

(51) International Patent Classification:  
*H04N 19/63* (2014.01)(21) International Application Number:  
PCT/IB2013/059007(22) International Filing Date:  
30 September 2013 (30.09.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
61/710,723 7 October 2012 (07.10.2012) US(71) Applicant: NUMERI LTD. [IL/IL]; 3A Keller St.,  
3448305 Haifa (IL).(72) Inventors: BAR-ON, Ilan; 9 Sukot St., 3464435 Haifa  
(IL). KOSTENKO, Oleg; 57 Tchernichovsky St., Apt.18,  
3570404 Haifa (IL).(74) Agent: FOGEL, Ronny; 8 Gordon St., 5323512 Givatay-  
im (IL).(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,  
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,  
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR,  
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,  
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,  
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,  
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,  
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM,  
ZW.(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, LR, NA, RW, TZ, UG, ZM, ZW), Eurasian (AM, AZ,  
BY, KG, KZ, RU, TJ, TM), European (AL, AT, BG, CZ,  
EE, HR, HU, IS, LT, LV, MK, MT, NO, PL, RO, RS, SI,  
SK, SM), OAPI (KM).**Published:**

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the  
claims and to be republished in the event of receipt of  
amendments (Rule 48.2(h))

(88) Date of publication of the international search report:  
30 May 2014

(54) Title: VIDEO COMPRESSION METHOD

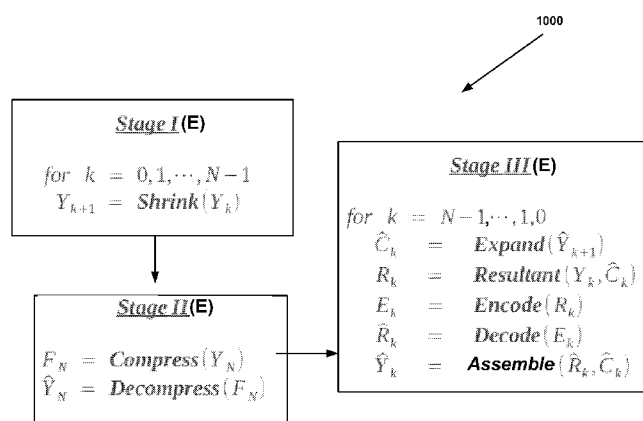


FIG. 10

(57) **Abstract:** A method of decoding and encoding video, the encoding method comprising: receiving a video; performing a shrink operation on the received video, the shrink operation comprising: creating a first lower resolution video from the video; and sequentially creating additional N-1 lower resolution videos, each one of the additional lower resolution videos created from the preceding lower resolution video; compressing the lowest resolution video; creating a lowest resolution reconstructed video by decompressing the lowest resolution compressed video; performing a first raise operation on the lowest resolution reconstructed video, the first raise operation comprising sequentially creating N higher resolutions reconstructed videos, each one of the higher resolution reconstructed videos created from the preceding lower resolution reconstructed video by: creating a higher resolution video from the lower resolution reconstructed video; computing a residual between the respective lower resolution video and the created higher resolution video; compressing the computed residual; decompressing the compressed residual; and combining the decompressed residual with the created higher resolution video, yielding the respective higher resolution reconstructed video; and providing a bit stream comprising the lowest resolution compressed video, said compressed residuals and control information.

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2013/059007

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>IPC (2014.01) H04N 19/63<br><br>According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                 |                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <b>B. FIELDS SEARCHED</b><br><br>Minimum documentation searched (classification system followed by classification symbols)<br>IPC (2014.01) H04N 19/00, H04N 7/00<br><br>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br><br>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br>See extra sheet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                 |                                                                          |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                 |                                                                          |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document, with indication, where appropriate, of the relevant passages                              | Relevant to claim No.                                                    |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | WO 2010024907 A1 DECEGAMA,A.<br>04 Mar 2010 (2010/03/04)<br>module 2240, 2245, page 3 lines 11-18, fig. 22      | 21                                                                       |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | page 3 lines 8-14 page 13 lines 1 – 6 ,video file 10, reduction method 20, reduced video File 30, fig. 1, fig.2 | 1-20,22-27                                                               |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | WO 2007036759 A1 TELECOM ITALIA S.P.A.<br>05 Apr 2007 (2007/04/05)<br>Whole document                            | 1-27                                                                     |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | WO 2007020230 A2 THOMSON LICENSING<br>22 Feb 2007 (2007/02/22)<br>Whole document                                | 1-27                                                                     |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US 2003021347 A1 LAN et al.<br>30 Jan 2003 (2003/01/30)<br>Whole document                                       | 1-27                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                 |                                                                          |
| <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                 |                                                                          |
| * Special categories of cited documents:<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier application or patent but published on or after the international filing date<br>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed<br>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<br>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone<br>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art<br>"&" document member of the same patent family |                                                                                                                 |                                                                          |
| Date of the actual completion of the international search<br>10 Apr 2014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                 | Date of mailing of the international search report<br>13 Apr 2014        |
| Name and mailing address of the ISA:<br>Israel Patent Office<br>Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel<br>Facsimile No. 972-2-5651616                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                 | Authorized officer<br>COPPENHAGEN Uri<br><br>Telephone No. 972-2-5657811 |

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2013/059007

| C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                                                                                                                                                                                                                   |                       |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Category*                                             | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                | Relevant to claim No. |
| A                                                     | Wavelet algorithms for high-resolution image reconstruction. SIAM Journal on Scientific Computing 24.4 (2003): 1408-1432. Retrieved from the Internet: <URL: ftp://ftp.math.cuhk.edu.hk/report/2000-20.pdf> Chan, Raymond H., et al<br>31 Dec 2013 (2013/12/31)<br>Whole document | 1-27                  |

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2013/059007

### B. FIELDS SEARCHED:

\* Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Databases consulted: THOMSON INNOVATION, Esp@cenet, Google Patents, Google Scholar, FamPat database

Search terms used: video, compression,decompression, shrink, sampling, downsampling, raise, upsampling decomposition, multi\*resolution, multi\*level,reduced resolution, decimation,wavelet, multiwavelets, transform coding, Dyadic, reconstruct\*,multi-resolution, fine,coarse, optical flow, hierarchical, pyramid

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/IB2013/059007

| Patent document cited search report |            |    | Publication date | Patent family member(s) |             |    | Publication Date |
|-------------------------------------|------------|----|------------------|-------------------------|-------------|----|------------------|
| WO                                  | 2010024907 | A1 | 04 Mar 2010      | WO                      | 2010024907  | A1 | 04 Mar 2010      |
|                                     |            |    |                  | EP                      | 2370934     | A1 | 05 Oct 2011      |
|                                     |            |    |                  | EP                      | 2370934     | A4 | 24 Oct 2012      |
|                                     |            |    |                  | US                      | 2010172419  | A1 | 08 Jul 2010      |
|                                     |            |    |                  | US                      | 2010329352  | A1 | 30 Dec 2010      |
|                                     |            |    |                  | US                      | 8031782     | B2 | 04 Oct 2011      |
|                                     |            |    |                  | US                      | 2012121022  | A1 | 17 May 2012      |
|                                     |            |    |                  | US                      | 8503543     | B2 | 06 Aug 2013      |
|                                     |            |    |                  | US                      | 2013315317  | A1 | 28 Nov 2013      |
| WO                                  | 2007036759 | A1 | 05 Apr 2007      | WO                      | 2007036759  | A1 | 05 Apr 2007      |
|                                     |            |    |                  | CN                      | 101313579   | A  | 26 Nov 2008      |
|                                     |            |    |                  | CN                      | 101313579   | B  | 03 Nov 2010      |
|                                     |            |    |                  | EP                      | 1938611     | A1 | 02 Jul 2008      |
|                                     |            |    |                  | JP                      | 2009510869  | A  | 12 Mar 2009      |
|                                     |            |    |                  | JP                      | 4906864     | B2 | 28 Mar 2012      |
|                                     |            |    |                  | US                      | 2009304090  | A1 | 10 Dec 2009      |
|                                     |            |    |                  | US                      | 8625678     | B2 | 07 Jan 2014      |
| WO                                  | 2007020230 | A2 | 22 Feb 2007      | WO                      | 2007020230  | A2 | 22 Feb 2007      |
|                                     |            |    |                  | WO                      | 2007020230  | A3 | 03 May 2007      |
|                                     |            |    |                  | EP                      | 1913781     | A2 | 23 Apr 2008      |
|                                     |            |    |                  | FR                      | 2889778     | A1 | 16 Feb 2007      |
|                                     |            |    |                  | US                      | 2010150229  | A1 | 17 Jun 2010      |
| US                                  | 2003021347 | A1 | 30 Jan 2003      | US                      | 2003021347  | A1 | 30 Jan 2003      |
|                                     |            |    |                  | CN                      | 1535538     | A  | 06 Oct 2004      |
|                                     |            |    |                  | EP                      | 1415478     | A1 | 06 May 2004      |
|                                     |            |    |                  | WO                      | 03010974    | A1 | 06 Feb 2003      |
|                                     |            |    |                  | JP                      | 2004537225  | A  | 09 Dec 2004      |
|                                     |            |    |                  | KR                      | 20040019357 | A  | 05 Mar 2004      |

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/IB2013/059007

| Patent document cited search<br>report | Publication date | Patent family member(s) | Publication Date |
|----------------------------------------|------------------|-------------------------|------------------|
|                                        |                  |                         |                  |