

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	TO BE ASSIGNED
Filing Date	Concurrently Herewith
First Named Inventor	Mehmet Oguz BICI
Title	METHOD FOR CODING AND AN APPARATUS
Art Unit	
Examiner Name	
Attorney Docket Number	042933/489677

SIGNATURE of Applicant or Patent Practitioner

Signature	/Guy R. Gosnell/	Date (Optional)	02/07/2017
Name	Guy R. Gosnell	Registration Number	34,610
Title (if Applicant is a juristic entity)	Patent Practitioner		
Applicant Name (if Applicant is a juristic entity)	NOKIA TECHNOLOGIES OY		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐

*Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Amazon.com, Inc., Amazon.com Services LLC - Ex. 1016, Page 000001

IPR2024-01505 (Amazon.com, Inc., Amazon.com Services LLC v. Nokia Technologies Oy)

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

10949

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☒ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name				
Address				
City	State	Zip		
Country				
Telephone	Email			

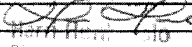
I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

NOKIA TECHNOLOGIES OY

- ☐ Inventor or Joint Inventor (title not required below)
- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
- ☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
- ☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

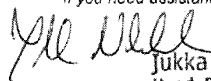
Signature		Date (Optional)	23 January 2015
Name	Jukka Nihtila		
Title	Legal and Intellectual Property		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.


Jukka Nihtila
Head, Business Development
Legal & IP

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		METHOD FOR CODING AND AN APPARATUS		
First Named Inventor/Applicant Name:		Mehmet Oguz BICI		
Filer:		Guy Randall Gosnell/Jan Snider		
Attorney Docket Number:		042933/489677		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	280	280
UTILITY SEARCH FEE	1111	1	600	600
UTILITY EXAMINATION FEE	1311	1	720	720
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	10	80	800
INDEPENDENT CLAIMS IN EXCESS OF 3	1201	3	420	1260
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				3660

Electronic Acknowledgement Receipt	
EFS ID:	28291679
Application Number:	15426822
International Application Number:	
Confirmation Number:	3935
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Jan Snider
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/489677
Receipt Date:	07-FEB-2017
Filing Date:	
Time Stamp:	17:26:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 3660
RAM confirmation Number	020817INTEFSW00004489160605
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	489677_ADS.PDF	1823015	no	9
			8149cb4be2cc59c12b5feb3641a9484cb219e9f4		
Warnings:					
Information:					
2		489677_Application.PDF	242059	yes	59
			0820bbafeb5a67f4d9a85a74ade43867a400cf76		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	44	
	Claims		45	58	
	Abstract		59	59	
Warnings:					
Information:					
3	Drawings-only black and white line drawings	489677_Drawings.pdf	721787	no	13
			1de7c6682fb98b1cc5c58d139e9f1d9fd828b304		
Warnings:					
Information:					
4	Oath or Declaration filed	489677_Declaration.PDF	221882	no	3
			e3ea52227f27a794ab5741ec6045fec8d8c98f73		
Warnings:					
Information:					
5	Power of Attorney	489677_POA.pdf	555560	no	2
			bb073b5ce62c3e18a691089ff6b4722b47012de1		

Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	38059	no	2
			d1a18c5f9590dabad9499d20ea99d3cb2a742232		
Warnings:					
Information:					
Total Files Size (in bytes):				3602362	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/489677
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor	1				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Mehmet	Oguz	BICI		
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Tampere		Country of Residenceⁱ	FI	
Mailing Address of Inventor:					
Address 1	Tammelan puistokatu 1-3 D 46				
Address 2					
City	Tampere		State/Province		
Postal Code	33500		Countryⁱ	FI	
Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Jani		AINEMA		
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Tampere		Country of Residenceⁱ	FI	
Mailing Address of Inventor:					
Address 1	Kisakentankatu 12 B 6				
Address 2					
City	Tampere		State/Province		
Postal Code	33230		Countryⁱ	FI	
Inventor	3				Remove
Legal Name					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/489677
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Prefix	Given Name	Middle Name	Family Name	Suffix
	Kemal		UGUR	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Tampere	Country of Residence ⁱ	FI	
Mailing Address of Inventor:				
Address 1	Lapintie 6D 25			
Address 2				
City	Tampere	State/Province		
Postal Code	33100	Country ⁱ	FI	
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add				

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).	
☐ An Address is being provided for the correspondence Information of this application.	
Customer Number	10949
Email Address	Add Email Remove Email

Application Information:

Title of the Invention	METHOD FOR CODING AND AN APPARATUS		
Attorney Docket Number	042933/489677	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	13	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country ⁱ

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/489677
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.			
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	10949		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78. When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	13/666680	2012-11-01
Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
13/666680	Claims benefit of provisional	61/555703	2011-11-04
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/489677
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)	Remove

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/489677
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/489677
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant	1		Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
		Clear	
☐ Assignee	Legal Representative under 35 U.S.C. 117		Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	NOKIA TECHNOLOGIES OY		
Mailing Address Information For Applicant:			
Address 1	Karaportti 3		
Address 2			
City	Espoo	State/Province	
Country	FI	Postal Code	02610
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/489677
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

Assignee	1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country i		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				Add

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet must be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, all joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of all joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Guy R. Gosnell/		Date (YYYY-MM-DD)	2017-02-07
First Name	Guy	Last Name	Gosnell	Registration Number
				34,610
Additional Signature may be generated within this form by selecting the Add button.				Add

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	042933/489677
		Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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

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

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

METHOD FOR CODING AND AN APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Application No. 13/666,680, filed November 1, 2012, which claims priority to U.S. Provisional Application No. 61/555,703, filed November 4, 2011, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] There is provided a method for encoding, a method for decoding, an apparatus, computer program products, an encoder and a decoder.

BACKGROUND INFORMATION

[0003] This section is intended to provide a background or context to the invention that is recited in the claims. The description herein may include concepts that could be pursued, but are not necessarily ones that have been previously conceived or pursued. Therefore, unless otherwise indicated herein, what is described in this section is not prior art to the description and claims in this application and is not admitted to be prior art by inclusion in this section

[0004] A video codec may comprise an encoder which transforms input video into a compressed representation suitable for storage and/or transmission and a decoder that can uncompress the compressed video representation back into a viewable form, or either one of them. The encoder may discard some information in the original video sequence in order to represent the video in a more compact form, for example at a lower bit rate.

[0005] Many hybrid video codecs, operating for example according to the International Telecommunication Union's ITU-T H.263 and H.264 coding standards, encode video information in two phases. In the first phase, pixel values in a certain picture area or "block" are predicted. These pixel values can be predicted, for example, by motion compensation mechanisms, which involve finding and indicating an area in one of the previously encoded video frames (or a later coded video frame) that corresponds closely to the block being coded. Additionally, pixel values can be predicted by spatial mechanisms which involve finding and indicating a spatial region relationship, for example by using pixel values around the block to be coded in a specified manner.

[0006] Prediction approaches using image information from a previous (or a later) image can also be called as Inter prediction methods, and prediction approaches using image information within the same image can also be called as Intra prediction methods.

[0007] The second phase is one of coding the error between the predicted block of pixels and the original block of pixels. This may be accomplished by transforming the difference in pixel values using a specified transform. This transform may be e.g. a Discrete Cosine Transform (DCT) or a variant thereof. After transforming the difference, the transformed difference may be quantized and entropy encoded.

[0008] By varying the fidelity of the quantization process, the encoder can control the balance between the accuracy of the pixel representation, (in other words, the quality of the picture) and the size of the resulting encoded video representation (in other words, the file size or transmission bit rate).

[0009] The decoder reconstructs the output video by applying a prediction mechanism similar to that used by the encoder in order to form a predicted representation of the pixel blocks (using the motion or spatial information created by the encoder and stored in the compressed representation of the image) and prediction error decoding (the inverse operation of the prediction error coding to recover the quantized prediction error signal in the spatial domain).

[0010] After applying pixel prediction and error decoding processes the decoder combines the prediction and the prediction error signals (the pixel values) to form the output video frame.

[0011] The decoder (and encoder) may also apply additional filtering processes in order to improve the quality of the output video before passing it for display and/or storing as a prediction reference for the forthcoming frames in the video sequence.

[0012] In some video codecs, such as High Efficiency Video Coding Working Draft 4, video pictures may be divided into coding units (CU) covering the area of a picture. A coding unit consists of one or more prediction units (PU) defining the prediction process for the samples within the coding unit and one or more transform units (TU) defining the prediction error coding process for the samples in the coding unit. A coding unit may consist of a square block of samples with a size selectable from a predefined set of possible coding unit sizes. A coding unit with the maximum allowed size can be named as a largest coding unit (LCU) and the video picture may be divided into non-overlapping largest coding units. A largest coding unit can further be split into a combination of smaller coding units, e.g. by recursively splitting the largest

coding unit and resultant coding units. Each resulting coding unit may have at least one prediction unit and at least one transform unit associated with it. Each prediction unit and transform unit can further be split into smaller prediction units and transform units in order to increase granularity of the prediction and prediction error coding processes, respectively. Each prediction unit may have prediction information associated with it defining what kind of a prediction is to be applied for the pixels within that prediction unit (e.g. motion vector information for inter predicted prediction units and intra prediction directionality information for intra predicted prediction units). Similarly, each transform unit may be associated with information describing the prediction error decoding process for samples within the transform unit (including e.g. discrete cosine transform (DCT) coefficient information). It may be signalled at coding unit level whether prediction error coding is applied or not for each coding unit. In the case there is no prediction error residual associated with the coding unit, it can be considered there are no transform units for the coding unit. The division of the image into coding units, and division of coding units into prediction units and transform units may be signalled in the bitstream allowing the decoder to reproduce the intended structure of these units.

[0013] In some video codecs, motion information is indicated by motion vectors associated with each motion compensated image block. These motion vectors represent the displacement of the image block in the picture to be coded (in the encoder) or decoded (at the decoder) and the prediction source block in one of the previously coded or decoded images (or pictures). In order to represent motion vectors efficiently, motion vectors may be coded differentially with respect to block specific predicted motion vector. In some video codecs, the predicted motion vectors are created in a predefined way, for example by calculating the median of the encoded or decoded motion vectors of the adjacent blocks.

[0014] Another way to create motion vector predictions is to generate a list or a set of candidate predictions from blocks in the current frame and/or co-located or other blocks in temporal reference pictures and signalling the chosen candidate as the motion vector prediction. A spatial motion vector prediction is a prediction obtained only on the basis of information of one or more blocks of the same frame than the current frame whereas temporal motion vector prediction is a prediction obtained on the basis of information of one or more blocks of a frame different from the current frame. It may also be possible to obtain motion vector predictions by

combining both spatial and temporal prediction information of one or more encoded blocks. These kinds of motion vector predictions are called as spatio-temporal motion vector predictions.

[0015] In addition to predicting the motion vector values, the reference index in the reference picture list can be predicted. The reference index may be predicted from blocks in the current frame and/or co-located or other blocks in a temporal reference picture. Moreover, some high efficiency video codecs employ an additional motion information coding/decoding mechanism, often called merging/merge mode, where all the motion field information, which includes motion vector and corresponding reference picture index for each available reference picture list, may be predicted and used without any modification or correction. Similarly, predicting the motion field information may be carried out using the motion field information of blocks in the current frame and/or co-located or other blocks in temporal reference pictures and the used motion field information is signalled among a list of motion field candidate list filled with motion field information of available blocks in the current frame and/or co-located or other blocks in temporal reference pictures.

[0016] In some video codecs the prediction residual after motion compensation is first transformed with a transform kernel (like DCT) and then coded. The reason for this is that often there still exists some correlation among the residual and transform can in many cases help reduce this correlation and provide more efficient coding.

[0017] Some video encoders utilize Lagrangian cost functions to find optimal coding modes, e.g. the desired Macroblock mode and associated motion vectors. This kind of cost function uses a weighting factor λ to tie together the (exact or estimated) image distortion due to lossy coding methods and the (exact or estimated) amount of information that is required to represent the pixel values in an image area:

$$C = D + \lambda R \quad (1)$$

where C is the Lagrangian cost to be minimized, D is the image distortion (e.g. Mean Squared Error) with the mode and motion vectors considered, and R the number of bits needed to represent the required data to reconstruct the image block in the decoder (including the amount of data to represent the candidate motion vectors).

[0018] Some video codecs such as hybrid video codecs may generate a list of motion vector predictions (MVP) consisting of motion vectors of spatial adjacent blocks (spatial MVP) and/or motion vectors of blocks in a previously decoded frame (temporal MVP). One of the candidate

motion vectors in the list is signalled to be used as the motion vector prediction of the current block. After the list is generated, some of the motion vector prediction candidates may have the same motion information. In this case, the identical motion vector prediction candidates may be removed to reduce redundancy. During the decoding, if the temporal motion vector prediction information is unavailable due to e.g. loss of reference frame, the decoder may not know if the temporal motion vector prediction candidate in the list is to be removed. This may lead to uncertainty for mapping the decoded candidate index to the candidates whose removal decision is based on comparing motion information with the temporal motion vector prediction. As a result, false assignment of motion vector prediction candidates may occur which may lead to degradation in the picture quality and drift of false motion information throughout the decoding process.

SUMMARY

[0019] The present invention introduces a method for generating a motion vector prediction list for an image block. In some embodiments video codecs employ in a motion prediction candidate list construction a way to reduce the complexity of the implementation. This can be achieved by performing a limited number of motion information comparisons between candidate pairs to remove the redundant candidates rather than comparing every available candidate pair. The decision of whether comparing two candidates may depend on the order of the candidates to be considered for the list and/or coding/prediction mode and/or location of the blocks associated with the candidates. In some embodiments a video codec employs a merge process for motion information coding and creates a list of motion prediction candidates from which one of the candidates is to be signalled as the motion information for the current coding or prediction unit. The motion prediction candidates may consist of several spatial motion predictions and a temporal motion prediction. The spatial candidates are obtained from the motion information of e.g. spatial neighbour blocks.

[0020] According to a first aspect of the present invention there is provided a method comprising:

receiving a block of pixels including a prediction unit; determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0021] According to a second aspect of the present invention there is provided a method comprising:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0022] According to a third aspect of the present invention there is provided an apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive a block of pixels
including a prediction unit;
determining a set of spatial motion vector prediction candidates for the block of pixels;
the spatial motion vector prediction candidates being provided with motion information;
selecting a first spatial motion vector prediction candidate from the set of spatial motion
vector prediction candidates as a potential spatial motion vector prediction candidate to be
included in a merge list for the prediction unit;
determining a subset of spatial motion vector predictions based on the location of the
block associated with the first spatial motion vector prediction candidate;
comparing motion information of the first spatial motion vector prediction candidate
with motion information of the spatial motion vector prediction candidate in the determined
subset of spatial motion vector prediction candidates;
if at least one the comparisons indicates that the motion vector information of the spatial
motion vector prediction candidates correspond with each other, excluding the first spatial
motion vector prediction candidate from the merge list.

[0023] According to a fourth aspect of the present invention there is provided an apparatus
comprising a processor and a memory including computer program code, the memory and the
computer program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels
including a prediction unit;
determining a set of spatial motion vector prediction candidates for the encoded block
of pixels; the spatial motion vector prediction candidates being provided with motion
information;
selecting a first spatial motion vector prediction candidate from the set of spatial motion
vector prediction candidates as a potential spatial motion vector prediction candidate to be
included in a merge list for the prediction unit;
determining a subset of spatial motion vector predictions based on the location of the
block associated with the first spatial motion vector prediction candidate;
comparing motion information of the first spatial motion vector prediction candidate
with motion information of another spatial motion vector prediction candidate of the set of
spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0024] According to a fifth aspect of the present invention there is provided a storage medium having stored thereon a computer executable program code for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determine a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other

[0025] According to a sixth aspect of the present invention there is provided a storage medium having stored thereon a computer executable program code for use by a decoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0026] According to a seventh aspect of the present invention there is provided an apparatus comprising:

means for receiving a block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0027] According to an eighth aspect of the present invention there is provided an apparatus comprising:

means for receiving an encoded block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

DESCRIPTION OF THE DRAWINGS

[0028] For better understanding of the present invention, reference will now be made by way of example to the accompanying drawings in which:

[0029] Figure 1 shows schematically an electronic device employing some embodiments of the invention;

[0030] Figure 2 shows schematically a user equipment suitable for employing some embodiments of the invention;

[0031] Figure 3 further shows schematically electronic devices employing embodiments of the invention connected using wireless and wired network connections;

[0032] Figure 4a shows schematically an embodiment of the invention as incorporated within an encoder;

[0033] Figure 4b shows schematically an embodiment of a prediction reference list generation and modification according to some embodiments of the invention;

[0034] Figures 5a and 5b show a flow diagram showing the operation of an embodiment of the invention with respect to the encoder as shown in figure 4a;

[0035] Figure 6a illustrates an example of spatial and temporal prediction of a prediction unit;

[0036] Figure 6b illustrates another example of spatial and temporal prediction of a prediction unit;

[0037] Figure 7 shows schematically an embodiment of the invention as incorporated within a decoder;

[0038] Figures 8a and 8b show a flow diagram of showing the operation of an embodiment of the invention with respect to the decoder shown in figure 7;

[0039] Figure 9 illustrates an example of a coding unit and some neighbour blocks of the coding unit;

[0040] Figure 10a illustrates an example of a horizontal division of the coding unit;

[0041] Figure 10b illustrates an example of a vertical division of the coding unit;

[0042] Figure 11a illustrates locations of five spatial neighbours A0, A1, B0, B1, B2 for a prediction unit generated as the second prediction unit of a horizontally divided coding unit;

[0043] Figure 11b illustrates locations of five spatial neighbours for a prediction unit generated as the second prediction unit of a vertically divided coding unit; and

[0044] Figure 12 illustrates an example of blocks between some spatial neighbours of a coding unit.

DETAILED DESCRIPTION OF SOME EXAMPLE EMBODIMENTS

[0045] The following describes in further detail suitable apparatus and possible mechanisms for the provision of improving the prediction accuracy and hence possibly reducing information to be transmitted in video coding systems. In this regard reference is first made to Figure 1 which shows a schematic block diagram of an exemplary apparatus or electronic device 50, which may incorporate a codec according to an embodiment of the invention.

[0046] The electronic device 50 may for example be a mobile terminal or user equipment of a wireless communication system. However, it would be appreciated that embodiments of the invention may be implemented within any electronic device or apparatus which may require encoding and decoding or encoding or decoding video images.

[0047] The apparatus 50 may comprise a housing 30 for incorporating and protecting the device. The apparatus 50 further may comprise a display 32 in the form of a liquid crystal display. In other embodiments of the invention the display may be any suitable display technology suitable to display an image or video. The apparatus 50 may further comprise a keypad 34. In other embodiments of the invention any suitable data or user interface mechanism may be employed. For example the user interface may be implemented as a virtual keyboard or

data entry system as part of a touch-sensitive display. The apparatus may comprise a microphone 36 or any suitable audio input which may be a digital or analogue signal input. The apparatus 50 may further comprise an audio output device which in embodiments of the invention may be any one of: an earpiece 38, speaker, or an analogue audio or digital audio output connection. The apparatus 50 may also comprise a battery 40 (or in other embodiments of the invention the device may be powered by any suitable mobile energy device such as solar cell, fuel cell or clockwork generator). The apparatus may further comprise an infrared port 42 for short range line of sight communication to other devices. In other embodiments the apparatus 50 may further comprise any suitable short range communication solution such as for example a Bluetooth wireless connection or a USB/firewire wired connection.

[0048] The apparatus 50 may comprise a controller 56 or processor for controlling the apparatus 50. The controller 56 may be connected to memory 58 which in embodiments of the invention may store both data in the form of image and audio data and/or may also store instructions for implementation on the controller 56. The controller 56 may further be connected to codec circuitry 54 suitable for carrying out coding and decoding of audio and/or video data or assisting in coding and decoding carried out by the controller 56.

[0049] The apparatus 50 may further comprise a card reader 48 and a smart card 46, for example a UICC and UICC reader for providing user information and being suitable for providing authentication information for authentication and authorization of the user at a network.

[0050] The apparatus 50 may comprise radio interface circuitry 52 connected to the controller and suitable for generating wireless communication signals for example for communication with a cellular communications network, a wireless communications system or a wireless local area network. The apparatus 50 may further comprise an antenna 44 connected to the radio interface circuitry 52 for transmitting radio frequency signals generated at the radio interface circuitry 52 to other apparatus(es) and for receiving radio frequency signals from other apparatus(es).

[0051] In some embodiments of the invention, the apparatus 50 comprises a camera capable of recording or detecting individual frames which are then passed to the codec 54 or controller for processing. In some embodiments of the invention, the apparatus may receive the video image data for processing from another device prior to transmission and/or storage. In some

embodiments of the invention, the apparatus 50 may receive either wirelessly or by a wired connection the image for coding/decoding.

[0052] With respect to Figure 3, an example of a system within which embodiments of the present invention can be utilized is shown. The system 10 comprises multiple communication devices which can communicate through one or more networks. The system 10 may comprise any combination of wired or wireless networks including, but not limited to a wireless cellular telephone network (such as a GSM, UMTS, CDMA network etc), a wireless local area network (WLAN) such as defined by any of the IEEE 802.x standards, a Bluetooth personal area network, an Ethernet local area network, a token ring local area network, a wide area network, and the Internet.

[0053] The system 10 may include both wired and wireless communication devices or apparatus 50 suitable for implementing embodiments of the invention.

[0054] For example, the system shown in Figure 3 shows a mobile telephone network 11 and a representation of the internet 28. Connectivity to the internet 28 may include, but is not limited to, long range wireless connections, short range wireless connections, and various wired connections including, but not limited to, telephone lines, cable lines, power lines, and similar communication pathways.

[0055] The example communication devices shown in the system 10 may include, but are not limited to, an electronic device or apparatus 50, a combination of a personal digital assistant (PDA) and a mobile telephone 14, a PDA 16, an integrated messaging device (IMD) 18, a desktop computer 20, a notebook computer 22. The apparatus 50 may be stationary or mobile when carried by an individual who is moving. The apparatus 50 may also be located in a mode of transport including, but not limited to, a car, a truck, a taxi, a bus, a train, a boat, an airplane, a bicycle, a motorcycle or any similar suitable mode of transport.

[0056] Some or further apparatuses may send and receive calls and messages and communicate with service providers through a wireless connection 25 to a base station 24. The base station 24 may be connected to a network server 26 that allows communication between the mobile telephone network 11 and the internet 28. The system may include additional communication devices and communication devices of various types.

[0057] The communication devices may communicate using various transmission technologies including, but not limited to, code division multiple access (CDMA), global

systems for mobile communications (GSM), universal mobile telecommunications system (UMTS), time divisional multiple access (TDMA), frequency division multiple access (FDMA), transmission control protocol-internet protocol (TCP-IP), short messaging service (SMS), multimedia messaging service (MMS), email, instant messaging service (IMS), Bluetooth, IEEE 802.11 and any similar wireless communication technology. A communications device involved in implementing various embodiments of the present invention may communicate using various media including, but not limited to, radio, infrared, laser, cable connections, and any suitable connection.

[0058] With respect to Figure 4a, a block diagram of a video encoder suitable for carrying out embodiments of the invention is shown. Furthermore, with respect to Figures 5a and 5b, the operation of the encoder exemplifying embodiments of the invention specifically with respect to construction of the list of candidate predictions is shown as a flow diagram.

[0059] Figure 4a shows the encoder as comprising a pixel predictor 302, prediction error encoder 303 and prediction error decoder 304. Figure 4a also shows an embodiment of the pixel predictor 302 as comprising an inter-predictor 306, an intra-predictor 308, a mode selector 310, a filter 316, and a reference frame memory 318. In this embodiment the mode selector 310 comprises a block processor 381 and a cost evaluator 382. The encoder may further comprise an entropy encoder 330 for entropy encoding the bit stream.

[0060] Figure 4b depicts an embodiment of the inter predictor 306. The inter predictor 306 comprises a reference frame selector 360 for selecting reference frame or frames, a motion vector definer 361, a prediction list modifier 363 and a motion vector selector 364. These elements or some of them may be part of a prediction processor 362 or they may be implemented by using other means.

[0061] The pixel predictor 302 receives the image 300 to be encoded at both the inter-predictor 306 (which determines the difference between the image and a motion compensated reference frame 318) and the intra-predictor 308 (which determines a prediction for an image block based only on the already processed parts of the current frame or picture). The output of both the inter-predictor and the intra-predictor may be passed to the mode selector 310. The intra-predictor 308 may have more than one intra-prediction modes. Hence, each mode may perform the intra-prediction and provide the predicted signal to the mode selector 310. The mode selector 310 also receives a copy of the image 300.

[0062] The mode selector 310 determines which encoding mode to use to encode the current block. If the mode selector 310 decides to use an inter-prediction mode it will pass the output of the inter-predictor 306 to the output of the mode selector 310. If the mode selector 310 decides to use an intra-prediction mode it will pass the output of one of the intra-predictor modes to the output of the mode selector 310.

[0063] The output of the mode selector is passed to a first summing device 321. The first summing device may subtract the pixel predictor 302 output from the image 300 to produce a first prediction error signal 320 which is input to the prediction error encoder 303.

[0064] The pixel predictor 302 further receives from a preliminary reconstructor 339 the combination of the prediction representation of the image block 312 and the output 338 of the prediction error decoder 304. The preliminary reconstructed image 314 may be passed to the intra-predictor 308 and to a filter 316. The filter 316 receiving the preliminary representation may filter the preliminary representation and output a final reconstructed image 340 which may be saved in a reference frame memory 318. The reference frame memory 318 may be connected to the inter-predictor 306 to be used as the reference image against which the future image 300 is compared in inter-prediction operations.

[0065] The operation of the pixel predictor 302 may be configured to carry out any known pixel prediction algorithm known in the art.

[0066] The pixel predictor 302 may also comprise a filter 385 to filter the predicted values before outputting them from the pixel predictor 302.

[0067] The operation of the prediction error encoder 302 and prediction error decoder 304 will be described hereafter in further detail. In the following examples the encoder generates images in terms of 16x16 pixel macroblocks which go to form the full image or picture. Thus, for the following examples the pixel predictor 302 outputs a series of predicted macroblocks of size 16x16 pixels and the first summing device 321 outputs a series of 16x16 pixel residual data macroblocks which may represent the difference between a first macro-block in the image 300 against a predicted macro-block (output of pixel predictor 302). It would be appreciated that other size macro blocks may be used.

[0068] The prediction error encoder 303 comprises a transform block 342 and a quantizer 344. The transform block 342 transforms the first prediction error signal 320 to a transform

domain. The transform is, for example, the DCT transform. The quantizer 344 quantizes the transform domain signal, e.g. the DCT coefficients, to form quantized coefficients.

[0069] The prediction error decoder 304 receives the output from the prediction error encoder 303 and performs the opposite processes of the prediction error encoder 303 to produce a decoded prediction error signal 338 which when combined with the prediction representation of the image block 312 at the second summing device 339 produces the preliminary reconstructed image 314. The prediction error decoder may be considered to comprise a dequantizer 346, which dequantizes the quantized coefficient values, e.g. DCT coefficients, to reconstruct the transform signal and an inverse transformation block 348, which performs the inverse transformation to the reconstructed transform signal wherein the output of the inverse transformation block 348 contains reconstructed block(s). The prediction error decoder may also comprise a macroblock filter (not shown) which may filter the reconstructed macroblock according to further decoded information and filter parameters.

[0070] In the following the operation of an example embodiment of the inter predictor 306 will be described in more detail. The inter predictor 306 receives the current block for inter prediction. It is assumed that for the current block there already exists one or more neighbouring blocks which have been encoded and motion vectors have been defined for them. For example, the block on the left side and/or the block above the current block may be such blocks. Spatial motion vector predictions for the current block can be formed e.g. by using the motion vectors of the encoded neighbouring blocks and/or of non-neighbour blocks in the same slice or frame, using linear or non-linear functions of spatial motion vector predictions, using a combination of various spatial motion vector predictors with linear or non-linear operations, or by any other appropriate means that do not make use of temporal reference information. It may also be possible to obtain motion vector predictors by combining both spatial and temporal prediction information of one or more encoded blocks. These kinds of motion vector predictors may also be called as spatio-temporal motion vector predictors.

[0071] Reference frames used in encoding the neighbouring blocks have been stored to the reference frame memory 404. The reference frames may be short term references or long term references and each reference frame may have a unique index indicative of the location of the reference frame in the reference frame memory. When a reference frame is no longer used as a reference frame it may be removed from the reference frame memory or marked as a non-

reference frame wherein the storage location of that reference frame may be occupied for a new reference frame. In addition to the reference frames of the neighbouring blocks the reference frame selector 360 may also select one or more other frames as potential reference frames and store them to the reference frame memory.

[0072] Motion vector information of encoded blocks is also stored into the memory so that the inter predictor 306 is able to retrieve the motion vector information when processing motion vector candidates for the current block.

[0073] In some embodiments the motion vectors are stored into one or more lists. For example, motion vectors of uni-directionally predicted frames (e.g. P-frames) may be stored to a list called as list 0. For bi-directionally predicted frames (e.g. B-frames) there may be two lists (list 0 and list 1) and for multi-predicted frames there may be more than two lists. Reference frame indices possibly associated with the motion vectors may also be stored in one or more lists.

[0074] In some embodiments there may be two or more motion vector prediction procedures and each procedure may have its own candidate set creation process. In one procedure, only the motion vector values are used. In another procedure, which may be called as a Merge Mode, each candidate element may comprise 1) The information whether 'block was uni-predicted using only list0' or 'block was uni-predicted using only list1' or 'block was bi-predicted using list0 and list1' 2) motion vector value for list0 3) Reference picture index in list0 4) motion vector value for list1 5) Reference picture index list1. Therefore, whenever two prediction candidates are to be compared, not only the motion vector values are compared, but also the five values mentioned above may be compared to determine whether they correspond with each other or not. On the other hand, if any of the comparisons indicate that the prediction candidates do not have equal motion information, no further comparisons need be performed.

[0075] The motion vector definer 361 defines candidate motion vectors for the current frame by using one or more of the motion vectors of one or more neighbour blocks and/or other blocks of the current block in the same frame and/or co-located blocks and/or other blocks of the current block in one or more other frames. These candidate motion vectors can be called as a set of candidate predictors or a predictor set. Each candidate predictor thus represents the motion vector of one or more already encoded block. In some embodiments the motion vector of the candidate predictor is set equal to the motion vector of a neighbour block for the same list if the

current block and the neighbour block refer to the same reference frames for that list. Also for temporal prediction there may be one or more previously encoded frames wherein motion vectors of a co-located block or other blocks in a previously encoded frame can be selected as candidate predictors for the current block. The temporal motion vector predictor candidate can be generated by any means that make use of the frames other than the current frame.

[0076] The candidate motion vectors can also be obtained by using more than one motion vector of one or more other blocks such as neighbour blocks of the current block and/or co-located blocks in one or more other frames. As an example, any combination of the motion vector of the block to the left of the current block, the motion vector of the block above the current block, and the motion vector of the block at the up-right corner of the current block may be used (i.e. the block to the right of the block above the current block). The combination may be a median of the motion vectors or calculated by using other formulas. For example, one or more of the motion vectors to be used in the combination may be scaled by a scaling factor, an offset may be added, and/or a constant motion vector may be added. In some embodiments the combined motion vector is based on both temporal and spatial motion vectors, e.g. the motion vector of one or more of the neighbour block or other block of the current block and the motion vector of a co-located block or other block in another frame.

[0077] If a neighbour block does not have any motion vector information a default motion vector such as a zero motion vector may be used instead.

[0078] Figure 9 illustrates an example of a coding unit 900 and some neighbour blocks 901—905 of the coding unit. As can be seen from Figure 9, if the coding unit 900 represents the current block, the neighbouring blocks 901—905 labelled A0, A1, B0, B1 and B2 could be such neighbour blocks which may be used when obtaining the candidate motion vectors.

[0079] Creating additional or extra motion vector predictions based on previously added predictors may be needed when the current number of candidates is limited or insufficient. This kind of creating additional candidates can be performed by combining previous two predictions and/or processing one previous candidate by scaling or adding offset and/or adding a zero motion vector with various reference indices. Hence, the motion vector definer 361 may examine how many motion vector candidates can be defined and how many potential candidate motion vectors exist for the current block. If the number of potential motion vector candidates is smaller than a threshold, the motion vector definer 361 may create additional motion vector predictions.

[0080] In some embodiments the combined motion vector can be based on motion vectors in different lists. For example, one motion vector may be defined by combining one motion vector from the list 0 and one motion vector from the list 1 e.g. when the neighbouring or co-located block is a bi-directionally predicted block and there exists one motion vector in the list 0 and one motion vector in the list 1 for the bi-directionally predicted block.

[0081] To distinguish the current block from the encoded/decoded blocks the motion vectors of which are used as candidate motion vectors, those encoded/decoded blocks are also called as reference blocks in this application.

[0082] In some embodiments not only the motion vector information of the reference block(s) is obtained (e.g. by copying) but also a reference index of the reference block in the reference picture list may be copied to the candidate list. The information whether the block was uni-predicted using only list0 or the block was uni-predicted using only list1 or the block was bi-predicted using list0 and list1 may also be copied. The candidate list may also be called as a candidate set or a set of motion vector prediction candidates.

[0083] Figure 6a illustrates an example of spatial and temporal prediction of a prediction unit. There is depicted the current block 601 in the frame 600 and a neighbour block 602 which already has been encoded. The motion vector definer 361 has defined a motion vector 603 for the neighbour block 602 which points to a block 604 in the previous frame 605. This motion vector can be used as a potential spatial motion vector prediction 610 for the current block. Figure 6a depicts that a co-located block 606 in the previous frame 605, i.e. the block at the same location than the current block but in the previous frame, has a motion vector 607 pointing to a block 609 in another frame 608. This motion vector 607 can be used as a potential temporal motion vector prediction-611 for the current frame.

[0084] Figure 6b illustrates another example of spatial and temporal prediction of a prediction unit. In this example the block 606 of the previous frame 605 uses bi-directional prediction based on the block 609 of the frame preceding the frame 605 and on the block 612 succeeding the current frame 600. The temporal motion vector prediction for the current block 601 may be formed by using both the motion vectors 607, 614 or either of them.

[0085] The operation of the prediction list modifier 363 will now be described in more detail with reference to the flow diagram of Figures 5a and 5b. The prediction list modifier 363 initializes a motion vector prediction list to default values in block 500 of Figure 5a. The

prediction list modifier 363 may also initialize a list index to an initial value such as zero. Then, in block 501 the prediction list modifier checks whether there are any motion vector candidates to process. If there is at least one motion vector candidate in the predictor set for processing, the prediction list modifier 363 generates the next motion vector candidate which may be a temporal motion vector or a spatial motion vector. The comparison can be an identity/equivalence check or comparing the (absolute) difference against a threshold or any other similarity metric.

[0086] In the following, a merge process for motion information coding according to an example embodiment will be described in more detail. The encoder creates a list of motion prediction candidates from which one of the candidates is to be signalled as the motion information for the current coding unit or prediction unit. The motion prediction candidates may consist of several spatial motion predictions and a temporal motion prediction. The spatial candidates can be obtained from the motion information of e.g. the spatial neighbour blocks A0, A1, B0, B1, B2, whose motion information is used as spatial candidate motion predictions. The temporal motion prediction candidate may be obtained by processing the motion of a block in a frame other than the current frame. In this example embodiment, the encoder operations to construct the merge list for the spatial candidates may include the following. The operations may be carried out by the prediction list modifier 363, for example.

[0087] A maximum number of spatial motion prediction candidates to be included in the merge list may be defined. This maximum number may have been stored, for example, to the memory 58 of the apparatus 50, or to another appropriate place. It is also possible to determine the maximum number by using other means, or it may be determined in the software of the encoder of the apparatus 50.

[0088] In some embodiments the maximum number of spatial motion prediction candidates to be included in the merge list is four but in some embodiments the maximum number may be less than four or greater than four.

[0089] In this example the spatial motion prediction candidates are the spatial neighbour blocks A0, A1, B0, B1, B2. The spatial motion vector prediction candidate A1 is located on the left side of the prediction unit when the encoding/decoding order is from left to right and from top to bottom of the frame, slice or another entity to be encoded/decoded. Respectively, the spatial motion vector prediction candidate B1 is located above the prediction unit. third; the spatial motion vector prediction candidate B0 is on the right side of the spatial motion vector

prediction candidate B1; the spatial motion vector prediction candidate A0 is below the spatial motion vector prediction candidate A1; and the spatial motion vector prediction candidate B2 is located on the same column than spatial motion vector prediction candidate A1 and on the same row than the spatial motion vector prediction candidate B1. In other words, the spatial motion vector prediction candidate B2 is cornerwise neighbouring the prediction unit as can be seen e.g. from Figure 9.

[0090] These spatial motion prediction candidates can be processed in a predetermined order, for example, A1, B1, B0, A0 and B2. The first spatial motion prediction candidate to be selected for further examination is thus A1. Before further examination is performed for the selected spatial motion prediction candidate, it may be determined whether the merge list already contains a maximum number of spatial motion prediction candidates. Hence, the prediction list modifier 363 compares 502 the number of spatial motion prediction candidates in the merge list with the maximum number, and if the number of spatial motion prediction candidates in the merge list is not less than the maximum number, the selected spatial motion prediction candidate is not included in the merge list and the process of constructing the merge list can be stopped 526. On the other hand, if the number of spatial motion prediction candidates in the merge list is less than the maximum number, a further analyses of the selected spatial motion prediction candidate is performed (blocks 504-522).

[0091] For all the spatial motion prediction candidates for which the further analyses is to be performed, some or all of the following conditions below may be tested for determining whether to include the spatial motion prediction candidate in the merge list.

[0092] The prediction list modifier 363 examines 504 if the prediction unit or block covering the spatial motion prediction candidate block is not available for motion prediction. If so, the candidate is not included in the merge list. The reason that the block is not available may be that the block is either coded in intra mode or resides in a different slice or outside of the picture area.

[0093] In addition to the common conditions above, for each spatial motion prediction candidate, if any of the following conditions holds, then the candidate is not included in the merge list, otherwise, it is included.

[0094] The prediction list modifier 363 determines 506 which spatial motion prediction candidate of the set of spatial motion prediction candidates is in question. If the spatial motion prediction candidate is the block A1, one or more of the following conditions may be examined

508, 510 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is vertically split into two rectangle prediction units 103, 104 as depicted in Figure 10b and the current prediction unit is the second prediction unit 104 in the coding/decoding order (508), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not vertically split into two rectangle prediction units but it is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit in the coding/decoding order and the block A1 has the same motion information as the block B1 (510), this spatial motion prediction candidate (block A1) is not included in the merge list. In the example of Figure 10a the second prediction unit is the lower prediction unit 102 of the coding unit 100 and in the example of Figure 10b the second prediction unit is the rightmost prediction unit 104 of the coding unit 100. If none of the conditions above is fulfilled the block A1 is included in the merge list as a spatial motion prediction candidate (524).

[0095] If the spatial motion prediction candidate is the block B1, one or more of the following conditions may be examined 512, 514 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit 104 in the coding/decoding order (512), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not horizontally split into two rectangle prediction units and if the block B1 has the same motion information than the block A1 (514), this spatial motion prediction candidate (block B1) is not included in the merge list. If none of the conditions above is fulfilled the block B1 is included in the merge list as a spatial motion prediction candidate (524).

[0096] If the spatial motion prediction candidate is the block B0, this spatial motion prediction candidate is not included in the merge list if the block B0 has the same motion information than the block B1 (516). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block B0) is included in the merge list (524).

[0097] If the spatial motion prediction candidate is the block A0, this spatial motion prediction candidate is not included in the merge list if the block A0 has the same motion

information than the block A1 (518). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block A0) is included in the merge list (524).

[0098] If the spatial motion prediction candidate is the block B2, this spatial motion prediction candidate is not included in the merge list if the maximum number of spatial motion prediction candidates is four and the other blocks A0, A1, B0, and B1 are all decided to be included in the merge list (520). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, the block B2 is not included in the merge list if the block B2 has the same motion information than the block B1 or the block A1 (522).

[0099] Then, after processing the blocks A1, B1, B0, A0 and B2 and including a subset of them in the merge list based on the above described conditions, no more redundancy check between these candidates are performed and remaining temporal motion prediction candidate and/or other possible additional candidates may be processed.

[00100] Comparing two blocks whether they have the same motion may be performed by comparing all the elements of the motion information, namely 1) The information whether 'the prediction unit is uni-predicted using only reference picture list0' or 'the prediction unit is uni-predicted using only reference picture list1' or 'the prediction unit is bi-predicted using both reference picture list0 and list1' 2) Motion vector value corresponding to the reference picture list0 3) Reference picture index in the reference picture list0 4) Motion vector value corresponding to the reference picture list1 5) Reference picture index in the reference picture list1.

[00101] In some embodiments similar restrictions for comparing candidate pairs can be applied if the current coding unit is coded/decoded by splitting into four or any number of prediction units.

[00102] The maximum number of merge list candidates can be any non-zero value. In the example above the merger list candidates were the spatial neighbour blocks A0, A1, B0, B1, B2 and the temporal motion prediction candidate, but there may be more than one temporal motion prediction candidate and also other spatial motion prediction candidates than the spatial

neighbour blocks. In some embodiments there may also be other spatial neighbour blocks than the blocks A0, A1, B0, B1, B2.

[00103] It is also possible that the maximum number of spatial motion prediction candidates included in the list can be different than four.

[00104] In some embodiments the maximum number of merge list candidates and maximum number of spatial motion prediction candidates included in the list can depend on whether a temporal motion vector candidate is included in the list or not.

[00105] A different number of spatial motion prediction candidates located at various locations in the current frame can be processed. The locations can be the same as or different than A1, B1, B0, A0 and B2.

[00106] The decision of including which spatial motion prediction candidates in the list can be realized in two steps. In the first step, some of the candidates are eliminated by checking whether the candidate block is available and/or the candidate block's prediction mode is intra and/or whether the current block is a second prediction unit of a coding unit coded with two prediction units and the candidate has the same motion with the first prediction unit. In the second step, remaining candidates are examined and some or all of them are included in the merge list. The examination in the second step does not include comparing motion information of each possible candidate pair but includes a subset of the possible comparison combinations.

[00107] The decisions for the candidates can be taken in any order of A1, B1, B0, A0 and B2 or independently in parallel.

[00108] For each candidate and/or a subset of the candidates, the following conditions may also be checked: Whether the candidate block has the same motion as the first prediction unit of the current coding unit when the current coding unit is split into two rectangle prediction units and the current prediction unit is the second prediction unit in the coding/decoding order.

[00109] Additional conditions related to various properties of current and/or previous slices and/or current and/or neighbour blocks can be utilized for determining whether to include a candidate in the list.

[00110] Motion comparison can be realized by comparing a subset of the whole motion information. For example, only the motion vector values for some or all reference picture lists and/or reference indices for some or all reference picture lists and/or an identifier value assigned to each block to represent its motion information can be compared. The comparison can be an

identity or an equivalence check or comparing the (absolute) difference against a threshold or any other similarity metric.

[00111] Conditions for deciding whether a candidate is to be included in the list can include motion information comparison with any subset of the candidates as long as not all possible candidate pairs are compared eventually.

[00112] Deciding whether a temporal motion vector candidate is to be included in the list can be based on comparing its motion information with motion information of a subset of the spatial motion vector prediction candidates.

[00113] When comparing motion information of two blocks, motion information of additional blocks can be considered too. For example, when comparing the block B2 and the block A1, all the blocks between the block B2 and the block A1 (illustrated in Figure 12) are checked whether they have the same motion; and when comparing the block B2 and the block B1, all the blocks between the block B2 and the block B1 (illustrated in Figure 12) are checked whether they have the same motion. This embodiment can be implemented so that the right-most block of each prediction unit or all blocks of each prediction unit may store the information of how many consecutive blocks to the above have the same motion information. Also the bottom-most block of each prediction unit or all blocks of each prediction unit may store the information of how many consecutive blocks to the left have the same motion information. Using this information the condition for not including B0 in the list can be realized by checking if the number of consecutive blocks with the same motion to the left of B0 is greater than 0. The condition for not including A0 in the list can be realized by checking if the number of consecutive blocks with same motion to the above of A0 is greater than 0. The conditions for not including B2 can be modified as follows:

[00114] It is not examined whether the block B2 has same motion as the block B1 or whether the block B2 has same motion as the block A1, but how many consecutive blocks exists to the left of the block B1 with the same motion than the block B1 and/or how many consecutive blocks exist above the block A1 with the same motion. If the number of consecutive blocks with the same motion to the left of the block B1 is greater than the number of blocks between B2 and B1, or if the number of consecutive blocks with the same motion above the block A1 is greater than the number of blocks between the block B2 and the block A1, the block B2 is not included in the merge list.

[00115] If the above implementation is used, the value of how many consecutive blocks to the left/above have the same motion information can be determined by direct comparison of motion information or checking the prediction mode and/or the merge index if the block employs a merge process.

[00116] When coding/decoding the selected merge index, the information whether the merge process is employed for coding/decoding a Skip mode coding unit or an Inter Merge mode prediction unit can be taken into account. For example, if a context adaptive binary arithmetic coder (CABAC) is used for entropy coding/decoding, different contexts can be used for the bins depending on the coding mode (Skip mode or inter merge mode) of the current block. Furthermore, assigning two contexts depending on whether the merge process is employed in a Skip mode coding unit or an inter Merge mode prediction unit can be applied for only the most significant bin of the merge index.

[00117] During the process of removal of redundant candidates, comparison between motion vector predictor candidates can also be based on any other information than the motion vector values. For example, it can be based on linear or non-linear functions of motion vector values, coding or prediction types of the blocks used to obtain the motion information, block size, the spatial location in the frame/(largest) coding unit/macroblock, the information whether blocks share the same motion with a block, the information whether blocks are in the same coding/prediction unit, etc.

[00118] The following pseudo code illustrates an example embodiment of the invention for constructing the merging list.

[00119] Inputs to this process are

- a luma location (xP, yP) specifying the top-left luma sample of the current prediction unit relative to the top-left sample of the current picture;
- variables specifying the width and the height of the prediction unit for luma, nPSW and nPSH; and
- a variable PartIdx specifying the index of the current prediction unit within the current coding unit.

[00120] Outputs of this process are (with N being replaced by A₀, A₁, B₀, B₁ or B₂ and with X being replaced by 0 or 1)

- the availability flags availableFlagN of the neighbouring prediction units,

- the reference indices refIdxLXN of the neighbouring prediction units,
 - the prediction list utilization flags predFlagLXN of the neighbouring prediction units,
 - the motion vectors mvLXN of the neighbouring prediction units.
- [00121]** For the derivation of availableFlagN, with N being A₀, A₁, B₀, B₁ or B₂ and (xN, yN) being (xP-1, yP + nPSH), (xP-1, yP + nPSH-1), (xP + nPSW, yP-1), (xP+nPSW-1, yP-1) or (xP-1, yP-1), the following applies.
- If one of the following conditions is true, the availableFlagN is set equal to 0, both components mvLXN are set equal to 0, refIdxLXN and predFlagLX[xN, yN] of the prediction unit covering luma location (xN, yN) are assigned respectively to mvLXN, refIdxLXN and predFlagLXN.
 - N is equal to B₂ and availableFlagA₀ + availableFlagA₁ + availableFlagB₀ + availableFlagB₁ is equal to 4.
 - The prediction unit covering luma location (xN, yN) is not available or PredMode is MODE_INTRA.
 - N is equal to A₁ and PartMode of the current prediction unit is PART_Nx2N or PART_nLx2N or PART_nRx2N and PartIdx is equal to 1.
 - N is equal to A₁ and PartMode of the current prediction unit is PART_2NxN or PART_2NxN_U or PART_2NxN_D and PartIdx is equal to 1 and the prediction units covering luma location (xP+nPSW-1, yP-1) (N = B₁) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $mvLX[xP+nPSW-1, yP-1] == mvLX[xN, yN]$
 - $refIdxLX[xP+nPSW-1, yP-1] == refIdxLX[xN, yN]$
 - $predFlagLX[xP+nPSW-1, yP-1] == predFlagLX[xN, yN]$
 - N is equal to B₁ and PartMode of the current prediction unit is 2NxN or PART_2NxN_U or PART_2NxN_D and PartIdx is equal to 1.
 - N is equal to B₁ and the prediction units covering luma location (xP-1, yP+nPSH-1) (N = A₁) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $mvLX[xP-1, yP+nPSH-1] == mvLX[xN, yN]$
 - $refIdxLX[xP-1, yP+nPSH-1] == refIdxLX[xN, yN]$
 - $predFlagLX[xP-1, yP+nPSH-1] == predFlagLX[xN, yN]$
 - N is equal to B₀ and the prediction units covering luma location (xP+nPSW-1, yP-1) (N = B₁) and luma location (xN, yN) (Cand. N) have identical motion parameters:

- $mvLX[xP+nPSW-1, yP-1] == mvLX[xN, yN]$
- $refIdxLX[xP+nPSW-1, yP-1] == refIdxLX[xN, yN]$
- $predFlagLX[xP+nPSW-1, yP-1] == predFlagLX[xN, yN]$
- N is equal to A0 and the prediction units covering luma location $(xP-1, yP+nPSH-1)$ (N = A1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $mvLX[xP-1, yP+nPSH-1] == mvLX[xN, yN]$
 - $refIdxLX[xP-1, yP+nPSH-1] == refIdxLX[xN, yN]$
 - $predFlagLX[xP-1, yP+nPSH-1] == predFlagLX[xN, yN]$
- N is equal to B2 and the prediction units covering luma location $(xP+nPSW-1, yP-1)$ (N = B1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $mvLX[xP+nPSW-1, yP-1] == mvLX[xN, yN]$
 - $refIdxLX[xP+nPSW-1, yP-1] == refIdxLX[xN, yN]$
 - $predFlagLX[xP+nPSW-1, yP-1] == predFlagLX[xN, yN]$
- N is equal to B2 and the prediction units covering luma location $(xP-1, yP+nPSH-1)$ (N = A1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $mvLX[xP-1, yP+nPSH-1] == mvLX[xN, yN]$
 - $refIdxLX[xP-1, yP+nPSH-1] == refIdxLX[xN, yN]$
 - $predFlagLX[xP-1, yP+nPSH-1] == predFlagLX[xN, yN]$
- PartMode of the current prediction unit is PART_NxN and PartIdx is equal to 3 and the prediction units covering luma location $(xP-1, yP)$ (PartIdx = 2) and luma location $(xP-1, yP-1)$ (PartIdx = 0) have identical motion parameters:
 - $mvLX[xP-1, yP] == mvLX[xP-1, yP-1]$
 - $refIdxLX[xP-1, yP] == refIdxLX[xP-1, yP-1]$
 - $predFlagLX[xP-1, yP] == predFlagLX[xP-1, yP-1]$
- and the prediction units covering luma location $(xP, yP-1)$ (PartIdx = 1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $mvLX[xP, yP-1] == mvLX[xN, yN]$
 - $refIdxLX[xP, yP-1] == refIdxLX[xN, yN]$
 - $predFlagLX[xP, yP-1] == predFlagLX[xN, yN]$

- PartMode of the current prediction unit is PART_NxN and PartIdx is equal to 3 and the prediction units covering luma location (xP, yP-1) (PartIdx = 1) and luma location (xP-1, yP-1) (PartIdx = 0) have identical motion parameters:
 - $mvLX[xP, yP-1] == mvLX[xP-1, yP-1]$
 - $refIdxLX[xP, yP-1] == refIdxLX[xP-1, yP-1]$
 - $predFlagLX[xP, yP-1] == predFlagLX[xP-1, yP-1]$
 and the prediction units covering luma location (xP-1, yP) (PartIdx = 2) and luma location (xN, yN) (Cand. N) have identical motion parameters:
 - $mvLX[xP-1, yP] == mvLX[xN, yN]$
 - $refIdxLX[xP-1, yP] == refIdxLX[xN, yN]$
 - $predFlagLX[xP-1, yP] == predFlagLX[xN, yN]$
- Otherwise, availableFlagN is set equal to 1 and the variables $mvLX[xN, yN]$, $refIdxLX[xN, yN]$ and $predFlagLX[xN, yN]$ of the prediction unit covering luma location (xN, yN) are assigned respectively to $mvLXN$, $refIdxLXN$ and $predFlagLXN$.

[00122] For the motion vector predictor candidate list generation process, each list candidate can include more information than the motion vector value, such as the reference lists used, the reference frames used in each list and motion vector for each list.

[00123] When all motion vector candidates have been examined, one motion vector is selected to be used as the motion vector for the current block. The motion vector selector 364 may examine different motion vectors in the list and determine which motion vector provides the most efficient encoding result, or the selection of the motion vector may be based on to other criteria as well. Information of the selected motion vector is provided for the mode selector for encoding and transmission to the decoder or for storage when the mode selector determines to use inter prediction for the current block. The information may include the index of the motion vector in the list, and/or motion vector parameters or other appropriate information.

[00124] The selected motion vector and the block relating to the motion vector is used to generate the prediction representation of the image block 312 which is provided as the output of the mode selector. The output may be used by the first summing device 321 to produce the first prediction error signal 320, as was described above.

[00125] The selected motion vector predictor candidate can be modified by adding a motion vector difference or can be used directly as the motion vector of the block. Moreover, after the motion compensation is performed by using the selected motion vector predictor candidate, the residual signal of the block can be transform coded or skipped to be coded.

[00126] Although the embodiments above have been described with respect to the size of the macroblock being 16x16 pixels, it would be appreciated that the methods and apparatus described may be configured to handle macroblocks of different pixel sizes.

[00127] In the following the operation of an example embodiment of the decoder 600 is depicted in more detail with reference to Figure 7.

[00128] At the decoder side similar operations are performed to reconstruct the image blocks. Figure 7 shows a block diagram of a video decoder 700 suitable for employing embodiments of the invention and Figures 8a and 8b show a flow diagram of an example of a method in the video decoder. The bitstream to be decoded may be received from the encoder, from a network element, from a storage medium or from another source. The decoder is aware of the structure of the bitstream so that it can determine the meaning of the entropy coded codewords and may decode the bitstream by an entropy decoder 701 which performs entropy decoding on the received signal. The entropy decoder thus performs the inverse operation to the entropy encoder 330 of the encoder described above. The entropy decoder 701 outputs the results of the entropy decoding to a prediction error decoder 702 and a pixel predictor 704.

[00129] In some embodiments the entropy coding may not be used but another channel encoding may be in use, or the encoded bitstream may be provided to the decoder 700 without channel encoding. The decoder 700 may comprise a corresponding channel decoder to obtain the encoded codewords from the received signal.

[00130] The pixel predictor 704 receives the output of the entropy decoder 701. The output of the entropy decoder 701 may include an indication on the prediction mode used in encoding the current block. A predictor selector 714 within the pixel predictor 704 determines that an intra-prediction or an inter-prediction is to be carried out. The predictor selector 714 may furthermore output a predicted representation of an image block 716 to a first combiner 713. The predicted representation of the image block 716 is used in conjunction with the reconstructed prediction error signal 712 to generate a preliminary reconstructed image 718. The preliminary reconstructed image 718 may be used in the predictor 714 or may be passed to a filter 720. The

filter 720, if used, applies a filtering which outputs a final reconstructed signal 722. The final reconstructed signal 722 may be stored in a reference frame memory 724, the reference frame memory 724 further being connected to the predictor 714 for prediction operations.

[00131] Also the prediction error decoder 702 receives the output of the entropy decoder 701. A dequantizer 792 of the prediction error decoder 702 may dequantize the output of the entropy decoder 701 and the inverse transform block 793 may perform an inverse transform operation to the dequantized signal output by the dequantizer 792. The output of the entropy decoder 701 may also indicate that prediction error signal is not to be applied and in this case the prediction error decoder produces an all zero output signal.

[00132] The decoder selects the 16x16 pixel residual macroblock to reconstruct. This residual macroblock is also called as a current block.

[00133] The decoder may receive information on the encoding mode used in encoding of the current block. The indication is decoded, when necessary, and provided to the reconstruction processor 791 of the prediction selector 714. The reconstruction processor 791 examines the indication and selects one of the intra-prediction mode(s), if the indication indicates that the block has been encoded using intra-prediction, or the inter-prediction mode, if the indication indicates that the block has been encoded using inter-prediction.

[00134] For inter-prediction mode the reconstruction processor 791 may comprise one or more elements corresponding to the prediction processor 362 of the encoder, such as a motion vector definer, a prediction list modifier and/or a motion vector selector.

[00135] The reconstruction processor 791 initializes a motion vector prediction list to default values in block 800. As was the case in the encoding part, in this example the spatial motion prediction candidates are the spatial neighbour blocks A0, A1, B0, B1, B2 and these spatial motion prediction candidates are processed in the same predetermined order than in the encoder: A1, B1, B0, A0 and B2. The first spatial motion prediction candidate to be selected for further examination is thus A1. Before further examination is performed for the selected spatial motion prediction candidate, it is examined whether the merge list already contains a maximum number of spatial motion prediction candidates. If the number of spatial motion prediction candidates in the merge list is not less than the maximum number, the selected spatial motion prediction candidate is not included in the merge list and the process of constructing the merge list can be stopped 826. On the other hand, if the number of spatial motion prediction candidates in the

merge list is less than the maximum number, a further analyses of the selected spatial motion prediction candidate is performed (blocks 804-822).

[00136] The decoder examines 804 if the prediction unit or block covering the spatial motion prediction candidate block is not available for motion prediction. If so, the candidate is not included in the merge list. The reason that the block is not available may be that the block is either coded in intra mode or resides in a different slice or outside of the picture area.

[00137] In addition to the common conditions above, for each spatial motion prediction candidate, if any of the following conditions holds, then the candidate is not included in the merge list, otherwise, it is included.

[00138] The decoder determines 806 which spatial motion prediction candidate of the set of spatial motion prediction candidates is in question. If the spatial motion prediction candidate is the block A1, one or more of the following conditions may be examined 808, 810 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is vertically split into two rectangle prediction units 103, 104 as depicted in Figure 10b and the current prediction unit is the second prediction unit 104 in the coding/decoding order (808), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not vertically split into two rectangle prediction units but it is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit in the coding/decoding order and the block A1 has the same motion information as the block B1 (810), this spatial motion prediction candidate (block A1) is not included in the merge list. In the example of Figure 10a the second prediction unit is the lower prediction unit 102 of the coding unit 100 and in the example of Figure 10b the second prediction unit is the rightmost prediction unit 104 of the coding unit 100. If none of the conditions above is fulfilled the block A1 is included in the merge list as a spatial motion prediction candidate (824).

[00139] If the spatial motion prediction candidate is the block B1, one or more of the following conditions may be examined 812, 814 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit 104 in the coding/decoding order (812), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not

horizontally split into two rectangle prediction units and if the block B1 has the same motion information than the block A1 (814), this spatial motion prediction candidate (block B1) is not included in the merge list. If none of the conditions above is fulfilled the block B1 is included in the merge list as a spatial motion prediction candidate (824).

[00140] If the spatial motion prediction candidate is the block B0, this spatial motion prediction candidate is not included in the merge list if the block B0 has the same motion information than the block B1 (816). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block B0) is included in the merge list (824).

[00141] If the spatial motion prediction candidate is the block A0, this spatial motion prediction candidate is not included in the merge list if the block A0 has the same motion information than the block A1 (818). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block A0) is included in the merge list (824).

[00142] If the spatial motion prediction candidate is the block B2, this spatial motion prediction candidate is not included in the merge list if the maximum number of spatial motion prediction candidates is four and the other blocks A0, A1, B0, and B1 are all decided to be included in the merge list (820). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, the block B2 is not included in the merge list if the block B2 has the same motion information than the block B1 or the block A1 (822).

[00143] Then, after processing the blocks A1, B1, B0, A0 and B2 and including a subset of them in the merge list based on the above described conditions, no more redundancy check between these candidates are performed and remaining temporal motion prediction candidate and/or other possible additional candidates may be processed.

[00144] When the merge list has been constructed the decoder may use 828 the indication of the motion vector received from the encoder to select the motion vector for decoding the current block. The indication may be, for example, an index to the merge list.

[00145] Basically, after the reconstruction processor 791 has constructed the merge list, it would correspond with the merge list constructed by the encoder if the reconstruction processor 791 has the same information available than the encoder had. If some information has been lost during transmission the information from the encoder to the decoder, it may affect the generation of the merge list in the decoder 700.

[00146] The above examples describe the operation mainly in the merge mode but the encoder and decoder may also operate in other modes.

[00147] The embodiments of the invention described above describe the codec in terms of separate encoder and decoder apparatus in order to assist the understanding of the processes involved. However, it would be appreciated that the apparatus, structures and operations may be implemented as a single encoder-decoder apparatus/structure/operation. Furthermore in some embodiments of the invention the coder and decoder may share some or all common elements.

[00148] Although the above examples describe embodiments of the invention operating within a codec within an electronic device, it would be appreciated that the invention as described below may be implemented as part of any video codec. Thus, for example, embodiments of the invention may be implemented in a video codec which may implement video coding over fixed or wired communication paths.

[00149] Thus, user equipment may comprise a video codec such as those described in embodiments of the invention above.

[00150] It shall be appreciated that the term user equipment is intended to cover any suitable type of wireless user equipment, such as mobile telephones, portable data processing devices or portable web browsers.

[00151] Furthermore elements of a public land mobile network (PLMN) may also comprise video codecs as described above.

[00152] In general, the various embodiments of the invention may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. For example, some aspects may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device, although the invention is not limited thereto. While various aspects of the invention may be illustrated and described as block diagrams, flow charts, or using some other pictorial representation, it is well understood that these blocks, apparatus, systems, techniques or methods

described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

[00153] The embodiments of this invention may be implemented by computer software executable by a data processor of the mobile device, such as in the processor entity, or by hardware, or by a combination of software and hardware. Further in this regard it should be noted that any blocks of the logic flow as in the Figures may represent program steps, or interconnected logic circuits, blocks and functions, or a combination of program steps and logic circuits, blocks and functions. The software may be stored on such physical media as memory chips, or memory blocks implemented within the processor, magnetic media such as hard disk or floppy disks, and optical media such as for example DVD and the data variants thereof, CD.

[00154] The memory may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor based memory devices, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory. The data processors may be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on multi core processor architecture, as non limiting examples.

[00155] Embodiments of the inventions may be practiced in various components such as integrated circuit modules. The design of integrated circuits is by and large a highly automated process. Complex and powerful software tools are available for converting a logic level design into a semiconductor circuit design ready to be etched and formed on a semiconductor substrate.

[00156] Programs, such as those provided by Synopsys, Inc. of Mountain View, California and Cadence Design, of San Jose, California automatically route conductors and locate components on a semiconductor chip using well established rules of design as well as libraries of pre stored design modules. Once the design for a semiconductor circuit has been completed, the resultant design, in a standardized electronic format (e.g., Opus, GDSII, or the like) may be transmitted to a semiconductor fabrication facility or "fab" for fabrication.

[00157] The foregoing description has provided by way of exemplary and non-limiting examples a full and informative description of the exemplary embodiment of this invention. However, various modifications and adaptations may become apparent to those skilled in the

relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings and the appended claims. However, all such and similar modifications of the teachings of this invention will still fall within the scope of this invention.

[00158] In the following some examples will be provided.

[00159] In some embodiments a method comprises:

receiving a block of pixels including a prediction unit; determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00160] In some embodiments the method comprises including neighbouring blocks of the received block of pixels in the set of spatial motion vector prediction candidates.

[00161] In some embodiments the method comprises constructing the set of spatial motion vector predictions by using motion vectors of one or more encoded blocks in a same frame than the block of pixels.

[00162] In some embodiments the method comprises selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

[00163] In some embodiments the method comprises comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

[00164] In some embodiments the method comprises prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

[00165] In some embodiments the method comprises
determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

[00166] In some embodiments the method comprises
examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

[00167] In some embodiments the method comprises including a temporal motion prediction candidate into the merge list.

[00168] In some embodiments the method comprises selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

[00169] In some embodiments a method according to the second aspect comprises:

receiving an encoded block of pixels including a prediction unit;
determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00170] In some embodiments the method comprises including neighbouring blocks of the received encoded block of pixels in the set of spatial motion vector prediction candidates.

[00171] In some embodiments the method comprises constructing the set of spatial motion vector predictions by using motion vectors of one or more decoded blocks in a same frame than the received encoded block of pixels.

[00172] In some embodiments the method comprises selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

[00173] In some embodiments the method comprises comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

[00174] In some embodiments the method comprises examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

[00175] In some embodiments the method comprises
determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

[00176] In some embodiments the method comprises

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

[00177] In some embodiments the method comprises including a temporal motion prediction candidate into the merge list.

[00178] In some embodiments the method comprises selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

[00179] In some embodiments an apparatus according to the third aspect comprises a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

- receive a block of pixels
- including a prediction unit;
- determining a set of spatial motion vector prediction candidates for the block of pixels;
- the spatial motion vector prediction candidates being provided with motion information;
- selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00180] In some embodiments an apparatus according to the fourth aspect comprises a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels including a prediction unit;

determine a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determine a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other

[00181] In some embodiments a storage medium having stored thereon a computer program code a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00182] In some embodiments a storage medium having stored thereon a computer program code a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00183] In some embodiments an apparatus comprises:

means for receiving a block of pixels including a prediction unit;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

[00184] In some embodiments an apparatus comprises:

means for receiving an encoded block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

Claims:

1. A method comprising:

determining a set of spatial motion vector prediction candidates for a block of pixels, the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for a prediction unit of the block of pixels, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; and

causing information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

2. The method according to claim 1 further comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

3. The method according to claim 1, further comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

4. The method according to claim 1 further comprising examining whether the block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

5. The method according to claim 1, further comprising
determining a maximum number of spatial motion vector prediction candidates to be included in the merge list; and
limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

6. The method according to claim 5 comprising:
examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;
if so, examining whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;
if so, performing at least one of the following:
for a potential spatial motion vector prediction candidate on a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is vertically divided into a first prediction unit and a second prediction unit;
- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

7. The method according to claim 1 further comprising including a temporal motion prediction candidate into the merge list.

8. The method according to claim 1 further comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

9. A method comprising:

determining a set of spatial motion vector prediction candidates for an encoded block of pixels, the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for a prediction unit of the encoded block of pixels, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; and

selecting a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using information that was received identifying a respective spatial motion vector prediction candidate from the merge list constructed by an encoder.

10. The method according to claim 9 further comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

11. The method according to claim 9 further comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

12. The method according to claim 9 further comprising
determining a maximum number of spatial motion vector prediction candidates to be included in the merge list; and
limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

13. The method according to claim 12 further comprising:
examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;
if so, examining whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;
if so, performing at least one of the following:
for a potential spatial motion vector prediction candidate on a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit;
- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;

- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

14. The method according to claim 9 further comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the encoded block of pixels.

15. An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

- determine a set of spatial motion vector prediction candidates for a block of pixels, the spatial motion vector prediction candidates being provided with motion information;

- select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for a prediction unit of the block of pixels, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

- determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

- compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; and

- cause information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

16. The apparatus according to claim 15 wherein the apparatus is further caused to select spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

17. The apparatus according to claim 15, wherein the apparatus is further caused to compare motion information of the potential spatial motion vector prediction candidate with motion

information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

18. The apparatus according to claim 15 wherein the apparatus is further caused to examine whether the block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

19. The apparatus according to claim 15, wherein the apparatus is further caused to:
determine a maximum number of spatial motion vector prediction candidates to be included in the merge list; and
limit the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

20. The apparatus according to claim 19 wherein the apparatus is further caused to:
examine, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;
if so, examine whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;
if so, perform at least one of the following:
for a potential spatial motion vector prediction candidate on a left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is vertically divided into a first prediction unit and a second prediction unit;
- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

21. The apparatus according to claim 15 wherein the apparatus is further caused to include a temporal motion prediction candidate into the merge list.

22. The apparatus according to claim 15 wherein the apparatus is further caused to select one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

23. An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

determine a set of spatial motion vector prediction candidates for an encoded block of pixels, the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for a prediction unit of the encoded block of pixels, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates;

determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; and

select a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using information that was received identifying a respective spatial motion vector prediction candidate from the merge list constructed by an encoder.

24. The apparatus according to claim 23 wherein the apparatus is further caused to compare motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

25. The apparatus according to claim 23 wherein the apparatus is further caused to examine whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

26. The apparatus according to claim 23 wherein the apparatus is further caused to:
determine a maximum number of spatial motion vector prediction candidates to be included in the merge list; and
limit the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

27. The apparatus according to claim 26 wherein the apparatus is further caused to:
examine if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;
if so, examine whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;
if so, perform at least one of the following:
for a potential spatial motion vector prediction candidate on a left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit;
- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction

candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

28. The apparatus according to claim 23 wherein the apparatus is further caused to select one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

29. A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprising instructions for:

determining a set of spatial motion vector prediction candidates for a block of pixels, the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for a prediction unit of the block of pixels, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; and

causing information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

30. A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprising instructions for:

- determining a set of spatial motion vector prediction candidates for an encoded block of pixels, the spatial motion vector prediction candidates being provided with motion information;

- selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for a prediction unit of the encoded block of pixels, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates;

- determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

- comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; and

- selecting a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using information that was received identifying a respective spatial motion vector prediction candidate from the merge list constructed by an encoder.

ABSTRACT

The invention relates to a method for encoding, a method for decoding, an apparatus, computer program products, an encoder and a decoder for video information. The motion vector for a block in a video image is predicted from a set of motion vector prediction candidates determined based on previously-coded motion vectors. A motion vector prediction candidate is included in the set based on the location of the block associated with the first spatial motion vector prediction candidate and in comparison with motion vector prediction candidates already in the set.

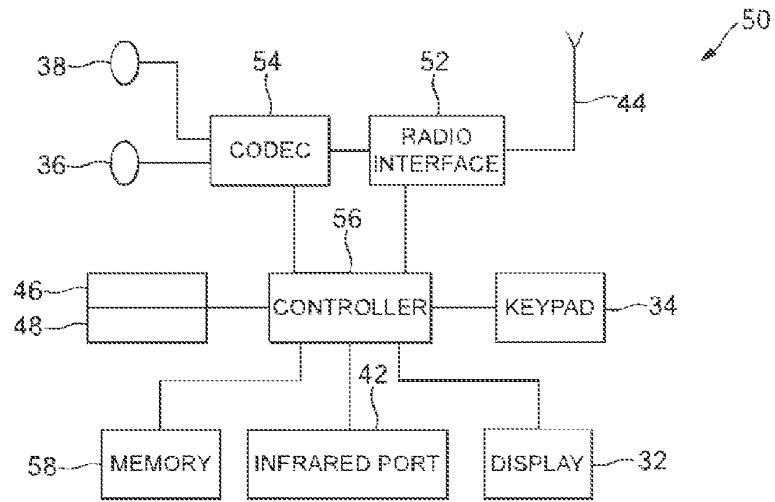


FIG. 1

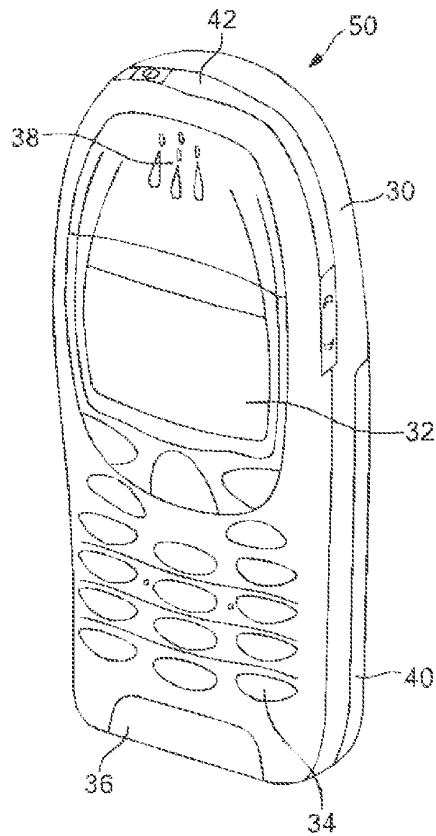


FIG. 2

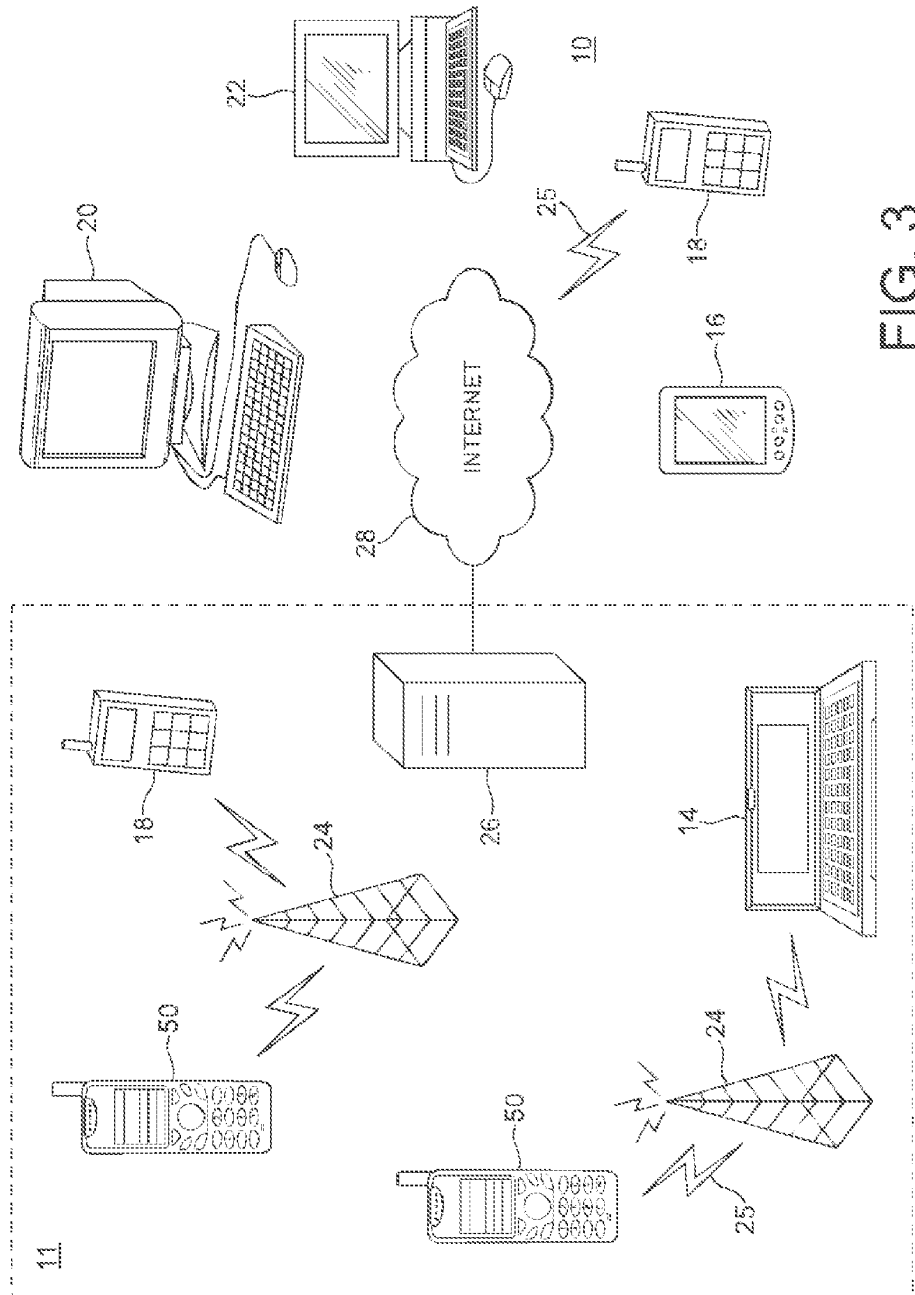


FIG. 3

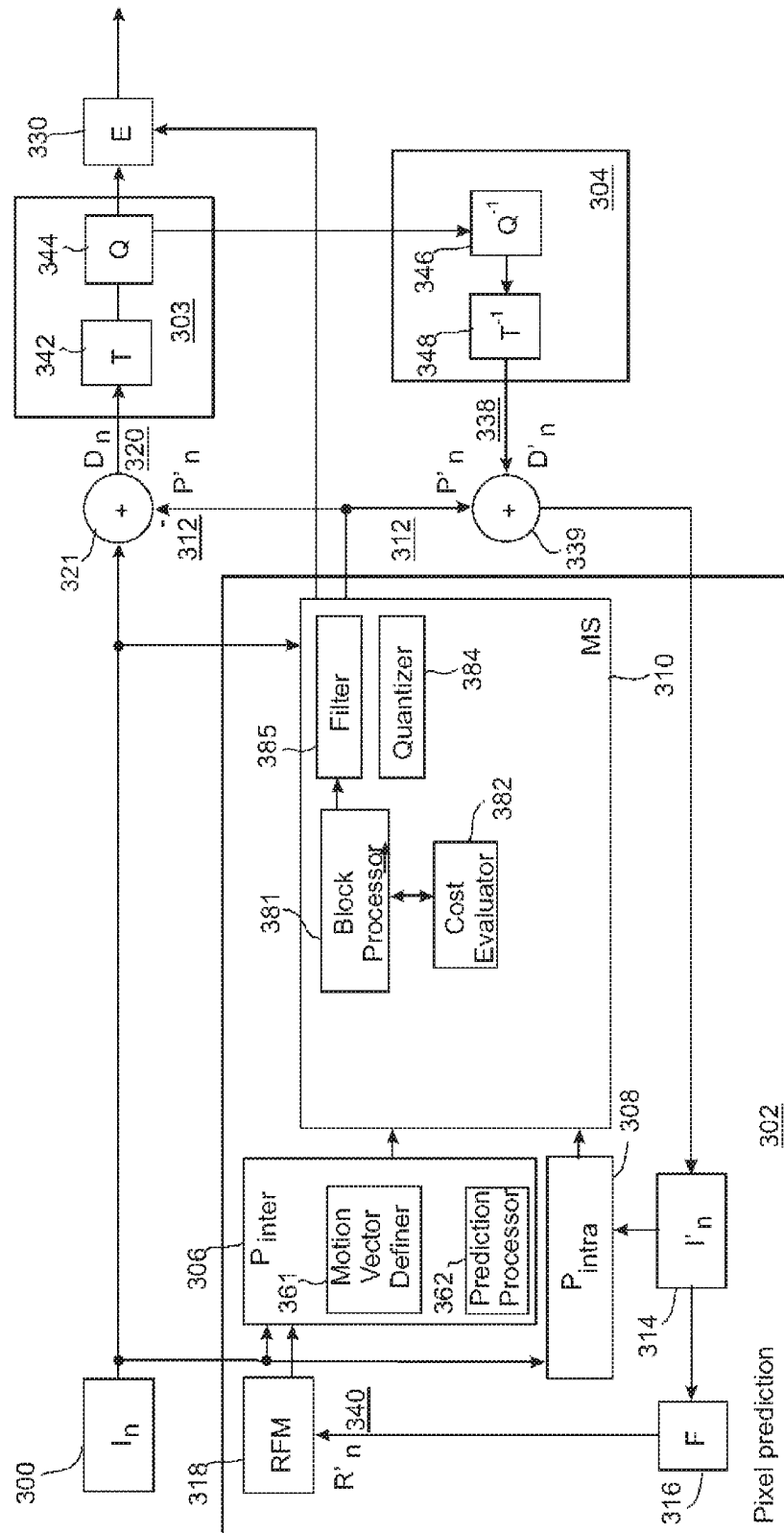


Fig. 4a

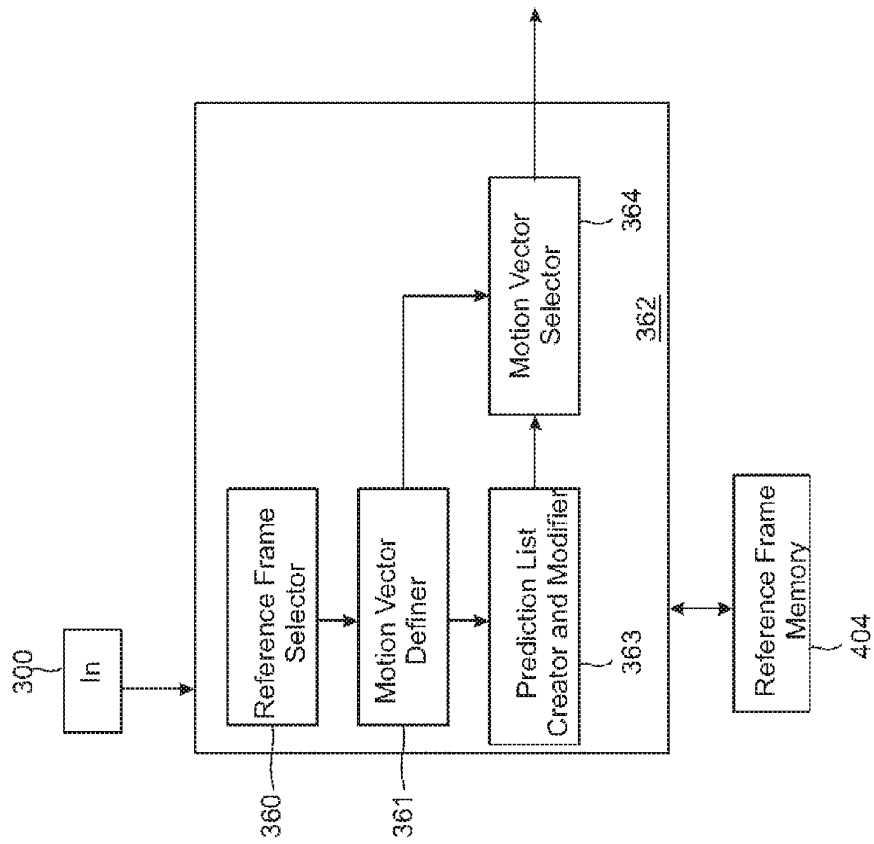


Fig. 4b

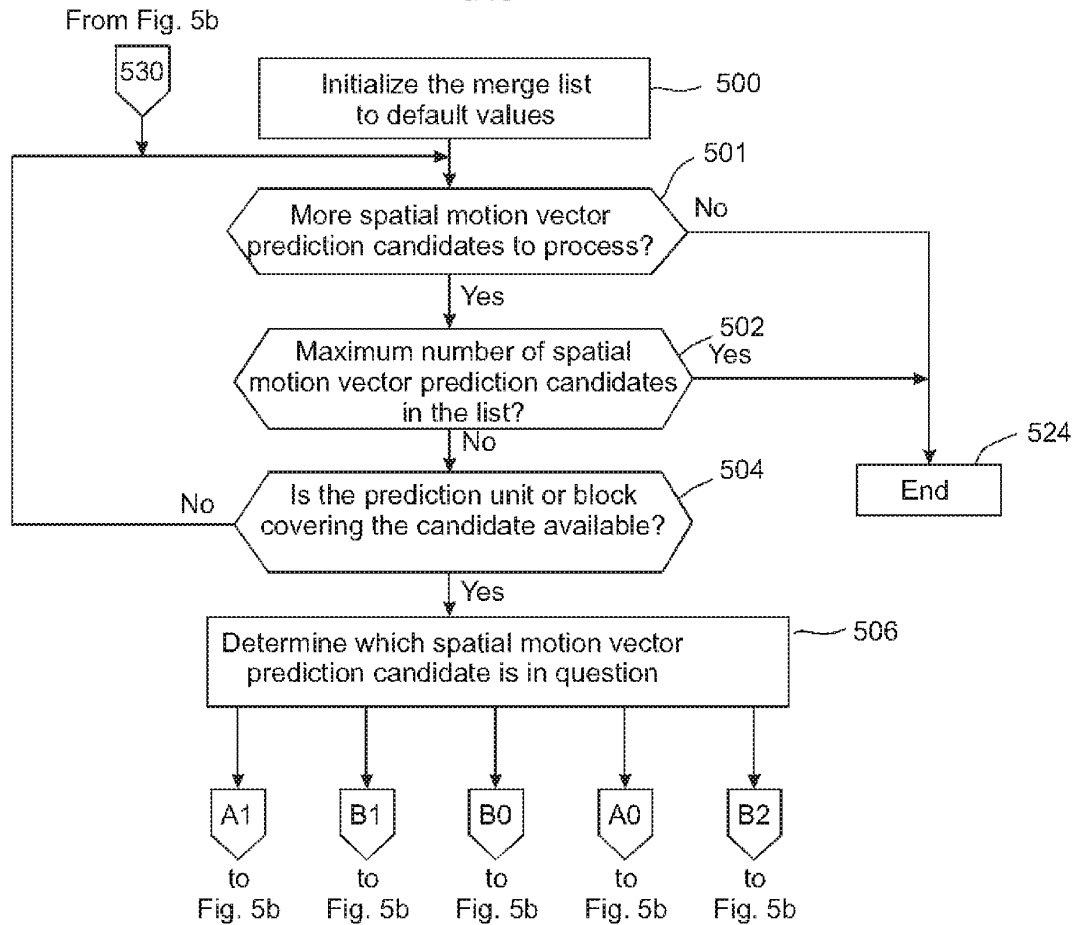


Fig. 5a

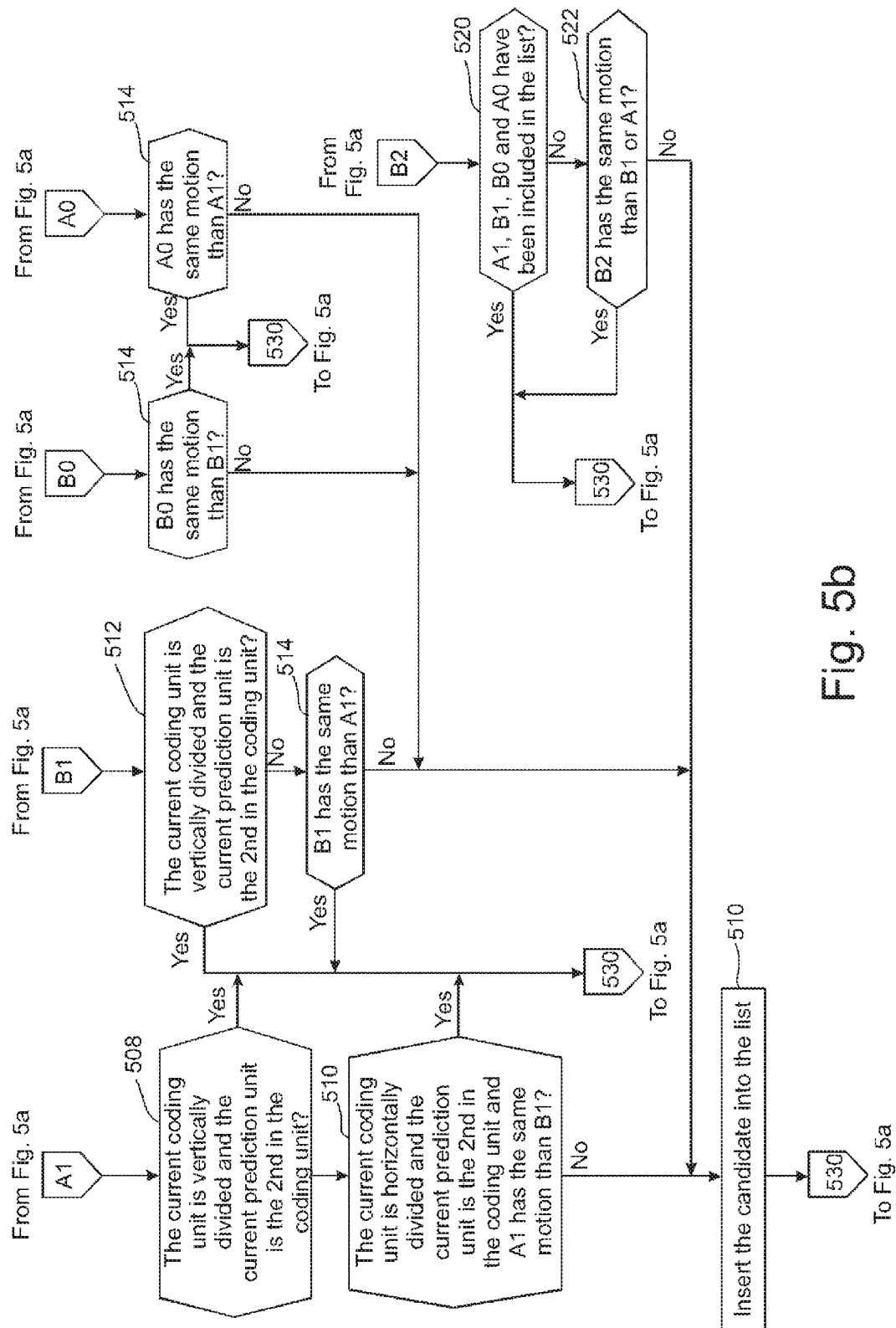


Fig. 5b

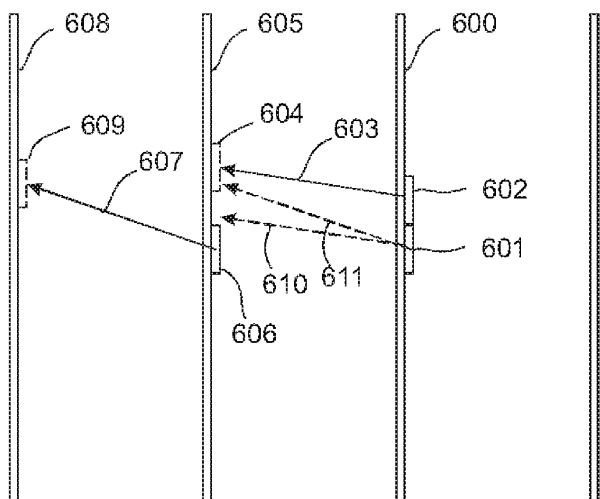


Fig. 6a

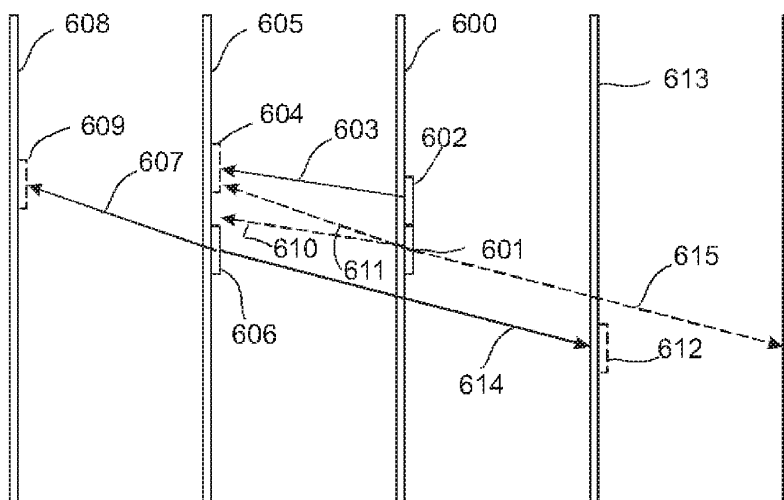


Fig. 6b

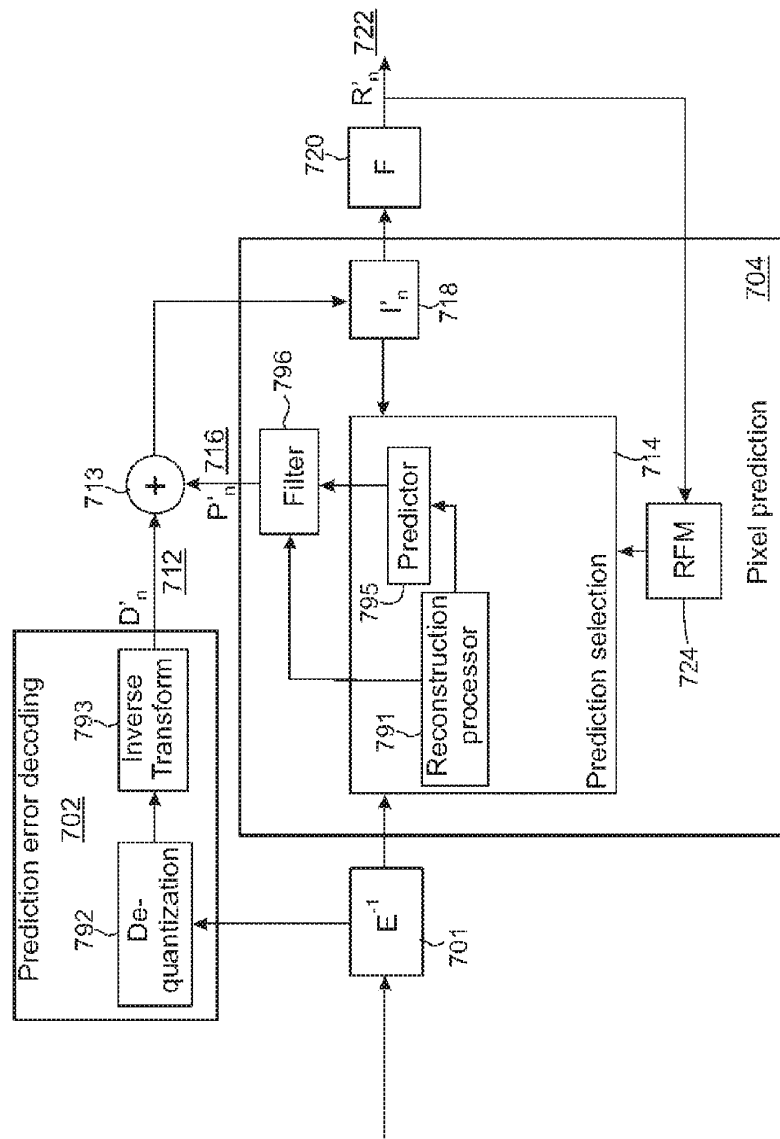


Fig. 7

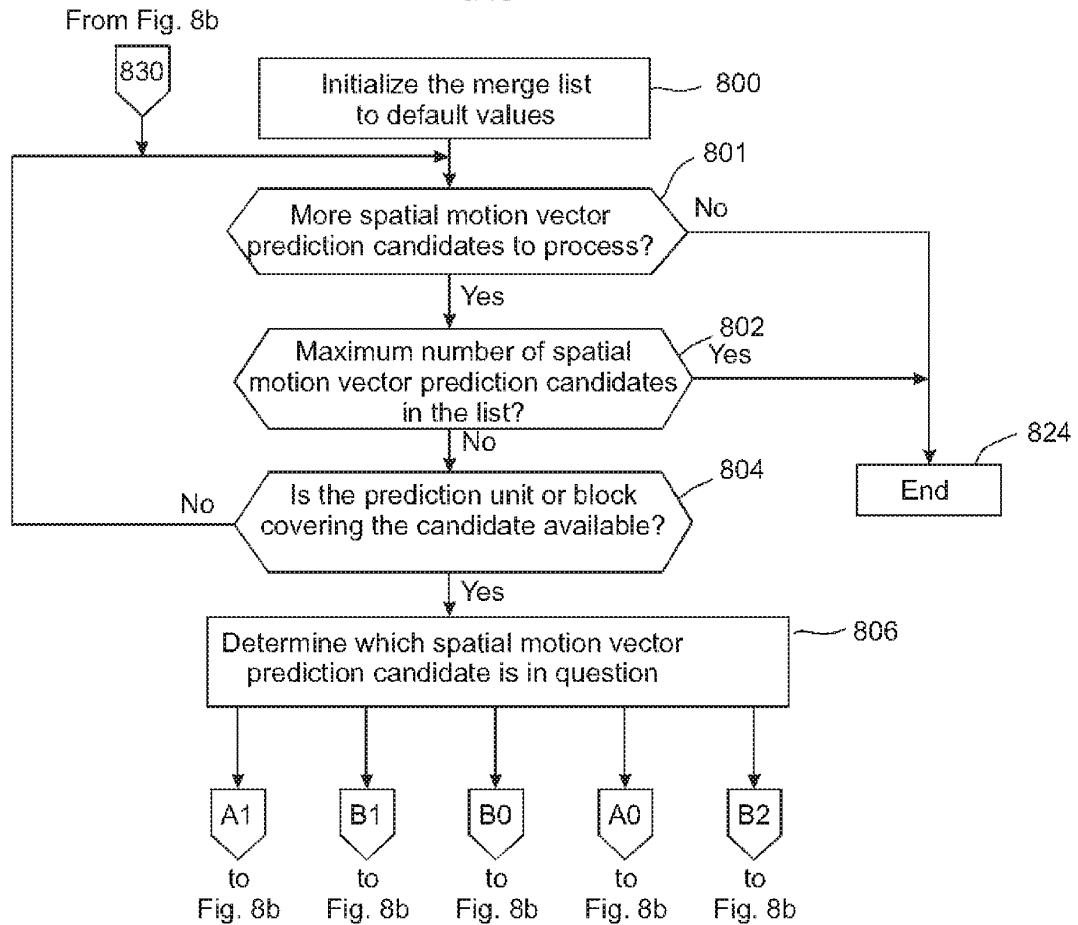


Fig. 8a

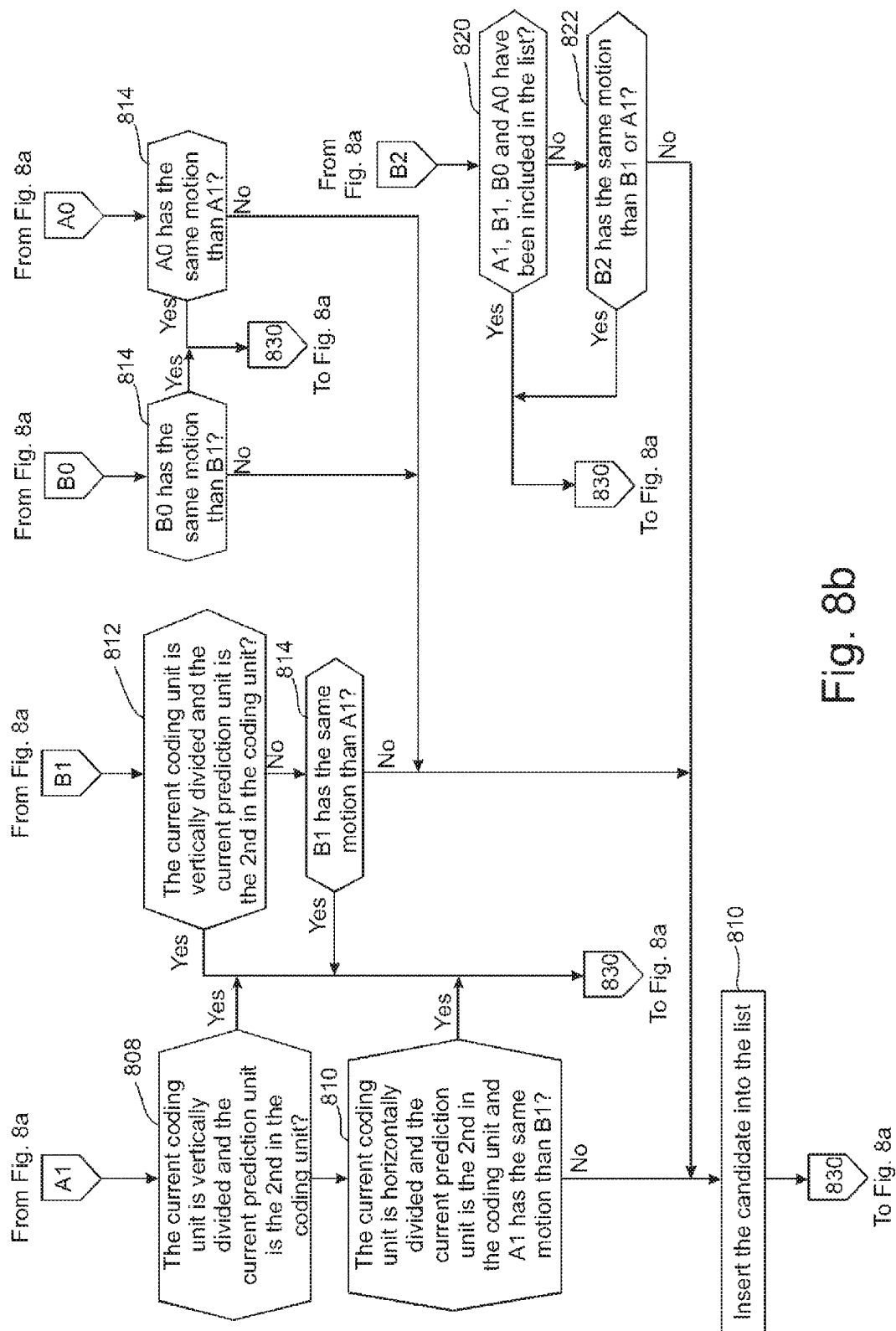


Fig. 8b

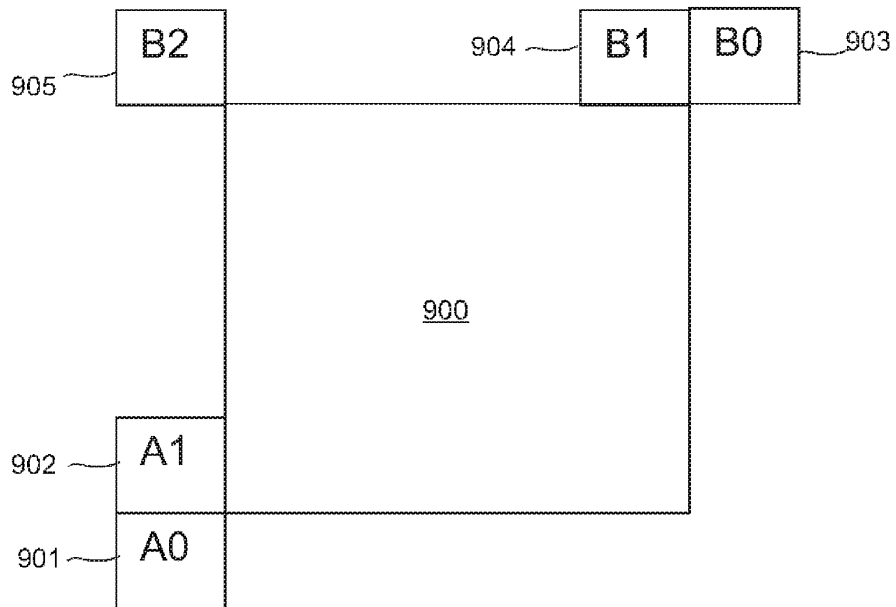


Fig. 9

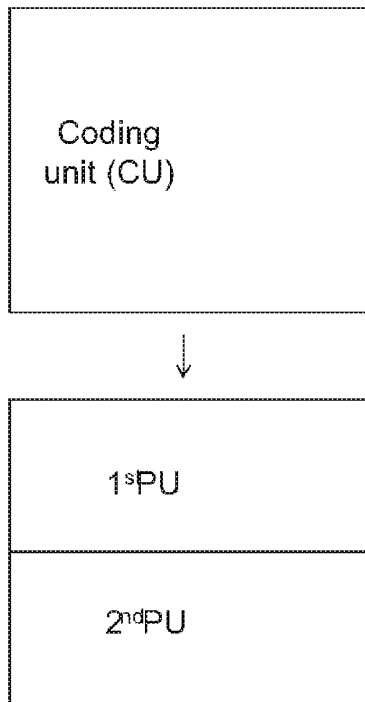


Fig. 10a

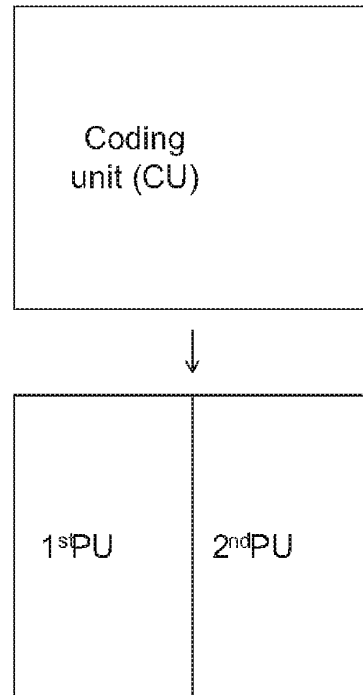


Fig. 10b

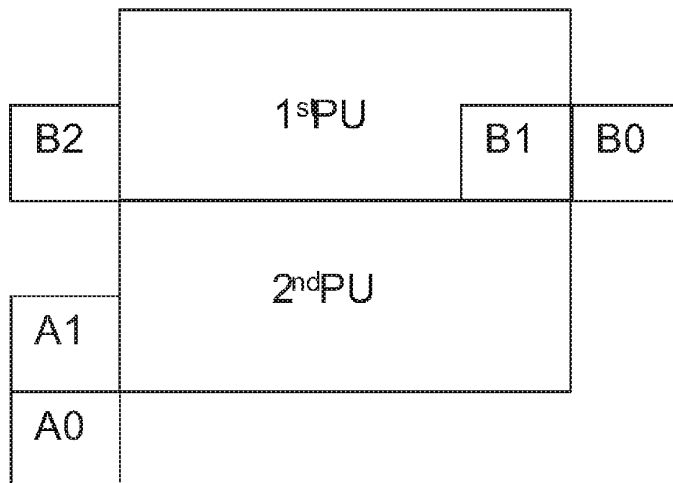


Fig. 11a

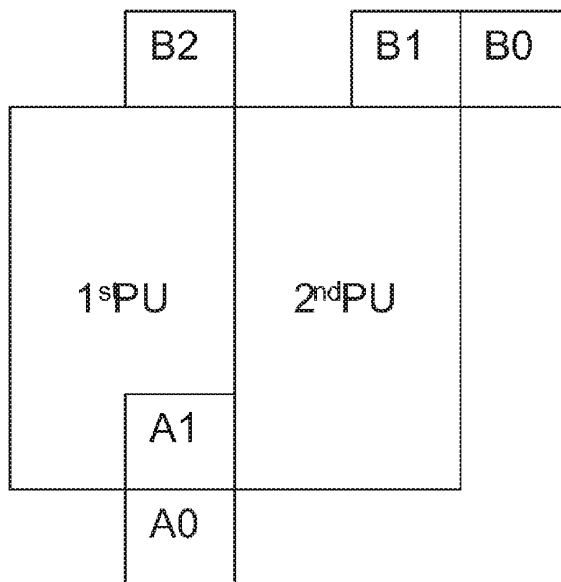


Fig. 11b

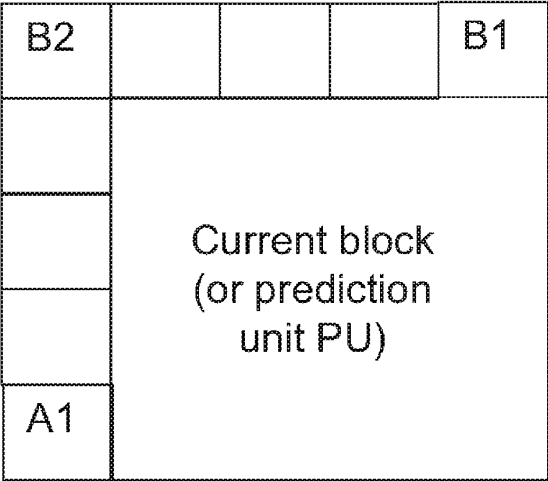


Fig. 12

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Title of Invention	METHOD FOR CODING AND AN APPARATUS
As the below named inventor, I hereby declare that: This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT international application number <u>13/666680</u> filed on <u>November 1, 2012</u>. The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. LEGAL NAME OF INVENTOR Inventor: <u>Mehmet Oguz BICI</u> Date (Optional): <u>NOV - 05 - 2012</u> Signature: <u></u> Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/01 form for each additional inventor.	

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This declaration
is directed to:☐

The attached application, or

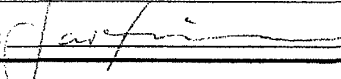
☒United States application or PCT international application number 13/666680filed on November 1, 2012.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001
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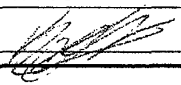
LEGAL NAME OF INVENTORInventor: Jani LAINEMADate (Optional): NOV-02-2012Signature: 

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APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	600			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720			
TOTAL CLAIMS (37 CFR 1.16(j))	30	minus 20 = *	10			x 80 =	800			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	6	minus 3 = *	3			x 420 =	1260			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
				TOTAL		TOTAL	3660			
* If the difference in column 1 is less than zero, enter "0" in column 2.										
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(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
15/426,822	02/07/2017	2482	3660	042933/489677	30	6

CONFIRMATION NO. 3935

FILING RECEIPT



10949
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Date Mailed: 02/17/2017

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Mehmet Oguz BICI, Tampere, FINLAND;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

Applicant(s)

NOKIA TECHNOLOGIES OY, Espoo, FINLAND;

Power of Attorney: The patent practitioners associated with Customer Number 10949

Domestic Priority data as claimed by applicant

This application is a CON of 13/666,680 11/01/2012 PAT 9571833
which claims benefit of 61/555,703 11/04/2011

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 02/15/2017

page 1 of 3

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/426,822**

Projected Publication Date: 05/25/2017

Non-Publication Request: No

Early Publication Request: No
Title

METHOD FOR CODING AND AN APPARATUS

Preliminary Class

375

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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Substitute for form SB08 INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known		
				Application Number	15/426,822	
				Filing Date	February 7, 2017	
				First Named Inventor	Bici et al.	
				Art Unit	2488	
				Examiner Name	Nathnael B. Aynalem	
Sheet	1	of	4	Attorney Docket Number	042933/489677	
U. S. PATENT DOCUMENTS						
Examiner Initials*	Cite No.	Document Number Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages of Relevant Figures Appear	
	1	US-2004/0234144 A1	11-25-2004	Sugimoto et al.		
	2	US-2008/0159401 A1	07-03-2008	Lee et al.		
	3	US-2011/0170602 A1	07-14-2011	Lee et al.		
	4	US-2011/0176013 A1	07-21-2011	Robertson et al.		
	5	US-2011/0182362 A1	07-28-2011	Kim et al.		
	6	US-2012/0230408 A1	09-13-2012	Zhou		
	7	US-2012/0257678 A1	10-11-2012	Zhou et al.		
	8	US-2012/0269270 A1	10-25-2012	Chen et al.		
	9	US-2012/0300846 A1	11-29-2012	Sugio et al.		
	10	US-2012/0307905 A1	12-06-2012	Kim et al.		
	11	US-2012/0320984 A1	12-20-2012	Zhou		
	12	US-2013/0003850 A1	01-03-2013	Sugio et al.		
	13	US-2013/0004092 A1	01-03-2013	Sasai et al.		
	14	US-2013/0070855 A1	03-21-2013	Zheng et al.		
	15	US-2013/0083853 A1	04-04-2013	Coban et al.		
	16	US-2013/0272408 A1	10-17-2013	Chen et al.		
FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document Country Code - Number Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	English Language Translation Attached
	17	WO 2011/062392 A2	05-26-2011	SK Telecom Co. Ltd.		
	18	WO 2011 115659 A1	09-22-2011	Thomson Licensing		
Examiner Signature				Date Considered		

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

Submitted February 28, 2017

Substitute for form SB08 INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	15/426,822
				Filing Date	February 7, 2017
				First Named Inventor	Bici et al.
				Art Unit	2488
				Examiner Name	Nathnael B. Aynalem
Sheet	2	of	4	Attorney Docket Number	042933/489677
OTHER DOCUMENTS					
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.			English Language Translation Attached
	19	<u>Bici, O. et al.</u> , <i>Non-CE13: Simplification of merge mode</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 7th Meeting: Geneva, CH, 21-30 November, 2011, Document JCTVC-G593; URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, 13 pages			
	20	<u>Bross, B. et al.</u> , <i>Core Experiment 9: MV Coding and Skip/Merge Operations</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F909, 13 pages			
	21	<u>Bross, Benjamin, et al.</u> ; "WD4: Working Draft 4 of High-Efficiency Video Coding"; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 6th Meeting; Torino, IT; 14-22 July 2011; Document JCTVC-F803_d; 232 pages			
	22	<u>Han, Woo-Jin, et al.</u> ; "Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools"; Circuits and Systems for Video Technology; IEEE Transactions on 20.12 (2010); 1709-1720			
	23	<u>Huang, Ai-Mei et al.</u> , <i>A multistage motion vector processing method for motion-compensated frame interpolation</i> , Image Processing, IEEE Transactions on 17.5 (2008) 694-708			
	24	<u>J.-L. Lin, Y.-W. Chen, Y.-W. Huang, S. Lei</u> ; "CE9: Results of Experiment ROB04"; JCT-VC Doc. JCTVC-F052, Turin; Jul 2011			
	25	<u>Jeon, Y. et al.</u> , <i>On MVP list pruning process</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011, Document JCTVC-F105, 7 pages			
	26	<u>Nakamura, H. et al.</u> , <i>Unification of derivation process for merge mode and MVP</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting; Torino, IT, 14-22 July, 2011; Document JCTVC-F419; URL: http://wftp3.itu.int/AV-ARCH/JCTVC-SITE/2011_07_F_Torino/, 10 pages			
	27	<u>Oudin, S. et al.</u> ; "Block Merging for Quadtree-Based Video Coding"; IEEE Int. Conf. on Multimedia and Expo; July 11-15; 2011; 6 pages			
Examiner Signature				Date Considered	

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

Submitted February 28, 2017

Substitute for form SB08 INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	15/426,822
				Filing Date	February 7, 2017
				First Named Inventor	Bici et al.
				Art Unit	2488
				Examiner Name	Nathnael B. Aynalem
Sheet	3	of	4	Attorney Docket Number	042933/489677
OTHER DOCUMENTS					
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.			English Language Translation Attached
	28	<u>Sullivan, G.J.</u> ; "Overview of the High Efficiency Video Coding (HEVC) Standard"; IEEE Trans. On Circuits and Systems for Video Technology; Vol. 22, No. 12; December 2012; pp. 1649-1668			
	29	<u>Tai, Shen-Chuan, et al.</u> ; "A Multi-Pass True Motion Estimation Scheme with Motion Vector Propagation for Frame Rate Up-Conversion Applications"; Journal of Display Technology; 4.2 (2008): 188-197			
	30	<u>Wiegand, Tomas, et al.</u> ; "WD3: Working Draft 3 of High-Efficiency Video Coding"; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 5 th Meeting; Geneva, CH, 16-23 March, 2011; Document JCTVC-E603; 239 pages			
	31	<u>Zheng, Y. et al.</u> ; Merge Candidate Selection in 2NxN, Nx2N, and NxN Mode, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F302, 6 pages			
	32	International Search Report and Written Opinion from corresponding International Application No. PCT/FI2012/051070, dated March 27, 2013			
	33	Office Action from corresponding Korean Patent Application No. 2014-7015093, dated August 21, 2015			
	34	Office Action from corresponding Canadian Patent Application No. 2,854,495, dated October 7, 2015			
	35	Taiwanese Office Action and Search Report from Taiwanese Patent Application No. 101140777 dated December 2, 2015			
	36	Extended European Search Report for corresponding European Application No. 12845839.5 dated March 21, 2016, 10 pages			
	37	Office Action from Korean Patent Application No. 2014-7015093 dated August 22, 2016			
	38	Office Action for Canadian Application No. 2,854,495 dated September 6, 2016			
Examiner Signature				Date Considered	

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

Submitted February 28, 2017

Substitute for form SB08 INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known			
				Application Number		15/426,822	
				Filing Date		February 7, 2017	
				First Named Inventor		Bici et al.	
				Art Unit		2488	
				Examiner Name		Nathnael B. Aynalem	
Sheet	4	of	4	Attorney Docket Number		042933/489677	
OTHER DOCUMENTS							
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.					English Language Translation Attached
	39	Office Action for Chinese Application No. 2012800657775 dated October 9, 2016					
	40	Office Action for U.S. Patent Application No. 13/666,680 dated July 6, 2015, 25 pages.					
	41	Final Office Action for U.S. Patent Application No. 13/666,680 dated March 1, 2016, 35 pages.					
	42	Advisory Action for U.S. Patent Application No. 13/666,680 dated November 7, 2016, 4 pages.					
	43	Notice of Allowance for U.S. Patent Application No. 13/666,680 dated September 30, 2016, 17 pages.					
Examiner Signature					Date Considered		

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

Submitted February 28, 2017

Electronic Acknowledgement Receipt	
EFS ID:	28485227
Application Number:	15426822
International Application Number:	
Confirmation Number:	3935
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Christopher Jason Gegg/Dennis Avery
Filer Authorized By:	Christopher Jason Gegg
Attorney Docket Number:	042933/489677
Receipt Date:	28-FEB-2017
Filing Date:	07-FEB-2017
Time Stamp:	14:17:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	489677US_IDS_Letter_02-28-2017.pdf	97020	no	1
			232c7666d26c34c0cc49e8c3a4d6dc6e73f41779		

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	489677US_IDS_List_02-28-2017.pdf	201497	no	4
			418e72fa36b03956fa2194c82173741e0a9b5c919		
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Non Patent Literature	489677US_NPL_US-13666680_OA_07-06-2015.PDF	911516	no	25
			a5289b113bc181f4c52268150105d5158e91fecb		
Warnings:					
Information:					
4	Non Patent Literature	489677US_NPL_US-13666680_FOA_03-01-2016.PDF	1149534	no	35
			8c8e80ed3734a7c2af33121143cf3479758df012		
Warnings:					
Information:					
5	Non Patent Literature	489677US_NPL_US-13666680_AA_07-11-2016.PDF	167012	no	4
			25b47a608a7a4c81f8c092a1711292cf6a13e3cd		
Warnings:					
Information:					
6	Non Patent Literature	489677US_NPL_US-13666680_NOA_09-30-2016.PDF	801296	no	17
			950e02f8d936a29eeaca78b219221b5e78b5303b		
Warnings:					
Information:					
Total Files Size (in bytes):			3327875		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Bici et al. Confirmation No.: 3935
Appl No.: 15/426,822 Group Art Unit: 2488
Filed: February 7, 2017 Examiner: Nathnael B. Aynalem
For: METHOD FOR CODING AND AN APPARATUS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

**INFORMATION DISCLOSURE STATEMENT
CITATION UNDER 37 C.F.R. § 1.97**

Attached is a list of documents on form PTO-1449.

It is requested that the Examiner consider these documents and officially make them of record in accordance with the provisions of 37 C.F.R. § 1.97 and Section 609 of the MPEP. By identifying the listed documents, Applicant in no way makes any admission as to the prior art status of the listed documents, but is instead identifying the listed documents for the sake of full disclosure.

Any foreign patents or non-patent literature documents items are attached, except those that were supplied in, or cited by the Office during prosecution of, parent Application No. 13/666,680 filed November 1, 2012. Since the benefit of this application was claimed under 35 U.S.C. 120, no copies need to be furnished in accordance with 37 C.F.R. 1.98(d); however, copies will be furnished on request.

Respectfully submitted,

/Guy R. Gosnell/

Guy R. Gosnell
Registration No. 34,610

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ELECTRONICALLY FILED USING THE EFS-WEB ELECTRONIC FILING SYSTEM OF THE UNITED STATES PATENT & TRADEMARK OFFICE ON February 28, 2017.

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce	
Electronic Petition Request	TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT		
Application Number	15426822		
Filing Date	07-Feb-2017		
First Named Inventor	Mehmet BICI		
Attorney Docket Number	042933/489677		
Title of Invention	METHOD FOR CODING AND AN APPARATUS		
☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action ☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.			
Owner		Percent Interest	
Nokia Technologies Oy		100%	
The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s) 9571833 as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns. In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later: - expires for failure to pay a maintenance fee; - is held unenforceable; - is found invalid by a court of competent jurisdiction; - is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; - has all claims canceled by a reexamination certificate; - is reissued; or - is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer. ☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.			

☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status:	
☐ Small Entity ☐ Micro Entity ☒ Regular Undiscounted	
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES	
I certify, in accordance with 37 CFR 1.4(d)(4) that I am:	
☒ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number <u>34610</u>	
☐ A sole inventor	
☐ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application	
☐ A joint inventor; all of whom are signing this request	
Signature	/Guy R. Gosnell/
Name	GUY R. GOSNELL

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
 Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal				
Application Number:		15426822		
Filing Date:		07-Feb-2017		
Title of Invention:		METHOD FOR CODING AND AN APPARATUS		
First Named Inventor/Applicant Name:		Mehmet Oguz BICI		
Filer:		Guy Randall Gosnell/Jan Snider		
Attorney Docket Number:		042933/489677		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				160

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 15426822

Filing Date: 07-Feb-2017

Applicant/Patent under Reexamination: BICI

Electronic Terminal Disclaimer filed on March 3, 2017

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	28530821
Application Number:	15426822
International Application Number:	
Confirmation Number:	3935
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Jan Snider
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/489677
Receipt Date:	03-MAR-2017
Filing Date:	07-FEB-2017
Time Stamp:	15:46:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$160
RAM confirmation Number	030617INTEFSW00002416160605
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	33353	no	2
			ae4813b150a586a589628ac66d8380af07f61c03		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30614	no	2
			45eb4db6d414b846dc6ccfc393cdca2f4eb2ca03		
Warnings:					
Information:					
Total Files Size (in bytes):			63967		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

10949 7590 03/10/2017
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

EXAMINER

AYNALEM, NATHNAEL B

ART UNIT

PAPER NUMBER

2488

DATE MAILED: 03/10/2017

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/426,822	02/07/2017	Mehmet Oguz BICI	042933/489677	3935

TITLE OF INVENTION: METHOD FOR CODING AND AN APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	06/12/2017

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

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

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

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

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

10949 7590 03/10/2017
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/426,822	02/07/2017	Mehmet Oguz BICI	042933/489677	3935

TITLE OF INVENTION: METHOD FOR CODING AND AN APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	06/12/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
AYNALEM, NATHNAEL B	2488	375-240160

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

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

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

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

(A) NAME OF ASSIGNEE

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

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

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

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

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

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

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

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/426,822	02/07/2017	Mehmet Oguz BICI	042933/489677	3935
10949 7590 03/10/2017 Nokia Corporation and Alston & Bird LLP c/o Alston & Bird LLP Bank of America Plaza, 101 South Tryon Street Suite 4000 Charlotte, NC 28280-4000			EXAMINER AYNALEM, NATHNAEL B	
			ART UNIT 2488	PAPER NUMBER

DATE MAILED: 03/10/2017

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

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

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

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

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

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

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 15/426,822	Applicant(s) BICI ET AL.	
	Examiner NATHNAEL AYNALEM	Art Unit 2488	AIA (First Inventor to File) Status No

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

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

1. ☒ This communication is responsive to application filed on 02/07/2017.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

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

3. ☒ The allowed claim(s) is/are 1-30. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

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

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

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

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

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

Attachment(s)

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

/NATHNAEL AYNALEM/ Examiner, Art Unit 2488	
---	--

DETAILED ACTION

This is in response to Application No. 15/426,822 filed on February 07, 2017. The present application is being examined under the pre-AIA first to invent provisions.

Allowable Subject Matter

Claims 1-30 are allowed.

The following is an examiner's statement of reasons for allowance:

Regarding claim 1, the current application is a continuation of patent issued application no. 13/666,680 and includes similar limitations as the cited patent issued application. Thus, claim 1 is allowable in view of applicant's arguments presented in the cited application (*See* Appl. No. 13/666,680, Remarks dated 09/01/2016, pgs. 17-18). Specifically, the argument regarding the difference between the prior arts of record the feature of " comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates," as recited in claim 1 and similarly recited in claims 9, 15, 23, 29 and 30.

Dependent claims 2-8, 10-14, 16-22, 24-28 are allowed by virtue of their dependency from allowed claims 1, 9, 15 and 23.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NATHNAEL AYNALÉM whose telephone number is (571)270-1482. The examiner can normally be reached on Monday-Friday 7:30 to 5:00 EST.

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

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Sath V. Perungavoor can be reached on (571)272-7455. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <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, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NATHNAEL AYNALAM/
Examiner, Art Unit 2488

Notice of References Cited	Application/Control No. 15/426,822		Applicant(s)/Patent Under Reexamination BICI ET AL.	
	Examiner NATHNAEL AYNALEM		Art Unit 2488	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2011/0176013 A1	07-2011	Robertson; Mark	H04N5/145	348/208.4
*	B	US-2012/0230408 A1	09-2012	Zhou; Minhua	H04N19/105	375/240.15
*	C	US-2012/0269270 A1	10-2012	Chen; Ying	H04N19/597	375/240.16
*	D	US-2012/0257678 A1	10-2012	Zhou; Minhua	H04N19/52	375/240.16
*	E	US-2012/0300846 A1	11-2012	SUGIO; Toshiyasu	H04N19/521	375/240.16
*	F	US-2012/0320984 A1	12-2012	Zhou; Minhua	H04N19/50	375/240.16
*	G	US-2013/0003850 A1	01-2013	SUGIO; Toshiyasu	H04N19/105	375/240.16
*	H	US-2013/0004092 A1	01-2013	SASAI; Hisao	H04N19/70	382/233
*	I	US-2013/0070855 A1	03-2013	Zheng; Yunfei	H04N19/105	375/240.16
*	J	US-2013/0083853 A1	04-2013	Coban; Muhammed Zeyd	H04N19/563	375/240.16
*	K	US-2013/0272408 A1	10-2013	CHEN; Ying	H04N19/597	375/240.16
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20170303

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	62871	(Nokia).as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 13:31
L4	384	(spatial or intra) with predict\$3 with candidate\$1 with (exclud\$3 or without or eliminat\$3 or skip\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 13:32
L5	238820	(compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3) with predict\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 13:32
L6	93	L4 same L5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 13:32
L7	84	L6 AND ((H04N19/52 OR H04N19/00684 OR H04N19/00703 OR H04N19/147 OR H04N19/30 OR H04N19/597 OR H04N19/105 OR H04N19/11 OR H04N19/119 OR H04N19/174 OR H04N19/176 OR H04N19/187 OR H04N19/513 OR H04N19/58 OR H04N19/70).CPC. OR (375/240.01-240.29).OCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 13:32
L8	5	L7 and 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 13:32
L9	31	"2011062392"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/03/04 14:03

S3	2798	(spatial or intra) with predict\$3 with candidate\$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 17:53
S4	559	(spatial or intra) with predict\$3 with candidate\$1 with list	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 17:55
S5	15357	(subset or sub\$set) with candidate\$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 17:57
S6	5	S4 same S5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 17:58
S7	33	(spatial or intra) with predict\$3 with candidate\$1 with list with (exclud\$3 or without or eliminat\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:02
S8	580	(compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3) with (spatial or intra) with predict\$3 with candidate\$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:17
S9	48	(spatial or intra) with predict\$3 with candidate\$1 with list with (exclud\$3 or without or eliminat\$3 or skip\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:18
S10	8	S8 same S9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:18
S11	5	S10 AND (H04N19/52 OR H04N19/00684 OR H04N19/00703 OR H04N19/147 OR H04N19/30 OR H04N19/597 OR H04N19/105 OR H04N19/11 OR H04N19/119 OR	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/09/20 18:19

		H04N19/174 OR H04N19/176 OR H04N19/187 OR H04N19/513 OR H04N19/58 OR H04N19/70).CPC. OR (375/240.01-240.29).CCLS.)	DERWENT; IBM_TDB			
S12	7278	merg\$3 near3 list	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:20
S13	292	S4 and S12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:20
S14	280	S13 AND ((H04N19/176 OR H04N19/52 OR H04N19/593 OR H04N19/105 OR H04N19/513 OR H04N19/139 OR H04N19/70 OR H04N19/503 OR H04N19/44 OR H04N19/463 OR H04N19/597 OR H04N19/61 OR H04N19/159 OR H04N19/51 OR H04N19/56 OR H04N19/107 OR H04N19/587 OR H04N19/174 OR H04N19/577).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:23
S15	722	(compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2) with (spatial or intra) with predict\$3 with candidate\$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:24
S16	8	S9 same S15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:25
S17	44	S9 AND ((H04N19/176 OR H04N19/52 OR H04N19/593 OR H04N19/105 OR H04N19/513 OR H04N19/139 OR H04N19/70 OR H04N19/503 OR H04N19/44 OR H04N19/463 OR H04N19/597 OR H04N19/61 OR H04N19/159 OR H04N19/51 OR H04N19/56 OR H04N19/107 OR H04N19/587 OR H04N19/174 OR H04N19/577).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:26
S18	736	(compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3) with (spatial or intra) with predict\$3 with candidate\$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:28
S19	18	(spatial or intra) with predict\$3 with candidate\$1 with list with (exclud\$3 or	US-PGPUB; USPAT;	OR	ON	2016/09/20 18:29

		without or eliminat\$3) with merg\$3	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S20	4	S18 same S19	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:29
S21	4	S18 and S19	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:29
S22	43381	(intra or spatial or spatio adj1 temporal or inter) near4 predict\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:14
S23	407	S12 same S22	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:14
S24	1072	(motion or vector\$1 or mv) with merg\$3 with list	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:16
S26	323	S23 same S24	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:16
S27	3255	(compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3) with (spatial or intra) with predict\$3 with (motion or vector or mv)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:17
S28	74	S26 and S27	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:17

S29	73	S28 AND ((H04N19/176 OR H04N19/52 OR H04N19/593 OR H04N19/105 OR H04N19/513 OR H04N19/139 OR H04N19/70 OR H04N19/503 OR H04N19/44 OR H04N19/463 OR H04N19/597 OR H04N19/61 OR H04N19/159 OR H04N19/51 OR H04N19/56 OR H04N19/107 OR H04N19/587 OR H04N19/174 OR H04N19/577).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:17
S30	73	S29 AND ((H04N19/52 OR H04N19/00684 OR H04N19/00703 OR H04N19/147 OR H04N19/30 OR H04N19/597 OR H04N19/105 OR H04N19/11 OR H04N19/119 OR H04N19/174 OR H04N19/176 OR H04N19/187 OR H04N19/513 OR H04N19/58 OR H04N19/70).CPC. OR (375/240.01-240.29).CCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:18
S31	29910	(motion or vector\$1 or mv) with list	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:20
S32	112	S27 same S31	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:20
S33	5698	candidate\$1 with list with (exclud\$3 or without or eliminat\$3 or remov\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:59
S34	259	S24 and S33	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:59
S35	152	S24 same S33	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:00
S37	227453	(compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3) with predict\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:03

S38	6	S35 same S37	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:03
S39	126	S35 and S37	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:03
S41	40	(BI Cl near3 (Mehmet Oguz)).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:44
S43	36069	(intra or inter) near3 predict\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:45
S44	13	S41 and S43	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:46
S46	431	(LAINEMA near2 Jani).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:47
S47	88	S43 and S46	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:47
S48	11	S33 and S47	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:47
S49	306	(UGUR near3 Kemal).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/09/20 20:48

			DERWENT; IBM_TDB			
S50	12	S33 and S49	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:49
S51	61847	(nokia).as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:50
S52	70	S33 and S51	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:50
S54	15	S43 and S52	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:50
S65	5	"13666680"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/21 12:11
S66	4	"20150010074"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/21 12:30
S67	62	(spatial or intra) with predict\$3 with candidate\$1 with list with (exclud\$3 or without or eliminat\$3 or skip\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/02/27 12:39
S68	6	"13666680"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/02/27 12:48
S69	384	(spatial or intra) with predict\$3 with candidate\$1 with (exclud\$3 or without or eliminat\$3 or skip\$4)	US-PGPUB; USPAT; USOCR;	OR	ON	2017/02/27 13:02

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S70	238369	(compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3) with predict\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/02/27 13:02
S71	93	S69 same S70	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/02/27 13:02
S72	84	S71 AND ((H04N19/52 OR H04N19/00684 OR H04N19/00703 OR H04N19/147 OR H04N19/30 OR H04N19/597 OR H04N19/105 OR H04N19/11 OR H04N19/119 OR H04N19/174 OR H04N19/176 OR H04N19/187 OR H04N19/513 OR H04N19/58 OR H04N19/70).CPC. OR (375/240.01-240.29).CCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/02/27 13:02
S73	42	(BICI near3 (Mehmet Oguz)).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/02/27 13:18
S74	454	(LAINEMA near2 Jani).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/02/27 13:21
S75	334	(UGUR near3 Kemal).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/02/27 13:22
S76	2	S71 and S74	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/02/27 13:22
S77	4	S71 and S75	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2017/02/27 13:22

IBM_TDB

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L10	920	(candidat\$1 with merg\$3).clm.	US-PGPUB; USPAT	OR	ON	2017/03/04 14:31
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L12	694	(candidate\$1 with list with (exclud\$3 or without or eliminat\$3 or remov\$3)).clm.	US-PGPUB; USPAT	OR	ON	2017/03/04 14:31
L13	4	L10 and L11 and L12	US-PGPUB; USPAT	OR	ON	2017/03/04 14:31
L14	14	L11 and L12	US-PGPUB; USPAT	OR	ON	2017/03/04 14:32
L15	22196	((block or macroblock or picture or image) with (predict\$3 or pu)).clm.	US-PGPUB; USPAT	OR	ON	2017/03/04 14:32
L16	298	((spatial or intra) with (mv or motion adj1 vector\$1) with candidate).clm.	US-PGPUB; USPAT	OR	ON	2017/03/04 14:32
L17	230	L15 and L16	US-PGPUB; USPAT	OR	ON	2017/03/04 14:32
L18	14	L11 and L12	US-PGPUB; USPAT	OR	ON	2017/03/04 14:32
L19	2	L17 and L18	US-PGPUB; USPAT	OR	ON	2017/03/04 14:32
S56	21002	((block or macroblock or picture or image) with (predict\$3 or pu)).clm.	US-PGPUB; USPAT	OR	ON	2016/09/20 20:54
S57	266	((spatial or intra) with (mv or motion adj1 vector\$1) with candidate).clm.	US-PGPUB; USPAT	OR	ON	2016/09/20 20:55
S58	818	(candidat\$1 with merg\$3).clm.	US-PGPUB; USPAT	OR	ON	2016/09/20 20:56
S59	739	((compar\$3 or evaluat\$3 or verif\$7 or check\$3 or search\$3 or differenc\$2 or examin\$3) with predict\$3 with candidat\$1).clm.	US-PGPUB; USPAT	OR	ON	2016/09/20 20:57
S60	668	(candidate\$1 with list with (exclud\$3 or without or eliminat\$3 or remov\$3)).clm.	US-PGPUB; USPAT	OR	ON	2016/09/20 20:58
S61	200	S56 and S57	US-PGPUB; USPAT	OR	ON	2016/09/20 20:58
S62	2	S58 and S59 and S60	US-	OR	ON	2016/09/20

EAST Search History

			PGPUB; USPAT			20:59
S63	11	S59 and S60	US- PGPUB; USPAT	OR	ON	2016/09/20 21:02
S64	1	S61 and S63	US- PGPUB; USPAT	OR	ON	2016/09/20 21:02

3/ 4/ 2017 2:37:32 PM**C:\ Users\ nayna\ Documents\ EAST\ Workspaces\ 13666680.wsp**



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BIB DATA SHEET

CONFIRMATION NO. 3935

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
15/426,822	02/07/2017	375	2488	042933/489677		
APPLICANTS NOKIA TECHNOLOGIES OY, Espoo, FINLAND; INVENTORS Mehmet Oguz BICI, Tampere, FINLAND; Jani LAINEMA, Tampere, FINLAND; Kemal UGUR, Tampere, FINLAND; ** CONTINUING DATA ***** This application is a CON of 13/666,680 11/01/2012 PAT 9571833 which claims benefit of 61/555,703 11/04/2011 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 02/15/2017						
Foreign Priority claimed 35 USC 119(a-d) conditions met Verified and Acknowledged	☐ Yes ☒ No ☐ Yes ☐ No /NATHNAEL B AYNALAM/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY FINLAND	SHEETS DRAWINGS 13	TOTAL CLAIMS 30	INDEPENDENT CLAIMS 6
ADDRESS Nokia Corporation and Alston & Bird LLP c/o Alston & Bird LLP Bank of America Plaza, 101 South Tryon Street Suite 4000 Charlotte, NC 28280-4000 UNITED STATES						
TITLE METHOD FOR CODING AND AN APPARATUS						
FILING FEE RECEIVED 3660	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

Search Notes 	Application/Control No. 15426822	Applicant(s)/Patent Under Reexamination BICI ET AL.
	Examiner NATHNAEL AYNALAM	Art Unit 2488

CPC- SEARCHED		
Symbol	Date	Examiner
H04N19/52 ; H04N19/00684 ; H04N19/00703 ; H04N19/147 ; H04N19/30 ; H04N19/597 ; H04N19/105 ; H04N19/11	2/27/2017	N.A.
H04N19/119 ; H04N19/174 ; H04N19/176 ; H04N19/187 ; H04N19/513 ; H04N19/58 ; H04N19/70	2/27/2017	N.A.

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
375	240.01-240.29	2/27/2017	N.A.

SEARCH NOTES		
Search Notes	Date	Examiner
East keyword search	2/27/2017	N.A.
Inventor's name search	2/27/2017	N.A.
Assignee search	3/4/2017	N.A.

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	General Interference Search of the claims (USPGPUB,USPAT)	3/4/2017	N.A.

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Substitute for form SB08 INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known		
				Application Number	15/426,822	
				Filing Date	February 7, 2017	
				First Named Inventor	Bici et al.	
				Art Unit	2488	
Examiner Name	Nathnael B. Aynalem					
Sheet	1	of	4	Attorney Docket Number	042933/489677	
U. S. PATENT DOCUMENTS						
Examiner Initials*	Cite No.	Document Number Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages of Relevant Figures Appear	
/N.B.A./	1	US-2004/0234144 A1	11-25-2004	Sugimoto et al.		
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/N.B.A./	3	US-2011/0170602 A1	07-14-2011	Lee et al.		
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/N.B.A./	16	US-2013/0272408 A1	10-17-2013	Chen et al.		
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Examiner Initials	Cite No.	Foreign Patent Document Country Code - Number Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	English Language Translation Attached
/N.B.A./	17	WO 2011/062392 A2	05-26-2011	SK Telecom Co. Ltd.		
/N.B.A./	18	WO 2011 115659 A1	09-22-2011	Thomson Licensing		
Examiner Signature	/NATHNAEL B AYNALÉM/			Date Considered	03/04/2017	

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

Submitted February 28, 2017

Substitute for form SB08 INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	15/426,822
				Filing Date	February 7, 2017
				First Named Inventor	Bici et al.
				Art Unit	2488
Examiner Name	Nathnael B. Aynalem				
Sheet	2	of	4	Attorney Docket Number	042933/489677
OTHER DOCUMENTS					
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.			English Language Translation Attached
/N.B.A./	19	<u>Bici, O. et al.</u> , <i>Non-CE13: Simplification of merge mode</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 7th Meeting: Geneva, CH, 21-30 November, 2011, Document JCTVC-G593; URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, 13 pages			
/N.B.A./	20	<u>Bross, B. et al.</u> , <i>Core Experiment 9: MV Coding and Skip/Merge Operations</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F909, 13 pages			
/N.B.A./	21	<u>Bross, Benjamin, et al.</u> ; "WD4: Working Draft 4 of High-Efficiency Video Coding"; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 6th Meeting: Torino, IT; 14-22 July 2011; Document JCTVC-F803_d; 232 pages			
/N.B.A./	22	<u>Han, Woo-Jin, et al.</u> ; "Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools"; Circuits and Systems for Video Technology; IEEE Transactions on 20.12 (2010); 1709-1720			
/N.B.A./	23	<u>Huang, Ai-Mei et al.</u> , <i>A multistage motion vector processing method for motion-compensated frame interpolation</i> , Image Processing, IEEE Transactions on 17.5 (2008) 694-708			
/N.B.A./	24	<u>J.-L. Lin, Y.-W. Chen, Y.-W. Huang, S. Lei</u> ; "CE9: Results of Experiment ROB04"; JCT-VC Doc. JCTVC-F052, Turin; Jul 2011			
/N.B.A./	25	<u>Jeon, Y. et al.</u> , <i>On MVP list pruning process</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011, Document JCTVC-F105, 7 pages			
/N.B.A./	26	<u>Nakamura, H. et al.</u> , <i>Unification of derivation process for merge mode and MVP</i> , Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting; Torino, IT, 14-22 July, 2011; Document JCTVC-F419; URL: http://wftp3.itu.int/AV-ARCH/JCTVC-SITE/2011_07_F_Torino/, 10 pages			
/N.B.A./	27	<u>Oudin, S. et al.</u> ; "Block Merging for Quadtree-Based Video Coding"; IEEE Int. Conf. on Multimedia and Expo; July 11-15; 2011; 6 pages			
Examiner Signature	/NATHNAEL B AYNALÉM/			Date Considered	03/04/2017

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

Submitted February 28, 2017

Substitute for form SB08 INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known			
				Application Number		15/426,822	
				Filing Date		February 7, 2017	
				First Named Inventor		Bici et al.	
				Art Unit		2488	
				Examiner Name		Nathnael B. Aynalem	
Sheet	3	of	4	Attorney Docket Number		042933/489677	
OTHER DOCUMENTS							
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.					English Language Translation Attached
/N.B.A./	28	Sullivan, G.J. ; "Overview of the High Efficiency Video Coding (HEVC) Standard"; IEEE Trans. On Circuits and Systems for Video Technology; Vol. 22, No. 12; December 2012; pp. 1649-1668					
/N.B.A./	29	Tai, Shen-Chuan, et al. ; "A Multi-Pass True Motion Estimation Scheme with Motion Vector Propagation for Frame Rate Up-Conversion Applications"; Journal of Display Technology; 4.2 (2008): 188-197					
/N.B.A./	30	Wiegand, Tomas, et al. ; "WD3: Working Draft 3 of High-Efficiency Video Coding"; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 5 th Meeting; Geneva, CH, 16-23 March, 2011; Document JCTVC-E603; 239 pages					
/N.B.A./	31	Zheng, Y. et al. ; Merge Candidate Selection in 2NxN, Nx2N, and NxN Mode, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6 th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F302, 6 pages					
/N.B.A./	32	International Search Report and Written Opinion from corresponding International Application No. PCT/FI2012/051070, dated March 27, 2013					
/N.B.A./	33	Office Action from corresponding Korean Patent Application No. 2014-7015093, dated August 21, 2015					
/N.B.A./	34	Office Action from corresponding Canadian Patent Application No. 2,854,495, dated October 7, 2015					
/N.B.A./	35	Taiwanese Office Action and Search Report from Taiwanese Patent Application No. 101140777 dated December 2, 2015					
/N.B.A./	36	Extended European Search Report for corresponding European Application No. 12845839.5 dated March 21, 2016, 10 pages					
/N.B.A./	37	Office Action from Korean Patent Application No. 2014-7015093 dated August 22, 2016					
/N.B.A./	38	Office Action for Canadian Application No. 2,854,495 dated September 6, 2016					
Examiner Signature	/NATHNAEL B AYNALÉM/				Date Considered	03/04/2017	

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

Submitted February 28, 2017

Substitute for form SB08 INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known			
				Application Number		15/426,822	
				Filing Date		February 7, 2017	
				First Named Inventor		Bici et al.	
				Art Unit		2488	
				Examiner Name		Nathnael B. Aynalem	
Sheet	4	of	4	Attorney Docket Number		042933/489677	
OTHER DOCUMENTS							
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.					English Language Translation Attached
/N.B.A./	39	Office Action for Chinese Application No. 2012800657775 dated October 9, 2016					
/N.B.A./	40	Office Action for U.S. Patent Application No. 13/666,680 dated July 6, 2015, 25 pages.					
/N.B.A./	41	Final Office Action for U.S. Patent Application No. 13/666,680 dated March 1, 2016, 35 pages.					
/N.B.A./	42	Advisory Action for U.S. Patent Application No. 13/666,680 dated November 7, 2016, 4 pages.					
/N.B.A./	43	Notice of Allowance for U.S. Patent Application No. 13/666,680 dated September 30, 2016, 17 pages.					
Examiner Signature	/NATHNAEL B AYNALEM/				Date Considered	03/04/2017	

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

Submitted February 28, 2017

Issue Classification 	Application/Control No. 15426822	Applicant(s)/Patent Under Reexamination BICI ET AL.
	Examiner NATHNAEL AYNALAM	Art Unit 2488

CPC					
Symbol				Type	Version
H04N	19	521		F	2014-11-01
H04N	19	176		A	2014-11-01
H04N	19	182		A	2014-11-01

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

		Total Claims Allowed:	
		30	
(Assistant Examiner)	(Date)		
/NATHNAEL AYNALAM/	03/04/2017	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification 	Application/Control No. 15426822	Applicant(s)/Patent Under Reexamination BICI ET AL.
	Examiner NATHNAEL AYNALAM	Art Unit 2488

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION													
CLASS		SUBCLASS				CLAIMED					NON-CLAIMED								
375		240.16				H	0	4	N	19 / 513 (2014.01.01)									
CROSS REFERENCE(S)						H	0	4	N	19 / 11 (2014.01.01)									
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																		
375	240.12																		

		Total Claims Allowed:	
		30	
(Assistant Examiner) /NATHNAEL AYNALAM/ Primary Examiner.Art Unit 2488	(Date) 03/04/2017	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/426,822	02/07/2017	Mehmet Oguz BICI	042933/489677

CONFIRMATION NO. 3935

PUBLICATION NOTICE



OC000000091636592

10949

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Title:METHOD FOR CODING AND AN APPARATUS

Publication No.US-2017-0150174-A1

Publication Date:05/25/2017

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or **Fax** (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

10949 7590 03/10/2017
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/426,822	02/07/2017	Mehmet Oguz BICI	042933/489677	3935

TITLE OF INVENTION: METHOD FOR CODING AND AN APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	06/12/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
AYNALEM, NATHNAEL B	2488	375-240160

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 Alston & Bird LLP
2
3

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

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

(A) NAME OF ASSIGNEE

Nokia Technologies Oy

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

Espoo, FINLAND

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

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies

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

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

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
☐ Applicant asserting small entity status. See 37 CFR 1.27
☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

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

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

Authorized Signature

Guy R. Gosnell

Date

6/19/17

Typed or printed name

Registration No.

34,610

Electronic Patent Application Fee Transmittal				
Application Number:		15426822		
Filing Date:		07-Feb-2017		
Title of Invention:		METHOD FOR CODING AND AN APPARATUS		
First Named Inventor/Applicant Name:		Mehmet Oguz BICI		
Filer:		Christopher Jason Gegg/Dennis Avery		
Attorney Docket Number:		042933/489677		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				960

Electronic Acknowledgement Receipt	
EFS ID:	29453125
Application Number:	15426822
International Application Number:	
Confirmation Number:	3935
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Christopher Jason Gegg/Dennis Avery
Filer Authorized By:	Christopher Jason Gegg
Attorney Docket Number:	042933/489677
Receipt Date:	09-JUN-2017
Filing Date:	07-FEB-2017
Time Stamp:	16:19:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$960
RAM confirmation Number	061217INTEFSW00003233160605
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	489677US_Issue_Fee_Payment _06-09-2017.pdf	1006226	no	1
			32984f9408c04a9293a767bac2b1073510e b67b5		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30888	no	2
			a9ebaa6f9aa7224f7dd4498ab952c84d6ce8 96cb		
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

[illegible]

Change(s) applied
to document,
/D.H.P./
3/27/2017

(Assistant Examiner)	(Date)
/NATHNAEL AYNALAM/ Primary Examiner.Art Unit 2488	03/04/20
(Primary Examiner)	(Date)

Part of Paper No. 20170303



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/426,822	08/22/2017	9743105	042933/489677	3935

10949 7590 08/02/2017
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Mehmet Oguz BICI, Tampere, FINLAND;
NOKIA TECHNOLOGIES OY, Espoo, FINLAND;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

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www.uspto.gov

APPLICATION NUMBER	PATENT NUMBER	GROUP ART UNIT	REQUEST ID
15/426,822	9743105	2488	57181

PAIR Correspondence Address/Fee Address Change

The following fields have been changed to Customer Number 00197 on 02/07/2018 via Private PAIR in view of the certification copied below that authorized the change.

- Maintenance Fee Address

The address for Customer Number 00197 is:

00197

CPA GLOBAL LIMITED

2318 Mill Road 12th Floor

ALEXANDRIA, VA 22314

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

An attorney or Agent of Record registered to practice before the Patent and Trademark Office who has been given power of attorney in this application

Signature:	/Guy R. Gosnell/
Name:	Guy R. Gosnell
Registration Number:	34610

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Mehmet Oguz Bici	Confirmation No. 3935
Appl. No.:	15/426,822	Patent No.: 9,743,105
Filed:	February 7, 2017	Issue Date: August 22, 2017
For:	METHOD FOR CODING AND AN APPARATUS	

Certificate of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION

On behalf of the Applicant and Assignee of the above-referenced patent, Nokia Technologies Oy, it is hereby requested that the Office issue a Certificate of Correction in order to make a correction to Claim 9 as set forth in the attached Certificate of Correction. Specifically, the requested correction brings the wording of Claim 9 consistent with corresponding independent Claims 1, 15, 23, 29 and 30.

The required Certificate of Correction fee of \$150 is being paid during e-filing concurrently herewith.

Respectfully submitted,

/Guy R. Gosnell/

Guy R. Gosnell
Registration No. 34,610

ALSTON & BIRD LLP
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LEGAL02/38421572v1

**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**

PATENT NO. : 9,743,105 B2

Page 1 of 1

APPLICATION NO. : 15/426,822

ISSUE DATE : August 22, 2017

INVENTOR(S) : Bici et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the claims:

Column 33,

Line 35, "set" should read --subset--.

MAILING ADDRESS OF SENDER

ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000

Electronic Patent Application Fee Transmittal				
Application Number:		15426822		
Filing Date:		07-Feb-2017		
Title of Invention:		METHOD FOR CODING AND AN APPARATUS		
First Named Inventor/Applicant Name:		Mehmet Oguz BICI		
Filer:		Guy Randall Gosnell/Kim Shaul		
Attorney Docket Number:		042933/489677		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
CERTIFICATE OF CORRECTION	1811	1	150	150

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				150

Electronic Acknowledgement Receipt	
EFS ID:	33854575
Application Number:	15426822
International Application Number:	
Confirmation Number:	3935
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Kim Shaul
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/489677
Receipt Date:	27-SEP-2018
Filing Date:	07-FEB-2017
Time Stamp:	18:21:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$150
RAM confirmation Number	092818INTEFSW00005742160605
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	489677CertCorr.pdf	25123	no	2
			e6537b369760401bd7bc8d742be5ab36a18bbb24		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30433	no	2
			b03523794ee3d329d8cfd98b86da0890c932e962		
Warnings:					
Information:					
Total Files Size (in bytes):			55556		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 9,743,105 B2
APPLICATION NO. : 15/426822
DATED : August 22, 2017
INVENTOR(S) : Bici et al.

Page 1 of 1

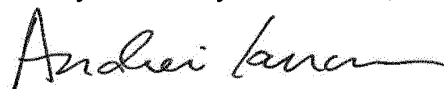
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 33,

Line 35, Claim 9, "set" should read --subset--.

Signed and Sealed this
Twenty-third Day of October, 2018



Andrei Iancu
Director of the United States Patent and Trademark Office