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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR   | ATTORNEY DOCKET NO.   | CONFIRMATION NO. |
|---|-------------|------------------------|-----------------------|------------------|
| 15/370,840  | 12/06/2016  | Alexander Jay Converse | GOGL-1153-B           | 5111             |
| 97818   | 7590        | 08/28/2018             | EXAMINER              |                  |
| Google LLC<br>c/o Young Basile Hanlon & MacFarlane, P.C.<br>3001 West Big Beaver Rd., Ste. 624<br>Troy, MI 48084-3107 |             |                        | PEREZ FUENTES, LUIS M |                  |
|   |             |                        | ART UNIT              | PAPER NUMBER     |
|   |             |                        | 2481                  |                  |
|   |             |                        | NOTIFICATION DATE     | DELIVERY MODE    |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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|                              |                                       |  |                          |
|------------------------------|---------------------------------------|--|--------------------------|
| <b>Office Action Summary</b> | <b>Application No.</b><br>15/370,840  | <b>Applicant(s)</b><br>Converse, Alexander Jay |                          |
|                              | <b>Examiner</b><br>LUIS PEREZ-FUENTES | <b>Art Unit</b><br>2481                        | <b>AIA Status</b><br>Yes |

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

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1)  Responsive to communication(s) filed on 04/11/2017.  
 A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.
- 2a)  This action is **FINAL**.    2b)  This action is non-final.
- 3)  An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4)  Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims\***

- 5)  Claim(s) 1-20 is/are pending in the application.  
5a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 6)  Claim(s) \_\_\_\_ is/are allowed.
- 7)  Claim(s) 1-20 is/are rejected.
- 8)  Claim(s) \_\_\_\_ is/are objected to.
- 9)  Claim(s) \_\_\_\_ are subject to restriction and/or election requirement

\* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

**Application Papers**

- 10)  The specification is objected to by the Examiner.
- 11)  The drawing(s) filed on See Continuation Sheet is/are: a)  accepted or b)  objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

- 12)  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a)  All        b)  Some\*\*        c)  None of the:
1.  Certified copies of the priority documents have been received.
2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3.  Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |  |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 3) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date ____. |
| 2) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)<br>Paper No(s)/Mail Date <u>07/13/2017; 08/28/2017</u> . | 4) <input type="checkbox"/> Other: ____.   |

Continuation of Application Papers 11): 06 December 2016

## **DETAILED ACTION**

1. *Current communication is being filed in response to the submission having a mailing date 04/11/2017 in which a (3) month Shortened Statutory Period for Response has been set.*
2. *All the material, pages, columns, line numbers, paragraphs, and the like, of the present application and prior art, will be identified in abbreviated form, as following:  
\_ Page/Column (1), Lines (3 -15) of an applied prior art will be called out as: (Refer. [1: 3 -15]).  
\_ Similarly, the twenty-fifth paragraph of a cited reference will be called out as (Refer. [0025]).*

## **Notice of Pre-AIA or AIA Status**

3. *The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.*

## **Information Disclosure Statement**

4. *The submitted IDS (07/13/2017; 08/28/2017), are in compliance with the provisions of 37 CFR 1.97, have been reviewed and considered by the Examiner.*
  - 4.1. *Multiple entries in the cited IDS have been discarded, for failure to cite the relevant pages in the publication associated with the case. Each of the submitted publications has to comply with the provisions of 37 CFR 1.98 in order evaluate the corresponded information listed in the IDS to be considered by the Office. Proper correction is required. See MPEP [ 37 CFR 1.98(b) - each publication must be identified by publisher, author (if any), title, relevant pages of the publication, and date and place of publication.]*
  - 4.2. *The newly filed PTO 429 (3th party submission form) dated on (08/11/2017) is in accordance with the 37 CFR 1.290 provision, it has been approved and considered on record.*

## **Drawings**

5. *The submitted Drawings on date (12/06/2016) have been accepted and considered under the 37 CFR 1.121 (d).*

## **Claim Clarification**

6. *For the sole purpose of further examination, and under the broadest reasonable interpretation consistent with the instant specification and the common knowledge of one of ordinary skill in the art ...*
  - 6.1. *The following terms will be considered to read as following:  
\_ The limitation/term “**encoder/decoder state machine**” will be read as (e.g. a set of software instructions for modeling an entropy codec functionality, that parses and uses “Boolean ANS” and “symbol ANS”, as illustrated in Fig. 6, [specs; 00002 -0003]).*

\_ The limitation/term “**a flag and/or token (symbol)**” will be read as (e.g. compute and store the flag and/or token using the probability value associated with the token; [specs; 0004]).

\_ The limitation/term “**a normalization state**” will be read as (e.g. computation of the codec sate range validation; [specs; 0082]).

6.2. Examiner notes that Applicant lists a set of standard codec features techniques, following by a set of passive terms - **receiving/initiating/processing/forming**/etc - indicating that a function is performed without requiring of any additional functional structure or method-algorithm, as a limitation on the claim itself. It is clear that such claim language does not further limit the claims, and **does not require a separate reason for rejection**; (see MPEP 2111.04 for more information). The clause may be given some weight to the extent it provides “**meaning and purpose**” to the claimed invention, but not when “**it simply expresses the intended result**” of the invention. While a cumulative rejection of such language is provided below for purposes of compact prosecution, Examiner undersigned suggests amend such claim language to recite clear limitations corresponding to the subject matter of the claim.

## **Claim Rejection**

### **35 USC § 101 Rejection**

7. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title. 7.05.014 Rejection, 35 U.S.C. 101, Non-Statutory (Abstract Idea Implemented on a Generic Computer - Not Significantly More than the Abstract Idea Itself)

7.1. Independent claims (1, 9 and 15) are rejected under 35 U.S.C. 101 for being directed to an abstract idea of processing and transforming data.

7.2. The cited claims, (as currently stated), they are performing a well-known set of software instructions, in form of a common used in the art “state machine”, also executed on a “generic codec computer”, with no specific details that would differentiate from a well-understood, routine, and/or conventional activities that confine the claims to a particular novel and useful application. Therefore the cited claims do not amount to significantly more than the abstract idea itself, and are not patent eligible. See MPEP 2106.05 (d) for “court cases for “significantly more” qualifiers.

7.3. See Alice analysis below:

\_ **STEP ONE**; for this step the Examiner decides whether the claims are directed to ineligible subject matter, such as an abstract idea. Based on these terms, cited claims could satisfy “Alice step one” when they are directed to a specific implementation/solution such as a computer codec application.

\_ **STEP TWO**; for this step the Examiner searches for any relevant “inventive concept”, sufficient to transform the nature of the claims into a “patent-eligible application”, and to

determine whether the claims complain with the “**significantly more**” doctrine. It is valid to point out that even when Applicant's specification offers support for the claim language as currently stated, nothing in the claims reveals the novel specificities of the inventive concepts, and solely relies on “performing/processing” a set of very well-known codec tools wherein a ANS open source algorithm is instantiated, and therefore fails to provide sufficient details regarding the manner in which the invention accomplished the alleged improvement.

7.4. Therefore, and viewed as a whole, the cited list of claim element(s) do not provide meaningful limitation(s) to transform the abstract idea into a patent eligible application of the abstract idea such that the claim(s) amounts to significantly more than the abstract idea itself.

7.5. For more information see also the latest USPTO guidance “Eligibility Quick Reference Identifying Abstract Ideas <https://www.uspto.gov/sites/default/files/documents/ieg-qrs.pdf> ; and specifically the court case - (**Digitech**); organizing and manipulating information through mathematical correlations.

## **35 USC § 112(a) Rejection**

8. The following is a quotation of 35 U.S.C. 112 (pre-AIA), first paragraph:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8.1. Independent Claims (1, 9 and 15) and the correspondent dependencies, are rejected under the 35 USC 112(a) doctrine, for failure to explain how the inventor envisioned the functionality to be performed, such that the written description does not show that the inventor has possession of the claimed invention.

8.2. In the presented parallel running independent claims (1, 9 and 15), Applicant recites the feature of “**computing a flag/token ...**” by using “**a probability model**” as disclosed in the specs; [specs; 0004]. The specs refers to “**probability model computation**” as (e.g. a plurality of well-known statistical models associated with video data-type [specs; 0019]); but with no specific details referenced in the claims about the specific used “**model**” in this case, and therefore fails to describe the real specificities, associations and contribution of the claimed “**model**” in the invention. Proper clarification is still required.

8.3. For the sole purpose of examination, the cited limitations/features will be read as pre-defined in section (6), and as described in the standard codec documentation and practices. Proper clarification is still required.

## **35 USC § 112(b) Rejection**

9. The following is a quotation of 35 U.S.C. 112:

(b) CONCLUSION.-The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

9.1. Claims (1, 9 and 15) are rejected under 35 U.S.C. 112(b) for lack of clarity/boundaries, and as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

9.2. Regarding the cited list of independent claims (1, 9 and 15) and the correspondent assigned dependencies, the Examiner notes that Applicant distinctly uses the terms “**token**” and “**symbol**” that was defined/derived as the same element in the specs - (e.g. a value associated with a token (also known as “symbol”), [specs; 0087]).

9.3. This language is not clear and fails to provide a clear-cut indication of claim scope because the functional language is not sufficiently precise and definite resulting in no boundaries on the described claim limitation-feature. Proper clarification is still needed.

9.4. For the sole purpose of examination, the cited limitations/features will be read as pre-defined in section (6), and as described in the standard codec documentation and practices. Proper clarification is still required.

## **35 USC § 103 Rejection**

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained through the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10.1. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1,148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or non-obviousness

10.2. Claims (1 -20) are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen; et al. (US 6,823,016), hereafter “Nguyen”, in view of Duda; et al. (Asymmetric numerical systems; entropy coding combining speed of Huffman coding with compression rate of arithmetic coding; Jan/2014), hereafter “Duda”, and further in view of Giesen; et. al. (Interleaved entropy coders; Feb/2014), hereafter “Giesen”,

CLAIM 1. (Original) Nguyen discloses the invention substantially as claimed - **A method for decoding an encoded bitstream using a computing device, the encoded bitstream including frames, the frames having blocks of pixels, the method comprising: (e.g. a system for controlling (22) codec/decoder hardware device (26) of an obtaining video data**

stream (18), performing VLC decoding (20), decoding each one of the plurality of instructions, and optionally performing an IDCT (26) in response to plurality of instructions (24); including locating each non-zero IDCT coefficient corresponding to plurality of partitioned blocks, and assigning an index/symbol to the non-zero IDCT coefficient, the index designating a location within the one of the plurality of blocks, packing the non-zero IDCT coefficient in little endian format, and specifying a terminator bit (Boolean/bit) corresponding to the non-zero coefficient, indicating the end of all non-zero IDCT coefficients for each of the blocks; [Nguyen; Summary]

Even when Nguyen in details discloses the use the structure (Figs. 1 -2) and algorithm functionality (Fig. 5) of sequentially producing DCT coefficients of the current block from the variable string using the entropy decoder state machine until an end of block flag is reached or a maximum number of transform coefficients, Fig. 5; [Nguyen; 10: 05 -10: 60];

it is note that the Nguyen invention fails to disclose the use of the "ANS algorithm" implemented by Duda's open-source (Asymmetric numerical systems; entropy coding combining speed of Huffman coding with compression rate of arithmetic coding; Duda et al.) that applies for both encoder-decoder techniques as described in [Duda; 2.1]).

Given the teachings of Duda's ANS algorithm, and under the obvious assumption, nature and purpose of Duda's papers, it is noted that some of the steps/elements as listed, are missed or not fully disclosed.

In the same field of endeavor Giesen discloses the use of (e.g. a new ANS family of arithmetic coders (as developed by J. Duda) having the unique property that encoder and decoder are completely symmetric, employing a set of analogous state instructions including the "boolean ANS" and the "symbol data-state" [section 3-4], able to produce DCT coefficients of the current block [section 3-4], and state evolution functionality; [section 3], and the normalization operation [section 4] as claimed. As a consequence, the output from multiple ABS/ANS coders can be interleaved into the same bitstream without any additional metadata; [Giesen; section 1-5])

**receiving the encoded bitstream including encoded transform coefficients of a current block;** (e.g. see analogous structure (Figs. 1 -2) and algorithm functionality (Fig. 5); [Nguyen; 10: 05 -10: 60])

**initializing a decoder state of an entropy decoder state machine, the entropy decoder state machine including a Boolean asymmetric numeral system (ANS) decoder and a symbol ANS decoder, and** (e.g. see analogous structure (Figs. 1 -2) and algorithm functionality (Fig. 5); [Nguyen; 10: 05 -10: 60]; see the also [Duda; 2.1] and [Giesen; 3-4])

**the decoder state including an ANS state and a buffer position within a buffer storing a variable string including the encoded transform coefficients;** (e.g. apparatus (Figs. 1 -2) and algorithm functionality (Fig. 5); [Nguyen; 10: 05 -10: 60]; see the also [Duda; 2.1] and [Giesen; 3-4])

**sequentially producing transform coefficients of the current block from the variable string using the entropy decoder state machine until an end of block flag is reached or a maximum number of transform coefficients is output by;** (e.g. apparatus (Figs. 1 -2) and algorithm functionality (Fig. 5); [Nguyen; 10: 05 -10: 60]; see the also [Duda; 2.1] and [Giesen; 3-4])

**processing a binary flag or bit using the Boolean ANS decoder to generate an output value for the binary flag or bit using the ANS state; and** (e.g. apparatus (Figs. 1 -



2) and algorithm functionality (Fig. 5); [Nguyen; 10: 05 -10: 60]; see the also [Duda; 2.1] and [Giesen; 3-4])

**processing a token using the symbol ANS decoder to generate an output value for the token using the ANS state; (e.g. apparatus (Figs. 1 -2) and algorithm functionality (Fig. 5); [Nguyen; 10: 05 -10: 60]; see the also [Duda; 2.1] and [Giesen; 3-4])**

**forming a transform block using the transform coefficients; inverse transforming the transform block to generate a residual block; and reconstructing the current block using the residual block; (e.g. apparatus (Figs. 1 -2) and algorithm functionality (Fig. 5); [Nguyen; 10: 05 -10: 60]; see the also [Duda; 2.1] and [Giesen; 3-4])**

*It would be obvious to one skilled in the art to combine the open source ANS algorithm with the system of Nguyen in order to include the advantages of the ANS functionality, and further with Giesen et al in order to provide (e.g. a simple and efficient coding interleaving, and where no additional metadata is necessary for this, provided that the sequence of coders and models used is the same between encoder and decoder.; [Giesen; Topics 2 -3])*

**CLAIM 2. (Original) Nguyen/Duda/Giesen discloses - The method of claim 1, further comprising:**

**the entropy decoder state machine operating according to a single state diagram with five nodes, each of the five nodes encompassing a non-overlapping range of available ANS states; and (same rationale and motivation applies as given for the claim 1.)**

**after generating the output value, perform a state evolution function for the ANS state, the state evolution function of the Boolean ANS decoder different from a state evolution function of the symbol ANS decoder depending on which of the five nodes in which the entropy decoder state machine is operating; (same rationale and motivation applies as given for the claim 1.)**

**CLAIM 3. (Original) Nguyen/Duda/Giesen discloses - The method of claim 1, further comprising:**

**sharing a single detokenizer between the Boolean ANS decoder and the symbol ANS decoder, wherein processing the binary flag or bit using the Boolean ANS decoder to generate the output value for the binary flag or bit uses the ANS state and a probability value associated with the flag or bit from the single detokenizer, (the same rationale and motivation applies as given for the claim 1.)**

**and processing the token using the symbol ANS decoder to generate the output value for the token using the ANS state and a probability distribution with the token from the single detokenizer; (the same rationale and motivation applies as given for the claim 1.)**

**CLAIM 4. (Original) Nguyen/Duda/Giesen discloses - The method of claim 3, wherein:**

**an output from the single detokenizer to the Boolean ANS decoder is a Boolean value for the binary flag or bit; and an output from the single detokenizer to the symbol ANS decoder is the token; (same rationale and motivation applies as given for the claim 1.)**

**CLAIM 5. (Original) Nguyen/Duda/Giesen discloses - The method of claim 1, further comprising: processing the binary flag or bit using the Boolean ANS decoder by:**

*performing a state normalization operation when the ANS state is outside a valid state range for the binary flag or but by updating the ANS state by appending a bitstream data unit from the variable string, and updating the buffer position; (the same rationale and motivation applies as given for the claim 1.)*

*performing an output computation operation to generate the output value for the binary flag or bit using the ANS state and a probability value associated with the flag or bit; and (the same rationale and motivation applies as given for the claim 1.)*

*performing a state evolution operation to update the ANS state; and (the same rationale and motivation applies as given for the claim 1.)*

*processing the token using the symbol ANS decoder by: (the same rationale and motivation applies as given for the claim 1.)*

*performing a state normalization operation when the ANS state is outside a valid state range for the token by updating the ANS state by appending a bitstream data unit from the variable string, and updating the buffer position; (the same rationale and motivation applies as given for the claim 1.)*

*performing an output computation operation to generate the output value for the token using the ANS state and a probability distribution associated with the token; (the same rationale and motivation applies as given for the claim 1.)*

*and performing a state evolution operation to update the ANS state; (the same rationale and motivation applies as given for the claim 1.)*

**CLAIM 6.** (Original) Nguyen/Duda/Giesen discloses - *The method of claim 5, wherein processing the binary flag or bit using the Boolean ANS decoder comprises performing the state evolution operation to update the ANS state using a first state evolution function, the output value, and the probability value as an input to the first state evolution function, and (the same rationale and motivation applies as given for the claim 1.)*

*processing the token using the symbol ANS decoder comprises performing the state evolution operation to update the ANS state using a second state evolution function, the second state evolution function different from the first state evolution function; (the same rationale and motivation applies as given for the claim 1.)*

**CLAIM 7.** (Original) Nguyen/Duda/Giesen discloses - *The method of claim 5, wherein the bitstream data unit is a byte; (the same rationale and motivation applies as given for the claim 1.)*

**CLAIM 8.** (Original) Nguyen/Duda/Giesen discloses - *The method of claim 5, wherein an input/output (I/O) base for ANS decoding is defined by  $(2U)^n$ , where  $n$  is a positive integer, and  $U$  is a size of the bitstream data unit, a probability granularity for the ANS decoding divides evenly into the I/O base, and a base value for the ANS state is evenly divisible by the probability granularity such that all I/O is done in whole bitstream units; (the same rationale and motivation applies as given for the claim 1.)*

**CLAIM 9.** (Original) Nguyen/Duda/Giesen discloses - An apparatus for decoding an encoded bitstream, the encoded bitstream including frames, the frames having blocks of pixels, the apparatus comprising:

**an entropy decoder state machine including a Boolean asymmetric numeral system (ANS) decoder and a symbol ANS decoder sharing an ANS state and sharing a buffer position within a common buffer storing a variable string including encoded tokenized transform coefficients of a current block, the entropy decoder state machine performing a method comprising:**

**receiving the encoded bitstream including the encoded tokenized transform coefficients of the current block;**

**decoding the encoded tokenized transform coefficients using the Boolean ANS decoder and the symbol ANS decoder, the Boolean ANS decoder decoding a token comprising a bit or a binary flag and the symbol ANS decoder decoding a token comprising a symbol operating according to a common state diagram comprising multiple nodes encompassing non-overlapping state ranges for the ANS state by:**

**performing a state normalization operation when the ANS state is outside a valid state range for the token by updating the ANS state by appending a bitstream data unit from the variable string, and updating the buffer position;**

**performing an output computation operation to generate an output value for the token using the ANS state and a probability associated with the token; and**

**performing a state evolution operation to update the ANS state using the output value and the probability as inputs, the state evolution operation of the Boolean ANS decoder being different from the state evolution operation of the symbol ANS decoder; and**

**a processor executing instructions stored in a non-transitory memory to: form a transform block using decoded transform coefficients corresponding to the tokens;**

**inverse transform the transform block to generate a residual block; and reconstruct the current block using the residual block. (Current lists all the same elements as described in Claim 1 applied to both method/apparatus using ANS technique, and is/are therefore on the same premise.)**

**CLAIM 10.** (Original) Nguyen/Duda/Giesen discloses - The apparatus of claim 9, wherein the common state diagram comprises five nodes, a first node that determines whether or not an end of block token has been reached, a second node that determines whether or not an encoded transform coefficient has a value of zero, a third node that outputs a value for a symbol when the encoded transform coefficient does not have a value of zero, a fourth node that decodes extra bits associated with the symbol, when the extra bits are present, and a fifth node that outputs a sign for the encoded transform coefficient when the encoded transform coefficient does not have a value of zero; (the same rationale and motivation applies as given for the claim 1.)

**CLAIM 11.** (Original) Nguyen/Duda/Giesen discloses - The apparatus of claim 10, wherein the Boolean ANS decoder performs the state normalization operation, the output computation operation, and the state evolution operation when the entropy

*decoder state machine is at the first node, the second node, the fourth node, or the fifth node, and wherein the symbol ANS decoder performs the state normalization operation the output computation operation, and the state evolution operation when the entropy decoder state machine is at the third node; (the same rationale and motivation applies as given for the claim 1.)*

*CLAIM 12. (Original) Nguyen/Duda/Giesen discloses - The apparatus of claim 9, wherein the entropy decoder state machine further comprises a single detokenizer coupled to each of the Boolean ANS decoder and the symbol ANS decoder; (the same rationale and motivation applies as given for the claim 1.)*

*CLAIM 13. (Original) Nguyen/Duda/Giesen discloses - The apparatus of claim 12, wherein the probability associated with the token is a single probability value from the single detokenizer for the Boolean ANS decoder and the probability associated with the token is a probability distribution from the single detokenizer for the symbol ANS decoder; (the same rationale and motivation applies as given for the claim 1.)*

*CLAIM 14. (Original) Nguyen/Duda/Giesen discloses - The apparatus of claim 9, wherein appending the bitstream data unit from the variable string comprises left shifting the ANS state by a number of bits comprising the bitstream data unit, and updating the buffer position comprises moving the buffer position by the number of bits comprising the bitstream data unit removed from the common buffer; (the same rationale and motivation applies as given for the claim 1.)*

*CLAIM 15. (Original) Nguyen/Duda/Giesen discloses - An apparatus for encoding a video sequence including frames, the frames having blocks of pixels, the apparatus comprising:*

*a processor configured to execute instructions stored in a non-transitory memory to:*

*form a transform block using transform coefficients of a current block; and*

*tokenize the transform coefficients of the transform block; and*

*an entropy encoding state machine including a Boolean asymmetric numeral system (ANS) encoder and a symbol ANS encoder sharing an ANS state and sharing a buffer position within a common buffer storing a variable string including encoded tokenized transform coefficients of the current block,*

*the entropy encoder state machine performing a method comprising:*

*encoding the tokenized transform coefficients using the Boolean ANS encoder and the symbol ANS encoder,*

*the Boolean ANS encoder encoding a token comprising a bit or a binary flag and the symbol ANS encoder encoding a token comprising a symbol operating according to a common state diagram by:*

*performing a state normalization operation when the ANS state is outside a valid state range for the token by updating the ANS state by removing a bitstream data unit from the ANS state into the variable string, and updating the buffer position;*

*performing an output computation operation to generate an output value for the token using the ANS state and a probability associated with the token; and performing a state evolution operation to update the ANS state using the output value and the probability as inputs, the state evolution operation of the Boolean ANS decoding being different from the state evolution operation of the symbol ANS decoder. (Current lists all the same elements as described in Claim 1 applied to both encoder-decoder using ANS, and is/are therefore on the same premise.)*

*CLAIM 16. (Original) Nguyen/Duda/Giesen discloses - The apparatus of claim 15, wherein removing the bitstream data unit from the ANS state comprises right shifting the ANS state by a number of bits comprising the bitstream data unit, and updating the buffer position comprises moving the buffer position by the number of bits comprising the bitstream data unit added to the common buffer; (the same rationale and motivation applies as given for the claim 1.)*

*CLAIM 17. (Original) Nguyen/Duda/Giesen discloses - The apparatus of claim 16, wherein removing the bitstream data unit from the ANS state comprises removing multiple bitstream data units until the ANS state is within the valid state range for the token; (the same rationale and motivation applies as given for the claim 1.)*

*CLAIM 18. (Original) Nguyen/Duda/Giesen discloses - The apparatus of claim 15, wherein the valid state range for the token depends upon a node of the common state diagram in which the entropy encoding state machine is operating; (the same rationale and motivation applies as given for the claim 1.)*

*CLAIM 19. (Original) Nguyen/Duda/Giesen discloses -The apparatus of claim 15, wherein the instructions further comprise instructions to form the transform block by: predicting the current block to form a prediction block; (the same rationale and motivation applies as given for the claim 1.) generate a residual block as a difference between the prediction block and the current block; and transform the residual block to form the transform block; (the same rationale and motivation applies as given for the claim 1.)*

*CLAIM 20. (Original) Nguyen/Duda/Giesen discloses -The apparatus of claim 19, wherein the instructions further comprise instructions to form the transform block by: quantizing the transform coefficients of the transform block before tokenizing the transform coefficients; (the same rationale and motivation applies as given for the claim 1.)*

## **EXAMINER'S NOTES**

11. The referenced citations made in the rejection(s) above are intended to exemplify areas in the prior art document(s) in which the examiner believed are the most relevant to the claimed subject matter. However, it is incumbent upon the applicant to analyze the prior art document(s) in its/their entirety since other areas of the document(s) may be relied upon at a

later time to substantiate examiner's rationale of record. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). However, "the prior art's mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed .." *In re Fulton*, 391 F.3d 1195, 1201, 73 USPQ2d 1141, 1146 (Fed. Cir. 2004)

12. The following List of prior art, made of record and not relied upon, is/are considered pertinent to applicant's disclosure:

12.1. Patent Literature:

|                   |             |                     |
|-------------------|-------------|---------------------|
| US 20160248440 A1 | H03M7/30    | Greenfield; et al.  |
| US 20170164007 A1 | H04N19/645; | Converse; et al.    |
| US 20180084279 A1 | H04N19/126; | Thiagarajan; et al. |
| US 20180174275 A1 | H04N19/126; | Bourdev; et al.     |
| US 6226413 B1     | H04N19/51;  | Jandel; et al.      |
| US 6823016 B1     | H04N19/176; | Nguyen; et al.      |
| US 9595976 B1     | H03M7/3084; | Hemmer; et al.      |
| US 8,483,290      | H04N19/176; | Nguyen; et al.      |

12.2. Non Patent Literature:

- \_ STIC-log: 15-370840 Google is currently trying to patent video compression application of ANS;
- \_ STIC-log: 15-370840 Inventor says Google is patenting work he put in the public domain;
- \_ STIC-log: 15-370840 Jaroslaw Duda CV;
- \_ STIC-log: 15-370840 List of Asymmetric Numeral Systems implementations;
- \_ STIC-log: 15-370840 Marlin A high throughput variable;
- \_ STIC-log: 15-370840 Modification of Adaptive Huffman;
- \_ STIC-log: 15-370840 MRCZ A Proposed fast compressed;
- \_ STIC-log: 15-370840 NPL Results;
- \_ STIC-log: 15-370840 Patent Results;
  
- \_ NPL: Interleaved entropy coders; 2014
- \_ NPL: Mixing discrete probability distribution; 2015
- \_ NPL: Models for adaptive arithmetic coding; 2015
- \_ NPL: rANS in practice; 2015
- \_ NPL: New entropy coding; faster than Huffman, compression rate like arithmetic; J. Duda; 2014
- \_ NPL: Asymmetric numerical systems as accurate replacement for Huffman coding; Duda et al; 2015
- \_ NPL: GPU-decodable super compressed textures; NC University, USA; 2016
- \_ NPL: Codec developers - ANS
- \_ NPL: Asymmetric numerical systems; Duda; 2009

## **CONCLUSIONS**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LUIS PEREZ-FUENTES ([luis.perez-fuentes@uspto.gov](mailto:luis.perez-fuentes@uspto.gov)) whose telephone number is (571) 270 -1168. The examiner can normally be reached on

*Monday-Friday 8am-5pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WILLIAM VAUGHN can be reached on (571) 272-3922. The fax phone number for the organization where this application or proceeding is assigned is (571) 272 -3922. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, please call (800) 786 -9199 (IN USA OR CANADA) or (571) 272 -1000.*

*/LUIS PEREZ-FUENTES/  
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