(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 December 2004 (02.12.2004)

PCT

(10) International Publication Number
WO 2004/104930 A3

(51) International Patent Classification:
H04N 7/26 (2006.01) *G06T 9/00* (2006.01)
H04N 7/46 (2006.01)

(21) International Application Number:
PCT/HU2004/000055

(22) International Filing Date: 20 May 2004 (20.05.2004)

(25) Filing Language: Hungarian

(26) Publication Language: English

(30) Priority Data:
P0301368 20 May 2003 (20.05.2003) HU

(71) Applicant *(for all designated States except US)*: **AMT ADVANCED MULTIMEDIA TECHNOLOGY AB** [SE/SE]; Box 102, S-374 22 Karlshamn (SE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **TOTH, Peter** [HU/SE]; Lärkvägen 20, S-374 50 Asarum (SE). **KÁROLY, József** [HU/SE]; Petreplan 9B, S-293 32 Olofström (SE).

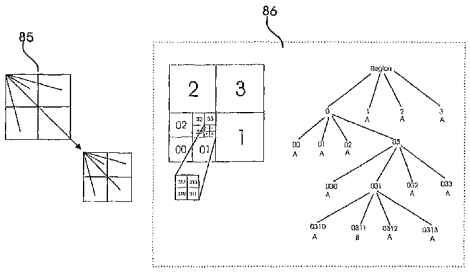
(74) Agent: **BOKOR, Tamás**; S.B.G. & K. Patent and Law Offices, Andrássy út 113., H-1062 Budapest (HU).

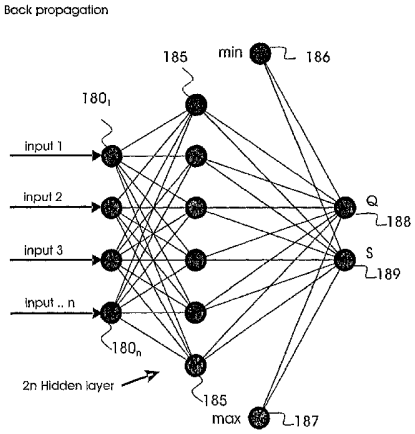
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: HYBRID VIDEO COMPRESSION METHOD





(57) Abstract: The invention concerns a method for compressing a digitally coded video frame sequence. In the method, a given frame is divided into blocks, and the information content of selected blocks is modified, relying on information contained in a neighbouring block or blocks (prediction), and the blocks are converted from spatial representation into frequency representation. The information content of the transformed blocks is encoded by arithmetic coding. The efficiency of the coding is improved by various methods, such as dynamically partitioning the blocks into sub-blocks, or performing a compressibility analysis is the blocks before carrying out further transformations. The entropy coding uses a neural network to determine the parameters of the arithmetic coding. The frames are dynamically re-scaled, depending on available bandwidth and quality of the coded image.

WO 2004/104930 A3

Declaration under Rule 4.17:
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report*

(88) Date of publication of the international search report:
18 May 2006

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

Inter ıl Application No
PCT/HU2004/000055

A. CLASSIFICATION OF SUBJECT MATTER
H04N7/26 H04N7/46 G06T9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N G06T H03M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	M. WIEN, A. DAHLHOFF: "hybrid video coding using variable size transforms" PROCEEDINGS OF SPIE, vol. 4671, 2002, pages 1040-1051, XP002338961	1-4,6,8, 9,13, 57-60
A	page 1046 - page 1047	5,10
A	OLIVER M A ET AL: "OPERATIONS ON QUADTREE ENCODED IMAGES" COMPUTER JOURNAL, OXFORD UNIVERSITY PRESS, SURREY, GB, vol. 26, no. 1, 1 February 1983 (1983-02-01), pages 83-91, XP000601538 ISSN: 0010-4620 the whole document	5,10
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"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

"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.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 December 2005	15. 02. 06

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Raeymaekers, P

INTERNATIONAL SEARCH REPORT

Inter l Application No
PCT/HU2004/000055

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WIEGAND T (EDITOR): "N4920 Text of Final Committee Draft of Joint Video Specification (ITU-T Rec. H.264 ISO/IEC 14496-10AVC) - Annex C Hypothetical Reference Decoder" ISO/IEC JTC1/SC29/WG11 MPEG02/N4920, XX, XX, July 2002 (2002-07), pages 157-161, XP002321520 paragraph '8.6.2.3! paragraph '12.4.3!	14,15, 21,22
X	CHENG-TIE CHEN ED - INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS: "ADAPTIVE TRANSFORM CODING VIA QUADTREE-BASED VARIABLE BLOCKSIZE DCT" MULTIDIMENSIONAL SIGNAL PROCESSING, AUDIO AND ELECTROACOUSTICS. GLASGOW, MAY 23 - 26, 1989, INTERNATIONAL CONFERENCE ON ACOUSTICS, SPEECH & SIGNAL PROCESSING. ICASSP, NEW YORK, IEEE, US, vol. VOL. 3 CONF. 14, 23 May 1989 (1989-05-23), pages 1854-1857, XP000089238 page 1855, right-hand column, paragraph 5	14,15, 21,22
X	US 6 529 634 B1 (THYAGARAJAN KADAYAM ET AL) 4 March 2003 (2003-03-04) column 2, paragraph 60 - column 3, paragraph 21 column 7, paragraph 41 - column 8, paragraph 12	14,15
A	MATTHIAS LARSSON CARLANDER: "JPEG2000 Verification model 9.1: visual frequency weighting" ISO/IEC JTC1/SC29/WG1 N2165, 28 June 2001 (2001-06-28), pages 200-204, XP002359425 page 200, paragraph 1 - paragraph 2	14,15

-/--

INTERNATIONAL SEARCH REPORT

Inte al Application No
PCT/HU2004/000055

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CHAN Y-L ET AL: "A BLOCK MOTION VECTOR ESTIMATION USING PATTERN BASED PIXEL DECIMATION" ISCAS '97. PROCEEDINGS OF THE 1997 IEEE INTERNATIONAL SYMPOSIUM ON CIRCUITS AND SYSTEMS. CIRCUITS AND SYSTEMS IN THE INFORMATION AGE. HONG KONG, JUNE 9 - 12, 1997, IEEE INTERNATIONAL SYMPOSIUM ON CIRCUITS AND SYSTEMS, NEW-YORK, NY : IEEE, US, vol. VOL. 2, 9 June 1997 (1997-06-09), pages 1153-1156, XP000832406 ISBN: 0-7803-3584-8 paragraph '0002! paragraph '02.1! - paragraph '02.2!; figures 1-3	23-34
X	MOSCHETTI F ET AL: "A fast block matching for SIMD processors using subsampling" CIRCUITS AND SYSTEMS, 2000. PROCEEDINGS. ISCAS 2000 GENEVA. THE 2000 IEEE INTERNATIONAL SYMPOSIUM ON MAY 28-31, 2000, PISCATAWAY, NJ, USA,IEEE, vol. 4, 28 May 2000 (2000-05-28), pages 321-324, XP010503602 ISBN: 0-7803-5482-6 paragraph '02.2!; figure 4	23-34
X	S ATEK, T VLADIMIROVA, P SWEENEY: "lossless compression for small satellite on-board imaging" 9TH INTERNATIONAL WORKSHOP ON SYSTEMS, SIGNALS AND IMAGE IWSSIP'02), 8 November 2002 (2002-11-08), pages 249-255, XP008057421 Manchester	35-39, 42,43
A	page 249, last paragraph; figure 1 page 250, paragraph 1 - page 251, last paragraph page 254	40,41
T	MAHONEY M V: "Fast text compression with neural networks" FLAIRS 2000: 13TH INTERNATIONAL FLAIRS CONFERENCE, 22 May 2000 (2000-05-22), pages 230-234, XP008057595 Orlando, FL, USA	35-43
T	M. MAHONEY: "Neural Network Compression FAQ"'Online! 25 March 2000 (2000-03-25), XP002359427 Retrieved from the Internet: URL:www.cs.fit.edu/{mmahoney/compression/faq.html> 'retrieved on 2005-12-15! the whole document	35-43

INTERNATIONAL SEARCH REPORT

...ional application No.
PCT/HU2004/000055

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [ ] Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. [X] Claims Nos.: 16-20
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

see FURTHER INFORMATION sheet PCT/ISA/210

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. [ ] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [X] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

1-6, 14-43 and their corressponding dependent claims 8,9,10,13, 57 -60

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[X] No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 16-20

Claim 16 treats about a formula or function for calculating quantized transformed coefficents. The technical problem that is solved with the formula is not clear from the application. The only hint in the application is the sentence on p. 11, par. I..2.6., "However, the error caused by the integer division also increases when the value of the divisor is increased." However, it is not clear how this could relate to the formula of claim 16. Although description p.28, last lines, says otherwise, the formula looks very different from a possible MPEG-2 quantization formula that can be deduced from the MPEG-2 dequantization formula F''u!'v!=((QF'u!'v!+k)*W'w!'v!'u!*quantizer_scale)/32. The factors 2 17 in the formula of claim 16 looks like a right bit shift of 17 bits, which presupposes coefficient word lengths higher than 17 are used. However, it is not specified in the description if the formula requires a certain word length, p.e. 32 bits. If normal 8-bit coefficients like in MPEG-2 are used for data(j) and matrix(j), the formula can be simplified since 2 17 is much higher than any other number in the formula. Simplification would lead to the formula (data(j)*16/matrix(j)+0.5)/2QP. It is not clear either what problem is being solved here.
Without knowing the problem solved, the formula should be searched as such, which is technically not possible. Moreover, it has no sense to search this particular mathematical expression. since the mathematical function of claim 16 can be expressed by many equivalent expressions. Consequently, the formula was not searched but the idea on description p. 30, lines 13-15 was searched instead.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-6,depending claims 8,9, 10, 13 and corresponding claims 57-60

   coding method with reduced block partition information

   ---

2. claim: 7

   coding method with selective use of Hadamard transform

   ---

3. claims: 11,12

   coding method with block subdivision criteria

   ---

4. claims: 14-22

   coding method with quantization depending on block size and available bandwidth

   ---

5. claims: 23-34

   coding method with improved motion compensation

   ---

6. claims: 35-43

   coding method with improved arithmetic coder

   ---

7. claims: 44-56

   coding method with improved neural network controlled quantiser

   ---

INTERNATIONAL SEARCH REPORT

Interr al Application No
PCT/HU2004/000055

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6529634 B1	04-03-2003	AU 782176 B2	07-07-2005
		AU 1481101 A	06-06-2001
		BR 0015341 A	15-07-2003
		CA 2389410 A1	17-05-2001
		CN 1421102 A	28-05-2003
		EP 1230804 A1	14-08-2002
		HK 1053565 A1	12-08-2005
		JP 2003523652 T	05-08-2003
		MX PA02004577 A	29-11-2002
		TW 517500 B	11-01-2003
		WO 0135673 A1	17-05-2001
		ZA 200203276 A	24-07-2003