective pairs of bits are equal, the method further comprising using the at least one specially programmed computer to:

render and compress a second portion of the unrendered data stream immediately preceding the first portion in the sequence; and,

insert the second portion into the first compressed data stream such that the second portion immediately precedes the end validation frame; or,

comparing respective pairs of bits includes determining that one respective pairs of bits is unequal, the method further comprising using the at least one specially programmed computer to:

select a ninth intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render and compress the second portion as a tenth intra-frame; and,

compare the respective compressed frame data for the adjusted end validation frame and the tenth intra-frame.

10. The computer-based method of claim **3**, further comprising, using the at least one specially programmed computer to:

identify an initial occurrence of fourth and fifth intra-frames from the first and second compressed data streams: following the start validation frame in the sequence; matched according to the sequence; and having equal respective compressed frame data;

determine that no pair of frames from the first and second compressed data streams, respectively, located in first and second segments preceding the fourth and fifth intra-frames, respectively, in the sequence, and matched in position according to the sequence, have respective compressed frame data more different than a threshold from remaining frames in the first and second segment, respectively; and,

select the fourth intra-frame as an end validation frame.

11. The computer-based method of claim **3**, further comprising, using the at least one specially programmed computer to:

identify an initial occurrence of fourth and fifth intra-frames from the first and second compressed data streams, respectively: following the start validation frame in the sequence; matched according to the sequence; and having equal respective compressed frame data;

compare respective compressed frame data for first and second segments, preceding the fourth and fifth intra-frames, respectively, in the sequence, to select first and second candidate frames from the first and second compressed data streams, respectively, the first and second candidate frames: having respective compressed frame data different by more than a threshold from remaining frames in the first and second segments, respectively; and matched in position according to the sequence;

at least partially decompress respective compressed frame data for the first and second candidate frames;

compare respective at least partially decompressed data for the first and second candidate frames; and,

when the respective at least partially decompressed data are no more different than a second threshold

access an unrendered data stream used to generate the first compressed data stream;

select a first portion, in the first unrendered data stream, matched with the first candidate frame;

render and compress the first portion such that the first portion is a sixth intra-frame; and,

replace the first candidate frame with the sixth intra-frame and identify the first candidate frame as an end validation frame; or

when the respective at least partially decompressed data are more different than a second threshold, select the fourth intra-frame as an end validation frame.

12. The computer-based method of claim **11**, wherein the end validation frame occurs at a first time in the sequence, the method further comprising using the at least one specially programmed computer to:

render the end validation frame such that the end validation frame includes first rendered frame data;

access a first unrendered data stream;

select a first portion, in the first unrendered data stream, matched with the end validation frame in the sequence;

render the first portion such that the first portion includes second rendered frame data;

compare the first and second rendered data; and

when the first and second rendered data are no more different than a third threshold:

render and compress a second portion of the unrendered data stream immediately preceding the first portion in the sequence; and,

insert the second portion into the first compressed data stream such that the second portion immediately precedes the end validation frame; or,

when the first and second rendered data are more different than a third threshold:

select an eighth intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render the eighth intra-frame and the second portion to include respective rendered frame data; and,

compare a difference between the respective rendered frame data to the third threshold.

13. A computer-based method for generating a video, comprising using at least one specially programmed computer to:

access a compressed data stream, for a first video, the compressed data stream including:

a first plurality of frames arranged in a sequence, each frame in the first plurality of frames including respective compressed frame data; and,

in the first plurality of frames: a start validation intra-frame, and an end validation intra-frame following the start validation intra-frame in the sequence;

access an unrendered data stream;

identify first and second portions in the unrendered data stream matched with the start validation frame and the end validation frame, respectively, in the sequence;

render and compress the first and second portions such that the first and second portions are first and second intra-frames, respectively;

compare respective compressed frame data for the start validation intra-frame and the first intra-frame, respectively; and,

when respective compressed frame data for the start validation intra-frame and the first intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the start validation frame and the first intra-frame; or,

when respective compressed frame data for the start validation intra-frame and the first intra-frame are unequal:

select a third intra-frame, from the first compressed data stream, preceding the start validation frame in the sequence as an adjusted start validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render and compress the third portion as a fourth intra-frame; and,

compare the respective compressed frame data for the adjusted start validation frame and the fourth intra-frame; and,

compare respective compressed frame data for the end validation intra-frame and the second intra-frame, respectively; and,

when respective compressed frame data for the end validation intra-frame and the second intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the end validation frame and the second intra-frame; or,

when respective compressed frame data for the end validation intra-frame and the second intra-frame are unequal:

select a third intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render and compress the third portion as a fourth intra-frame; and,

compare the respective compressed frame data for the adjusted end validation frame and the fourth intra-frame.

14. The computer-based method of claim **13**, wherein:

comparing respective pairs of bits for the start validation intra-frame and the first intra-frame includes determining that all respective pairs of bits are equal, the method further comprising using the at least one specially programmed computer to:

render and compress a third portion of the unrendered data stream immediately following the first portion in the sequence; and,

insert the third portion into the first compressed data stream such that the third portion immediately follows the start validation frame; or,

comparing respective pairs of bits for the start validation intra-frame and the first intra-frame includes determining that one respective pairs of bits is unequal, the method further comprising using the at least one specially programmed computer to:

select a third intra-frame, from the first compressed data stream, following the start validation frame in the sequence as an adjusted start validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render and compress the third portion as a fourth intra-frame; and,

compare the respective compressed frame data for the adjusted start validation frame and the fourth intra-frame.

15. The computer-based method of claim **13**, wherein:

comparing respective pairs of bits for the end validation intra-frame and the second intra-frame includes determining that all respective pairs of bits are equal, the

method further comprising using the at least one specially programmed computer to:

render and compress a third portion of the unrendered data stream immediately preceding the second portion in the sequence; and,

insert the third portion into the first compressed data stream such that the third portion immediately precedes the end validation frame; or,

comparing respective pairs of bits for the end validation intra-frame and the second intra-frame includes determining that one respective pairs of bits is unequal, the method further comprising using the at least one specially programmed computer to:

select a third intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render and compress the third portion as a fourth intra-frame; and,

compare the respective compressed frame data for the adjusted end validation frame and the fourth intra-frame.

16. A computer-based system for generating a compressed template data stream, comprising:

a memory element for at least one specially programmed computer arranged to store computer executable instructions; and,

at least one processor for the at least one specially programmed computer arranged to execute the computer executable instructions to:

access a first compressed data stream for a first movie, the first compressed data stream including a first plurality of frames arranged in a sequence, each frame in the first plurality including respective compressed frame data;

access a second compressed data stream for a second movie, the second compressed data stream including a second plurality of frames arranged in a sequence, each frame in the second plurality including respective compressed frame data;

compare respective compressed frame data for respective pairs of frames in the first and second pluralities of frames, matched according to the sequence;

select, based on the comparison, a common portion and a unique portion in the first compressed data stream; and,

select, based on the comparison, first and second portions in the second compressed data stream, matched with the common and unique portions, respectively, in the sequence, wherein:

the first portion has respective compressed frame data equal to the respective compressed frame data for the common portion; and,

the second portion has respective compressed frame data unequal to the respective compressed frame data for the common portion.

17. The computer-based system of claim **16**, wherein:

each respective compressed frame data includes respective compressed video data and respective compressed audio data;

for respective pairs of frames in the common and first portions, matched according to the sequence, sizes for respective compressed frame data are substantially equal; and,

for respective pairs of frames in the unique and second portions, matched according to the sequence, sizes for respective compressed frame data are substantially unequal.

18. The computer-based system of claim **17**, wherein:

the first and second compressed data streams include first and second pluralities of segments, respectively, including the first and second pluralities of frames, respectively;

each segment in the first and second pluralities of segments includes a respective intra-frame, in a starting position according to the sequence in said each segment;

the respective intra-frame includes all data necessary to replicate images and audio for a scene associated with the respective intra-frame; and,

the at least one processor is arranged to:

select first and second intra-frames from the first and second data streams, respectively, matched according to the sequence and having equal respective compressed frame data;

identify an initial occurrence of a pair of frames from the first and second data streams following the first and second intra-frames, matched according to the sequence, and having unequal respective compressed frame data; and,

identify a first frame, in the first data stream, immediately preceding the pair of frames in the sequence, as a start validation frame for the unique portion, wherein the start validation frame is a third intra-frame or the start validation frame is not an intra-frame.

19. The computer-based system of claim **18**, wherein the at least one processor is arranged to:

access an unrendered data stream used to generate the first compressed data stream;

select a portion of the unrendered data stream matched with the start validation frame in the sequence;

render and compress the portion such that the portion is the third intra-frame; and,

replace the start validation frame with the third intra-frame.

20. The computer-based system of claim **19**, wherein:

the start validation frame occurs at a first time in the sequence; and,

the at least one processor is arranged to:

access a first unrendered data stream;

select a first portion, in the first unrendered data stream, matched with the start validation frame in the sequence;

render and compress the first portion such that the first portion is a fourth intra-frame;

compare the respective compressed frame data for the start validation frame and the fourth intra-frame; and

when the respective compressed frame data for the start validation frame and the fourth intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the end validation frame and the eighth intra-frame; or,

when the respective compressed frame data for the start validation frame and the fourth intra-frame are unequal:

select a fifth intra-frame, from the first compressed data stream, preceding the start validation frame in the sequence as an adjusted start validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render and compress the second portion as a sixth intra-frame; and,

compare the respective compressed frame data for the adjusted start validation frame and the sixth intra-frame.

21. The computer-based system of claim **20**, wherein:

comparing respective pairs of bits includes determining that all respective pairs of bits are equal; and,

the at least one processor is arranged to

render and compress a second portion of the unrendered data stream immediately following the first portion in the sequence; and,

insert the second portion into the first compressed data stream such that the second portion immediately follows the start validation frame; or,

comparing respective pairs of bits includes determining that one respective pairs of bits is unequal; and,

the at least one processor is arranged to:

select a fifth intra-frame, from the first compressed data stream, preceding the start validation frame in the sequence as an adjusted start validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render and compress the second portion as a sixth intra-frame; and,

compare the respective compressed frame data for the adjusted start validation frame and the fifth intra-frame.

22. The computer-based system of claim **18**, wherein the at least one processor is arranged to:

identify an initial occurrence of fourth and fifth intra-frames from the first and second compressed data streams, respectively: following the start validation frame in the sequence; matched according to the sequence; and having equal respective compressed frame data;

compare respective compressed frame data for first and second segments, preceding the fourth and fifth intra-frames, respectively, in the sequence, to select first and second candidate frames from the first and second compressed data streams, respectively, the first and second candidate frames: having respective compressed frame data different by more than a threshold from remaining frames in the first and second segments, respectively; and matched in position according to the sequence;

access an unrendered data stream used to generate the first compressed data stream;

select first and second portions, in the first unrendered data stream, matched with the first and second candidate frames, respectively, in the sequence;

render and compress the first and second portions such that the first and second portions are sixth and seventh intra-frames; and,

determine that all respective pairs of bits, matched according to the sequence, in first and second bit streams for the sixth and seventh intra-frames, respectively, are equal, and select the sixth intra-frame as an end validation frame; or,

determine that at least one respective pair of bits, matched according to the sequence, in first and second bit streams for the sixth and seventh intra-frames, respectively, is unequal, select the fourth intra-frame as an end validation frame.

23. The computer-based system of claim **22**, wherein:

the end validation frame occurs at a first time in the sequence; and,

the at least one processor is arranged to:

access a first unrendered data stream;

select a first portion, in the first unrendered data stream, matched with the end validation frame in the sequence;

render and compress the first portion such that the first portion is an eighth intra-frame;

compare the respective compressed frame data for the end validation frame and the eighth infra-frame; and

when the respective compressed frame data for the end validation frame and the eighth intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the end validation frame and the eighth intra-frame; or,

when the respective compressed frame data for the end validation frame and the eighth intra-frame are unequal:

select a ninth intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence; and,

compare the respective compressed frame data for the adjusted end validation frame and the ninth intra-frame.

24. The computer-based system of claim **18**, wherein:

comparing respective pairs of bits includes determining that all respective pairs of bits are equal; and,

the at least one processor is arranged to:

render and compress a second portion of the unrendered data stream immediately preceding the first portion in the sequence; and,

insert the second portion into the first compressed data stream such that the second portion immediately precedes the end validation frame; or,

comparing respective pairs of bits includes determining that one respective pairs of bits is unequal; and,

the at least one processor is arranged to:

select a ninth intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence; and,

compare the respective compressed frame data for the adjusted end validation frame and the ninth intra-frame.

25. The computer-based system of claim **18**, wherein the at least one specially programmed computer is arranged to:

identify an initial occurrence of fourth and fifth intra-frames from the first and second compressed data streams: following the start validation frame in the sequence; matched according to the sequence; and having equal respective compressed frame data;

determine that no pair of frames from the first and second compressed data streams, respectively, located in first and second segments preceding the fourth and fifth intra-frames, respectively, in the sequence, and matched in position according to the sequence, have respective compressed frame data more different than a threshold from remaining frames in the first and second segment, respectively; and,

select the fourth intra-frame as an end validation frame.

26. The computer-based system of claim **14**, wherein the at least one processor is arranged to:

identify an initial occurrence of fourth and fifth intra-frames from the first and second compressed data streams, respectively: following the start validation frame in the sequence; matched according to the sequence; and having equal respective compressed frame data;

compare respective compressed frame data for first and second segments, preceding the fourth and fifth intra-frames, respectively, in the sequence, to select first and second candidate frames from the first and second compressed data streams, respectively, the first and second candidate frames: having respective compressed frame data different by more than a threshold from remaining frames in the first and second segments, respectively; and matched in position according to the sequence;

at least partially decompress respective compressed frame data for the first and second candidate frames;

compare respective at least partially decompressed data for the first and second candidate frames; and,

when the respective at least partially decompressed data are no more different than a second threshold

access an unrendered data stream used to generate the first compressed data stream;

select a first portion, in the first unrendered data stream, matched with the first candidate frame;

render and compress the first portion such that the first portion is a sixth intra-frame; and,

replace the first candidate frame with the sixth intra-frame and identify the first candidate frame as an end validation frame; or

when the respective at least partially decompressed data are more different than a second threshold, select the fourth intra-frame as an end validation frame.

27. The computer-based method of claim **26**, wherein:

the end validation frame occurs at a first time in the sequence; and,

the at least one processor is arranged to:

render the end validation frame such that the end validation frame includes first rendered frame data;

access a first unrendered data stream;

select a first portion, in the first unrendered data stream, matched with the end validation frame in the sequence;

render the first portion such that the first portion includes second rendered frame data;

compare the first and second rendered data; and

when the first and second rendered data are no more different than a third threshold:

render and compress a second portion of the unrendered data stream immediately preceding the first portion in the sequence; and,

insert the second portion into the first compressed data stream such that the second portion immediately precedes the end validation frame; or,

when the first and second rendered data are more different than a third threshold:

select an eighth intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a second portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render the eighth intra-frame and the second portion to include respective rendered frame data; and,

compare a difference between the respective rendered frame data to a third threshold.

28. A computer-based system for generating a video, comprising:

a memory element for at least one specially programmed computer arranged to store computer executable instructions; and,

at least one processor for the at least one specially programmed computer arranged to execute the computer executable instructions to:

access a compressed data stream, for a first video, the compressed data stream including:

a first plurality of frames arranged in a sequence, each frame in the first plurality of frames including respective compressed frame data; and,

in the first plurality of frames: a start validation intra-frame, and an end validation intra-frame following the start validation intra-frame in the sequence;

access an unrendered data stream;

identify first and second portions in the unrendered data stream matched with the start validation frame and the end validation frame, respectively, in the sequence;

render and compress the first and second portions such that the first and second portions are first and second intra-frames, respectively;

compare respective compressed frame data for the start validation intra-frame and the first intra-frame, respectively; and,

when respective compressed frame data for the start validation intra-frame and the first intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the start validation frame and the first intra-frame; or,

when respective compressed frame data for the start validation intra-frame and the first intra-frame are unequal:

select a third intra-frame, from the first compressed data stream, preceding the start validation frame in the sequence as an adjusted start validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render and compress the third portion as a fourth intra-frame; and,

compare the respective compressed frame data for the adjusted start validation frame and the fourth intra-frame; and,

compare respective compressed frame data for the end validation intra-frame and the second intra-frame, respectively; and,

when respective compressed frame data for the end validation intra-frame and the second intra-frame are equal, compare respective pairs of bits, matched according to the sequence, in respective bit streams for the end validation frame and the second intra-frame; or,

when respective compressed frame data for the end validation intra-frame and the second intra-frame are unequal:

select a third intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render and compress the third portion as a fourth intra-frame; and,

compare the respective compressed frame data for the adjusted end validation frame and the fourth intra-frame.

29. The computer-based system of claim **28**, wherein:

comparing respective pairs of bits for the start validation intra-frame and the first intra-frame includes determining that all respective pairs of bits are equal; and,

the at least one processor is arranged to:

render and compress a third portion of the unrendered data stream immediately following the first portion in the sequence; and,

insert the third portion into the first compressed data stream such that the third portion immediately follows the start validation frame; or,

comparing respective pairs of bits for the start validation intra-frame and the first intra-frame includes determining that one respective pairs of bits is unequal; and,

the at least one processor is arranged to:

select a third intra-frame, from the first compressed data stream, following the start validation frame in the sequence as an adjusted start validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render and compress the third portion as a fourth intra-frame; and,

compare the respective compressed frame data for the adjusted start validation frame and the fourth intra-frame.

30. The computer-based system of claim **28**, wherein:

comparing respective pairs of bits for the end validation intra-frame and the second intra-frame includes determining that all respective pairs of bits are equal; and,

the at least one processor is arranged to:

render and compress a third portion of the unrendered data stream immediately preceding the second portion in the sequence; and,

insert the third portion into the first compressed data stream such that the third portion immediately precedes the end validation frame; or,

comparing respective pairs of bits for the end validation intra-frame and the second intra-frame includes determining that one respective pairs of bits is unequal; and,

the at least one processor is arranged to:

select a third intra-frame, from the first compressed data stream, following the end validation frame in the sequence as an adjusted end validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render and compress the third portion as a fourth intra-frame; and,

compare the respective compressed frame data for the adjusted end validation frame and the fourth intra-frame.

31. A computer-based method for generating a video, comprising using at least one specially programmed computer to:

access a compressed data stream, for a first video, the compressed data stream including:

a first plurality of frames arranged in a sequence, each frame in the first plurality of frames including respective compressed frame data; and,

in the first plurality of frames: a start validation intra-frame, and an end validation intra-frame following the start validation intra-frame in the sequence;

render the start and end validation frames such that the start and validation frames include first and second rendered frame data, respectively;

access an unrendered data stream;

identify first and second portions in the unrendered data stream matched with the start validation frame and the end validation frame, respectively, in the sequence;

render the first and second portions such that the first and second portions include third and fourth rendered frame data, respectively;

compare the first and third rendered frame data; and,

when the first and third rendered data are no more different than a threshold:

render and compress a third portion of the unrendered data stream immediately following the first portion in the sequence; and,

insert the third portion into the first compressed data stream such that the third portion immediately follows the start validation frame; or,

when the first and third rendered data are more different than a threshold:

select an intra-frame, from the first compressed data stream, preceding the validation frame in the sequence as an adjusted start validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render the intra-frame and the third portion to include respective rendered frame data; and,

compare a difference between the respective rendered frame data to the threshold;

compare the second and fourth rendered frame data; and,

when the second and fourth rendered data are no more different than a threshold:

render and compress a third portion of the unrendered data stream immediately preceding the second portion in the sequence; and,

insert the third portion into the first compressed data stream such that the third portion immediately precedes the end validation frame; or,

when the second and fourth rendered data are more different than a threshold:

select an intra-frame, from the first compressed data stream, following the validation frame in the sequence as an adjusted end validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render the intra-frame and the third portion to include respective rendered frame data; and,

compare a difference between the respective rendered frame data to the threshold.

32. A computer-based system for generating a compressed template data stream, comprising:

a memory element for at least one, specially programmed computer arranged to store computer executable instructions; and,

at least one processor for the at least one specially programmed computer arranged to execute the computer executable instructions to:

access a compressed data stream, for a first video, the compressed data stream including:

a first plurality of frames arranged in a sequence, each frame in the first plurality of frames including respective compressed frame data; and,

in the first plurality of frames: a start validation intra-frame, and an end validation intra-frame following the start validation intra-frame in the sequence;

render the start and end validation frames such that the start and validation frames include first and second rendered frame data, respectively;

access an unrendered data stream;

identify first and second portions in the unrendered data stream matched with the start validation frame and the end validation frame, respectively, in the sequence;

render the first and second portions such that the first and second portions include third and fourth rendered frame data, respectively;

compare the first and third rendered frame data; and,

when the first and third rendered data are no more different than a threshold:

render and compress a third portion of the unrendered data stream immediately following the first portion in the sequence; and,

insert the third portion into the first compressed data stream such that the third portion immediately follows the start validation frame; or,

when the first and third rendered data are more different than a threshold:

select an intra-frame, from the first compressed data stream, preceding the validation frame in the sequence as an adjusted start validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted start validation frame in the sequence;

render the intra-frame and the third portion to include respective rendered frame data; and,

compare a difference between the respective rendered frame data to the threshold;

compare the second and fourth rendered frame data; and,

when the second and fourth rendered data are no more different than a threshold:

render and compress a third portion of the unrendered data stream immediately preceding the second portion in the sequence; and,

insert the third portion into the first compressed data stream such that the third portion immediately precedes the end validation frame; or,

when the second and fourth rendered data are more different than a threshold:

select an intra-frame, from the first compressed data stream, following the validation frame in the sequence as an adjusted end validation frame;

select a third portion, in the unrendered data stream, matched with the adjusted end validation frame in the sequence;

render the intra-frame and the third portion to include respective rendered frame data; and,

compare a difference between the respective rendered frame data to the threshold.

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