PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	05.04.2017
Applicant's or agent's file reference PS2015-0094	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/KR2016/015141	23.12.2016	15.02.2016

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

G06F19/00(2011.01)i; A61B6/00(2006.01)i; A61B6/03(2006.01)i; A61B5/08(2006.01)i; A61B5/091(2006.01)i; A61B5/00(2006.01)i; A61B5/113(2006.01)i

Applicant

SAMSUNG ELECTRONICS CO., LTD.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☒ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

a. ☐ forming part of the international application as filed:

☐ in the form of an Annex C/ST.25 text file.

☐ on paper or in the form of an image file.

b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

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Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-15	YES
	Claims	None	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-15	NO
Industrial applicability (IA)	Claims	1-15	YES
	Claims	None	NO

2. Citations and explanations:

Reference is made to the following documents:

D1: US 2015-0005659 A1 (FUJIFILM CORPORATION) 01 January 2015

D2: KR 10-2013-0030663 A (SAMSUNG MADISON CO., LTD.) 27 March 2013

1. Novelty and Inventive Step

1.1 Independent Claim: Claim 1

Document D1, which is the closest prior art to the invention as set forth in claim 1, discloses "an image analysis apparatus comprising: a storage unit which comprises a plurality of three-dimensional image groups of different patients or of the same subject imaged at different times (see D1, paragraph [0056] and figure 1); an alignment unit for extracting lung regions between a series of three-dimensional images, performing non-rigid registration, and calculating a displacement vector field in the lung regions (see D1, paragraph [0058], claims 1

and 7, and figure 2); a function calculation unit for calculating a local ventilation volume function which represents a change in ventilation volume per unit time at each point in the displacement vector field of each of the three-dimensional images on the basis of the displacement vector field (see D1, paragraphs [0061] and [0064]); and the feature of determining whether a ventilation volume is normal, by using a quantification unit which calculates a difference between the local ventilation volume function and a benchmark ventilation volume function as a quantitative value (see D1, paragraphs [0065] and [0083]-[0087], and claims 1 and 2)".

There is a difference between both inventions in that document D1 does not explicitly disclose "the feature of normalizing, for each of a plurality of regions of an anatomical entity, a local motion vector by using a predicted local motion vector generated from a standard database" in claim 1. However, the difference could be readily derived by a person skilled in the art through a simple design change from "the feature of normalizing, in a time axis, the local ventilation volume function and the benchmark ventilation volume function stored in the storage unit (see D1, paragraphs [0026], [0065], [0066] and [0072]-[0074], and figures 3 and 4)" in document D1. Since the invention as set forth in claim 1 would be obvious from document D1, the invention as set forth in claim 1 lacks an inventive step under PCT Article 33(3).

1.2 Dependent Claims: Claims 2-9

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The additional technical feature in claim 2 could be readily derived by a person skilled in the art within the ordinary inventive skill from "the display control unit for visualizing a quantitative value obtained from a displayed three-dimensional image (see D1, paragraphs [0077] and [0078], claim 5, and figure 8)" in document D1. Therefore, since the invention as set forth in claim 2 would be obvious from document D1, the invention as set forth in claim 2 lacks an inventive step under PCT Article 33(3).

The additional technical feature in claim 3 could be readily derived by a person skilled in the art within the ordinary inventive skill from "the features of: an alignment unit for extracting lung regions between a series of three-dimensional images, performing non-rigid registration, and calculating a displacement vector field in the lung regions (see D1, paragraph [0058], claims 1 and 7, and figure 2); and a function calculation unit for calculating a local ventilation volume function which represents a change in ventilation volume per unit time at each point in the displacement vector field of each of the three-dimensional images on the basis of the displacement vector field (see D1, paragraphs [0061] and [0064])" in document D1. Therefore, since the invention as set forth in claim 3 would be obvious from document D1, the invention as set forth in claim 3 lacks an inventive step under PCT Article 33(3).

The additional technical feature in claim 4 could be readily derived by a person skilled in the art within the ordinary inventive skill from "the feature of performing

non-rigid registration on an expiratory image and an inspiratory image (see D1, paragraph [0008])" in document D1. Therefore, since the invention as set forth in claim 4 would be obvious from document D1, the invention as set forth in claim 4 lacks an inventive step under PCT Article 33(3).

The additional technical feature in claim 5 could be readily derived by a person skilled in the art within the ordinary inventive skill from "the feature wherein a plurality of three-dimensional image groups of different patients or of the same subject imaged at different times, and a mathematical model ventilation volume function or a global ventilation volume function which can be used as a benchmark ventilation volume function are stored in a storage unit (see D1, paragraphs [0056] and [0065]-[0071], and figures 1 and 3)" in document D1. Therefore, since the invention as set forth in claim 5 would be obvious from document D1, the invention as set forth in claim 5 lacks an inventive step under PCT Article 33(3).

The additional technical features in claims 6-8 are not disclosed in document D1, but the features could be readily derived by a person skilled in the art from "the feature of comprising: a database for storing a reference image with respect to one or more standard planes, for human body information and each human body region; a search unit for searching for a reference image corresponding to human body information and each human body region of a subject; and a standard image generation unit for generating an ultrasound standard image from

acquired ultrasound image data on the basis of the searched reference image, wherein the standard image generation unit performs a modification process, such as a synthesis process, an interpolation process, a translation process, a rotation process, or a scaling process, on the ultrasound image data (see D2, paragraphs [0051] and [0064]-[0070], claims 1, 3 and 7, and figures 5 and 9)" in document D2. Therefore, since it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 with the feature disclosed in document D2, the invention as set forth in claims 6-8 lacks an inventive step under PCT Article 33(3).

The additional technical feature in claim 9 could be readily derived by a person skilled in the art from: "the feature of normalizing, in a time axis, a local ventilation volume function and a benchmark ventilation volume function stored in a storage unit (see D1, paragraphs [0026], [0065], [0066] and [0072]-[0074], and figures 3 and 4)" in document D1; and "the feature of performing image registration, and a modification process, such as a synthesis process, an interpolation process, a translation process, a rotation process, or a scaling process, on the basis of a reference image stored in a database (see D2, paragraphs [0048]-[0051], and claims 3 and 7)" in document D2. Therefore, since it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 with the feature disclosed in document D2, the invention as set forth in claim 9 lacks an inventive step under PCT Article 33(3).

1.3 Independent Claim: Claim 10

Document D1, which is the closest prior art to the invention as set forth in claim 10, discloses "an image analysis method comprising: extracting, by an alignment unit, lung regions between a series of three-dimensional images, performing non-rigid registration, and calculating a displacement vector field in the lung regions (see D1, paragraph [0058], claims 1 and 7, and figure 2); calculating, by a function calculation unit, a local ventilation volume function which represents a change in ventilation volume per unit time at each point in the displacement vector field of each of the three-dimensional images on the basis of the displacement vector field (see D1, paragraphs [0061] and [0064]); and determining whether a ventilation volume is normal, by using a quantification unit which calculates a difference between the local ventilation volume function and a benchmark ventilation volume function as a quantitative value (see D1, paragraphs [0065] and [0083]-[0087], and claims 1 and 2)".

There is a difference between both inventions in that document D1 does not explicitly disclose "the step of normalizing, for each of a plurality of regions of an anatomical entity, a local motion vector by using a predicted local motion vector generated from a standard database" in claim 10. However, the difference could be readily derived by a person skilled in the art through a simple design change from "the feature of normalizing, in a time axis, the local ventilation volume function and

the benchmark ventilation volume function stored in a storage unit (see D1, paragraphs [0026], [0065], [0066] and [0072]-[0074], and figures 3 and 4)" in document D1. Since the invention as set forth in claim 10 would be obvious from document D1, the invention as set forth in claim 10 lacks an inventive step under PCT Article 33(3).

1.4 Dependent Claims: Claims 11-15

The additional technical feature in claim 11 could be readily derived by a person skilled in the art within the ordinary inventive skill from "the feature of comprising: an alignment unit for extracting lung regions between a series of three-dimensional images, performing non-rigid registration, and calculating a displacement vector field in the lung regions (see D1, paragraph [0058], claims 1 and 7, and figure 2); and a function calculation unit for calculating a local ventilation volume function which represents a change in ventilation volume per unit time at each point in the displacement vector field of each of the three-dimensional images on the basis of the displacement vector field (see D1, paragraphs [0061] and [0064]), in which non-rigid registration on an expiratory image and an inspiratory image is performed (see D1, paragraph [0008])" in document D1. Therefore, since the invention as set forth in claim 11 would be obvious from document D1, the invention as set forth in claim 11 lacks an inventive step under PCT Article 33(3).

The additional technical feature in claim 12 could be readily derived by a person skilled in the art within the ordinary inventive skill from "the feature wherein a

plurality of three-dimensional image groups of different patients or of the same subject imaged at different times, and a mathematical model ventilation volume function or a global ventilation volume function which can be used as a benchmark ventilation volume function are stored in a storage unit (see D1, paragraphs [0056] and [0065]-[0071], and figures 1 and 3)" in document D1. Therefore, since the invention as set forth in claim 12 would be obvious from document D1, the invention as set forth in claim 12 lacks an inventive step under PCT Article 33(3).

The additional technical features in claims 13 and 14 could be readily derived by a person skilled in the art from: "the feature of normalizing, in a time axis, a local ventilation volume function and a benchmark ventilation volume function stored in a storage unit (see D1, paragraphs [0026], [0065], [0066] and [0072]-[0074], and figures 3 and 4)" in document D1; and "the feature of comprising: a database for storing a reference image with respect to one or more standard planes, for human body information and each human body region; a search unit for searching for a reference image corresponding to human body information and each human body region of a subject; and a standard image generation unit for generating an ultrasound standard image from acquired ultrasound image data on the basis of the searched reference image (see D2, paragraphs [0051] and [0064]-[0070], claims 1, 3 and 7, and figures 5 and 9)" in document D2. Therefore, since it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 with the feature disclosed in document D2, the invention as set

forth in claims 13 and 14 lacks an inventive step under PCT Article 33(3).

The additional technical feature in claim 15 could be readily derived by a person skilled in the art from: "the feature of normalizing, in a time axis, a local ventilation volume function and a benchmark ventilation volume function stored in a storage unit (see D1, paragraphs [0026], [0065], [0066] and [0072]-[0074], and figures 3 and 4)" in document D1; and "the feature of performing image registration, and a modification process, such as a synthesis process, an interpolation process, a translation process, a rotation process, or a scaling process, on the basis of a reference image stored in a database (see D2, paragraphs [0048]-[0051], and claims 3 and 7)" in document D2. Therefore, since it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 with the feature disclosed in document D2, the invention as set forth in claim 15 lacks an inventive step under PCT Article 33(3).

2. Industrial Applicability

The invention as set forth in claims 1 to 15 is industrially applicable (PCT Article 33(4)).

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claims 6 and 13 include the wording "the predicted local vector", but a "predicted local vector" is not defined prior to the wording and thus claims 6 and 13 are unclear. Thus, claims 6 and 13 do not meet the requirement of PCT Article 6.