

3D THERMAL BREAST CANCER DETECTION

FIELD OF THE INVENTION

5 The present invention relates to a system and method for 3D imaging thermographic imaging, and more particularly to 3D thermographic imaging of a portion of a human body.

BACKGROUND OF THE INVENTION

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U.S. Patent No. 6,442,419 is believed to represent the current state of the art.

SUMMARY OF THE INVENTION

Embodiments of the present invention seek to provide a system and method for combination of 3D non-thermographic and thermographic imaging of a portion of a human body, preferably for medical diagnostic purposes.

In accordance with a first aspect of the present invention, there is provided a system for determining presence or absence of a thermally distinguished object in a living body, the system comprising: a combined image generator configured for combining non-thermographic three-dimensional data of a three-dimensional tissue region in the living body with thermographic two-dimensional data of said tissue region so as to generate three-dimensional temperature data associated with said three-dimensional tissue region.

In accordance with a second aspect of the present invention, there is provided a method of determining presence or absence of a thermally distinguishable object in a living body, the method comprising: combining non-thermographic three-dimensional data of a three-dimensional tissue region in the living body with thermographic two-dimensional data of said tissue region so as to generate three-dimensional temperature data associated with said three-dimensional tissue region, thereby determining the presence or absence of the thermally distinguishable object.

There is provided in accordance with a preferred embodiment of the present invention a system for 3D thermographic imaging of a portion of a human body including non-thermographic image data acquisition functionality operative to acquire non-thermographic image data for at least a portion of a human body, thermographic image data acquisition functionality operative to acquire thermographic image data for at least a part of the at least one portion of the human body containing at least one object and a combined image generator operative to combine the non-thermographic and thermographic image data to provide a visually sensible three-dimensional output indicating the location and orientation of the at least one object within the at least a portion of the human body.

In accordance with a preferred embodiment of the present invention the system for 3D thermographic imaging of a portion of a human body also includes a housing containing the non-thermographic image data acquisition functionality and the thermographic image data acquisition functionality. Additionally or alternatively, the

system for 3D thermographic imaging of a portion of a human body also includes a positioning device operative to reposition the housing.

In accordance with another preferred embodiment of the present invention the non-thermographic image data and the thermographic image data include at least one two-dimensional image. Additionally or alternatively, the non-thermographic image data and the thermographic image data include at least one three-dimensional image.

In accordance with yet another preferred embodiment of the present invention the non-thermographic image data acquisition functionality includes a stills camera or a digital camera. Optionally and preferably, the stills camera includes a black-and-white stills camera or a color stills camera. Additionally or alternatively, the digital camera includes CCD or CMOS. In accordance with a further preferred

embodiment of the present invention the non-thermographic image data acquisition functionality also includes a polarizer. Alternatively, the non-thermographic image data acquisition functionality may also include a color filter. In accordance with another further preferred embodiment of the present invention the thermographic image data acquisition functionality is sensitive to infra-red wavelengths.

In accordance with a still further preferred embodiment of the present invention the object in the portion of a human body includes a tumor. Preferably, the tumor includes cancerous tumor.

In accordance with a preferred embodiment of the present invention the combined image generator includes a computing device operative to combine the non-thermographic and thermographic image data to provide the visibly sensible three-dimensional output, a display for displaying the visibly sensible three-dimensional output and a communications network operative to connect the computing device to the display. Preferably, the system also includes a communications network operative to connect the non-thermographic image data acquisition functionality and the thermographic image data acquisition functionality to the combined image generator. Preferably, the computing device includes a PC or a PDA and the display includes of at least one LCD, at least one CRT or a plasma screen. As a further alternative, the display may include two LCDs or two CRTs packaged together in an eyeglasses structure. Preferably, the display is operative to display a pointer.

In accordance with another preferred embodiment of the present invention the communications networks include at least one of intranet, Internet, Blue-Tooth communications network, cellular communications network, infra-red communications network and radio frequency communications network.

In accordance with yet another preferred embodiment of the present invention the system for 3D thermographic imaging of a portion of a human body also includes a positioning device operative to reposition the non-thermographic image data acquisition functionality or the thermographic image data acquisition functionality. Additionally or alternatively, the system also includes a positioning device operative to reposition the human body.

There is also provided in accordance with another preferred embodiment of the present invention a method for 3D thermographic imaging of a portion of a

human body including acquiring non-thermographic image data for at least a portion of a human body, acquiring thermographic image data for at least a part of the at least one portion of the human body containing at least one object and combining the non-thermographic and thermographic image data to provide a visually sensible three-dimensional output indicating the location and orientation of the at least one object within the at least a portion of the human body.

In accordance with a preferred embodiment of the present invention the non-thermographic image data and the thermographic image data include at least one two-dimensional image. Additionally or alternatively, the non-thermographic image data and the thermographic image data include at least one three-dimensional image.

In accordance with another preferred embodiment of the present invention the acquiring non-thermographic image data includes acquiring first non-thermographic image data in a first relative position of the human body and at least one non-thermographic image data acquisition functionality and acquiring at least second non-thermographic image data in at least a second relative position of the human body and at least one non-thermographic image data acquisition functionality.

In accordance with yet another preferred embodiment of the present invention the acquiring thermographic image data includes acquiring first thermographic image data in a first relative position of the human body and at least one thermographic image data acquisition functionality and acquiring at least second thermographic image data in at least a second relative position of the human body and at least one thermographic image data acquisition functionality.

In accordance with a further preferred embodiment of the present invention the at least second relative position is configured by repositioning the human body. Alternatively, the at least second relative position is configured by repositioning the at least one non-thermographic image data acquisition functionality or the at least one thermographic image data acquisition functionality. As a further alternative, the first relative position is configured by a first the non-thermographic image data acquisition functionality or by a first thermographic image data acquisition functionality and the at least second relative position is configured by at least a second the non-thermographic image data acquisition functionality or by at least a second thermographic image data acquisition functionality.

In accordance with another further preferred embodiment of the present invention the non-thermographic image data acquisition functionality or the thermographic image data acquisition functionality is enclosed within a housing, and the at least second relative position is configured by repositioning the housing.

5 Alternatively, the first relative position is configured by a first the non-thermographic image data acquisition functionality or a first thermographic image data acquisition functionality enclosed within a first housing, and the at least second relative position is configured by at least a second the non-thermographic image data acquisition functionality or at least a second thermographic image data acquisition functionality
10 enclosed within at least a second housing.

In accordance with yet a further preferred embodiment of the present invention the combining includes computing a non-thermographic three-dimensional model of the non-thermographic image data, computing a thermographic three-dimensional model of the thermographic image data, combining the non-thermographic
15 three-dimensional model and the thermographic three-dimensional model to provide the visually sensible three-dimensional output and displaying the visually sensible three-dimensional output.

In accordance with a still further preferred embodiment of the present invention the computing a non-thermographic three-dimensional model of the non-thermographic image data also includes computing spatial data of the non-thermographic three-dimensional model. Preferably, the computing spatial data of the non-thermographic three-dimensional model includes computing the X, Y and Z coordinates of the portion of the human body. Additionally or alternatively, the computing a non-thermographic three-dimensional model of the non-thermographic
20 image data also includes obtaining information relating to the color, hue or tissue texture of the portion of the human body.

In accordance with another preferred embodiment of the present invention the computing a thermographic three-dimensional model of the non-thermographic image data also includes computing spatial temperature data of the non-thermographic three-dimensional model. Preferably, the computing spatial data of the non-thermographic three-dimensional model includes computing the temperature of the
30 portion of the human body along the X, Y and Z coordinates.

In accordance with yet another preferred embodiment of the present invention the combining the non-thermographic three-dimensional model and the thermographic three-dimensional model includes substantially positioning the non-thermographic three-dimensional model and the thermographic three-dimensional
5 model in parallel manner. Preferably, the substantially positioning the non-thermographic three-dimensional model and the thermographic three-dimensional model includes substantially positioning a marker. Additionally or alternatively the substantially positioning the non-thermographic three-dimensional model and the thermographic three-dimensional model includes substantially positioning X, Y and Z
10 coordinates of the non-thermographic three-dimensional model and the thermographic three-dimensional model.

In accordance with still another preferred embodiment of the present invention the displaying the visually sensible three-dimensional output also includes displaying a pointer. Additionally or alternatively the displaying the visually sensible
15 three-dimensional output also includes displaying sectional views of the visually sensible three-dimensional output.

In accordance with a further preferred embodiment of the present invention the method also includes extracting information from the visibly sensible three-dimensional output, and preferably also includes displaying the extracted
20 information. Additionally or alternatively, the method also includes comparing the visibly sensible three-dimensional output to at least one visibly sensible three-dimensional model.

BRIEF DESCRIPTION OF THE DRAWINGS

5 The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

Fig. 1 is a simplified pictorial illustration of a 3D non-thermographic and thermographic imaging system operative in accordance with a preferred embodiment of
10 the present invention;

Figs. 2A-2E are simplified pictorial illustrations of five alternative embodiments of one stage of a method in accordance with a preferred embodiment of the present invention;

Figs. 3A-3E are simplified pictorial illustrations of five alternative
15 embodiments of another stage of a method in accordance with a preferred embodiment of the present invention;

Fig. 4 is a flow chart illustration of the computing stage of a method in accordance with a preferred embodiment of the present invention;

Fig. 5 is a simplified pictorial illustration of an initial step of the
20 computing stage of a method in accordance with a preferred embodiment of the present invention;

Fig. 6 is a simplified pictorial illustration of another step of the computing stage of a method in accordance with a preferred embodiment of the present invention; and

25 Fig. 7 is a simplified pictorial illustration of the final step of the computing stage of a method in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference is now made to Fig. 1, which illustrates a system for 3D non-thermographic and thermographic imaging of a portion of a human body, in accordance with a preferred embodiment of the present invention. The system may be used as a diagnostic tool, for example for medical diagnosis such as diagnosis of tumors, and specifically in the diagnosis of cancerous breast tumors.

As seen in Fig. 1, a body part 10 of a person 12 is located in front of an imaging device 14. The person 12, may be standing, sitting or in any other suitable position relative to imaging device 14. Person 12 may initially be positioned or later be repositioned relative to imaging device 14 by positioning device 15, which typically comprises a platform moving on a rail, by force of an engine, or by any other suitable force. Additionally, a tumor 16 may exist in body part 10 of person 12. Typically, body part 10 comprises a breast, and tumor 16 comprises a breast tumor such as a cancerous tumor.

In accordance with a preferred embodiment of the present invention, person 12 may be wearing a clothing garment 18, such as a shirt. Preferably, clothing garment 18 may be non-penetrable or partially penetrable to visible wavelengths such as 400-700 nanometers, and may be penetrable to wavelengths that are longer than visible wavelengths, such as IR wavelengths. Additionally, a reference mark 20 may be located close to person 12, preferably directly on the body of person 12 and in close proximity to body part 10. Optionally and preferably, reference mark 20 is directly attached to body part 10. Reference mark 20 may typically comprise a piece of material, a mark drawn on person 12 or any other suitable mark, as described hereinbelow.

Imaging device 14 typically comprises at least one non-thermographic imaging system 22 that can sense at least visible wavelengths and at least one thermographic imaging system 24 which is sensitive to infra-red (IR) wavelengths, typically in the range of as 3-5 micrometer and/or 8-12 micrometer. Typically imaging systems 22 and 24 are capable of sensing reference mark 20 described hereinabove.

Optionally, a polarizer 25 may be placed in front of non-thermographic imaging system 22. As a further alternative, a color filter 26, which may block at least a

portion of the visible wavelengths, may be placed in front of non-thermographic imaging system 22.

Typically, at least one non-thermographic imaging system 22 may comprise a black-and-white or color stills camera, or a digital camera such as CCD or CMOS. Additionally, at least one non-thermographic imaging system 22 may comprise a plurality of imaging elements, each of which may be a three-dimensional imaging element.

Optionally, imaging device 14 may be repositioned relative to person 12 by positioning device 27. As a further alternative, each of imaging systems 22 and 24 may also be repositioned relative to person 12 by at least one positioning device 28. Positioning device 27 may comprise an engine, a lever or any other suitable force, and may also comprise a rail for moving imaging device 14 thereon. Preferably, repositioning device 28 may be similarly structured.

Data acquired by non-thermographic imaging system 22 and thermographic imaging system 24 is output to a computing device 30 via a communications network 32, and is typically analyzed and processed by an algorithm running on the computing device. The resulting data may be displayed on at least one display device 34, which is preferably connected to computing device 30 via a communications network 36. Computing device 30 typically comprises a PC, a PDA or any other suitable computing device. Communications networks 32 and 36 typically comprise a physical communications network such as an internet or intranet, or may alternatively comprise a wireless network such as a cellular network, IR communication network, a radio frequency (RF) communications network, a blue-tooth (BT) communications network or any other suitable communications network.

In accordance with a preferred embodiment of the present invention display 34 typically comprises a screen, such as an LCD screen, a CRT screen or a plasma screen. As a further alternative display 34 may comprise at least one visualizing device comprising two LCDs or two CRTs, located in front of a user's eyes and packaged in a structure similar to that of eye-glasses. Preferably, display 34 also displays a pointer 38, which is typically movable along the X, Y and Z axes of the displayed model and may be used to point to different locations or elements in the displayed data.

Reference is now made to Figs. 2A-4, which illustrate various stages in method of 3D non-thermographic and thermographic imaging of a portion of a human body, in accordance with a preferred embodiment of the present invention.

As seen in Fig. 2A, person 12 comprising body part 10 is located on a positioning device 15 in front of an imaging device 14, in a first position 40 relative to the imaging device. First image data of body part 10 is acquired by at least one non-thermographic imaging system 22, optionally through polarizer 25 or as an alternative option through color filter 26. Additionally, at least second image data of body part 10 is acquired by at least one non-thermographic imaging system 22, such that body part 10 is positioned in at least a second position 42 relative to imaging device 14.

The second relative position 42 may be configured by repositioning person 12 using positioning device 15 as seen in Fig. 2A, by repositioning imaging device 14 using positioning device 27 as seen in Fig. 2B or by repositioning non-thermographic imaging system 22 using positioning device 28 as seen in Fig. 2C. As a further alternative, the second relative position 42 may be configured by using two separate imaging devices 14 as seen in Fig. 2D or two separate non-thermographic imaging systems 22 as seen in Fig. 2E.

In a further stage of the method in accordance with a preferred embodiment of the present invention, person 12 comprising body part 10 is located on a positioning device 15 in front of an imaging device 14, in a first position 44 relative to the imaging device. First thermographic image data of body part 10 is acquired by at least one thermographic imaging system 24. Additionally, at least second thermographic image data of body part 10 is acquired by at least one thermographic imaging system 24, such that body part 10 is positioned in at least a second position 42 relative to imaging device 14.

The second relative position 46 may be configured by repositioning person 12 using positioning device 15 as seen in Fig. 3A, by repositioning imaging device 14 using positioning device 27 as seen in Fig. 3B, or by repositioning thermographic imaging system 24 using positioning device 28 as seen in Fig. 3C. As a further alternative, the second relative position 46 may be configured by using two separate imaging devices 14 as seen in Fig. 3D or two separate thermographic imaging systems 24 as seen in Fig. 3E.

It will be appreciated that the non-thermographic image data acquisition described in Figs. 2A-2E may be performed before, after or concurrently with the thermographic image data acquisition described in Figs. 3A-3E.

Image data of body part 10 may be acquired by thermographic imaging system 24, by separately imaging a plurality of narrow strips of the complete image of body part 10. Alternatively, the complete image of body part 10 is acquired by thermographic imaging system, and the image is sampled in a plurality of narrow strips or otherwise shaped portions for processing. As a further alternative, the imaging of body part 10 may be performed using different exposure times.

The thermographic and non-thermographic image data obtained from imaging device 14 is analyzed and processed by computing device 30 as illustrated in Fig. 4.

In stage 50, image data acquired from non-thermographic imaging system 22 is processed by computing device 30 to build a non-thermographic three-dimensional model of body part 10 of person 12, using algorithms and methods that are well known in the art, such as the method described in U.S. Patent No. 6,442,419 which is hereby incorporated by reference as if fully set forth herein. The non-thermographic three-dimensional model, preferably includes spatial information, typically the X, Y and Z coordinates of the body part 10, as well as the location of reference marker 20. Additionally, the non-thermographic three-dimensional model preferably includes information relating to the color, hue and tissue texture of body part 10. An exemplary non-thermographic three-dimensional model and the process of building such a model are illustrated in Fig. 5.

Thermographic image data acquired from thermographic imaging system 24 is processed by computing device 30 in stage 52 to build a thermographic three-dimensional model of body part 10 of person 12, using algorithms and methods that are well known in the art, such as the method described in U.S. Patent No. 6,442,419 which is hereby incorporated by reference as if fully set forth herein. The thermographic three-dimensional model preferably includes spatial temperature information, typically the X, Y and Z coordinates of the temperature of body part 10 and of reference marker 20. An exemplary thermographic three-dimensional model and the process of building such a model are illustrated in Fig. 6.

It is appreciated that the thermographic three-dimensional model may be built before, after or concurrently with the non-thermographic three-dimensional model.

The three-dimensional models built in stages 50 and 52 as described hereinabove are combined into a single three-dimensional model in stage 54. Correct
5 positioning of the two models in the combined three-dimensional model may be achieved by accurately positioning reference marker 20 in the two models, by comparing X, Y and Z coordinates or using any other suitable method. An exemplary combined three-dimensional model as built in stage 54 is illustrated in Fig. 7.

In stage 56, computing device 30 extracts information included in the
10 combined three-dimensional model, such as information regarding temperature, temperature changes in a certain point and a comparison of temperatures in different points in body part 10. Additionally, computing device 30 may extract, compute and display a comparison of size or temperature between body part 10 and another body part of person 12, such as the two breasts of person 12.

15 In an additional or alternative stage 58, the computing device 30 may compare and display differences between a plurality of three-dimensional models of the same body part 10 of a person 12, the plurality of models being based on data acquired at a plurality of different time points. Typically, the information compared, computed and displayed includes information about temperature, dimensions such as length,
20 width, height and depth, shape, volume, color, hue and tissue texture. The information may be displayed graphically or textually, and may be described as a change in percentage or in absolute value.

As shown in stage 60, the output of any of stages 54, 56 and 58 is displayed on display 34. Pointer 38 is also displayed, and may be used to point to
25 sections or elements of the displayed model, along any of the X, Y and Z coordinates. Optionally and preferably, an algorithm is provided to facilitate the display of sectional views of the three-dimensional model or of specific tissue layers of the modeled body part 10.

It will be appreciated by persons skilled in the art that the present
30 invention is not limited to what has been particularly shown and described hereinabove. Rather the scope of the present invention includes both combinations and subcombinations of the various features described hereinabove as well as modifications

and variations thereof as would occur to a person of skill in the art upon reading the foregoing specification and which are not in the prior art.

WHAT IS CLAIMED IS:

1. A system for determining presence or absence of a thermally distinguishable object in a living body, the system comprising: a combined image generator configured for combining non-thermographic three-dimensional data of a three-dimensional tissue region in the living body with thermographic two-dimensional data of said tissue region so as to generate three-dimensional temperature data associated with said three-dimensional tissue region.
2. The system of claim 1, further comprising non-thermographic image data acquisition functionality configured for acquiring said non-thermographic three-dimensional data.
3. The system of claim 1, further comprising thermographic image data acquisition functionality configured for acquiring said thermographic two-dimensional data.
4. The system of claim 2, further comprising thermographic image data acquisition functionality configured for acquiring said thermographic two-dimensional data.
5. The system of claim 3, further comprising a housing containing said non-thermographic image data acquisition functionality and said thermographic image data acquisition functionality.
6. The system of claim 1, further comprising a positioning device operative to reposition said housing.
7. The system of claim 1, wherein said combined image generator comprises a computing device configured for calculating the location and/or orientation of the thermally distinguishable object in the three-dimensional tissue region, based on said three-dimensional temperature data.

8. The system of claim 7, further comprising a display, wherein said computing device is in communication with said display and is configured for transmitting a visibly sensible three-dimensional output indicating said location and/or orientation to said display.

9. The system of claim 8, further comprising a communication network configured for establishing said communication between said computing device and said display.

10. The system of claim 1, further comprising a comparing functionality configured for comparing said three-dimensional temperature data to at least one three-dimensional model.

11. The system of claim 7, wherein said computing device is configured for computing a non-thermographic three-dimensional model, and computing spatial data of said non-thermographic three-dimensional model so as to generate spatial data pertaining to the location and/or orientation of the thermally distinguishable object within the living body.

12. The system of claim 11, wherein said computing device is configured for computing spatial temperature data of said non-thermographic three-dimensional model.

13. The system of claim 1, wherein said non-thermographic three-dimensional data comprise a combination of a plurality of two-dimensional images.

14. The system of claim 2, wherein said non-thermographic image data acquisition functionality comprises a stills camera or a digital camera.

15. The system of claim 2, wherein said non-thermographic image data acquisition functionality comprises a plurality of cameras configured and positioned for acquiring a plurality of non-thermographic two-dimensional datasets from a plurality of perspective viewpoints with respect to the surface of said three-dimensional tissue region.

16. The system of claim 15, wherein said non-thermographic image data acquisition functionality comprises a combiner configured for combining said plurality of non-thermographic two-dimensional datasets so as to form said non-thermographic three-dimensional data.

17. The system of claim 3, wherein said thermographic image data acquisition functionality comprises a plurality of infrared cameras configured and positioned for acquiring a plurality of thermographic two-dimensional datasets from a plurality of perspective viewpoints with respect to the surface of said three-dimensional tissue region.

18. The system of claim 17, wherein said combined image generator is configured for combining said non-thermographic three-dimensional data with each thermographic two-dimensional dataset.

19. The system of claim 1, wherein said thermally distinguishable object comprises a tumor.

20. The system of claim 19, wherein said tumor comprises a cancerous tumor.

21. The system of claim 8, wherein said display comprises two LCDs or two CRTs packaged together in an eye-glasses structure.

22. The system of claim 8, wherein said display is operative to display a pointer.

23. The system of claim 3, further comprising a positioning device operative to reposition said non-thermographic image data acquisition functionality or said thermographic image data acquisition functionality.

24. The system of claim 3, further comprising a communications network configured for establishing said communication between at least two of said non-

thermographic image data acquisition functionality, said thermographic image data acquisition functionality and said combined image generator.

25. The system of claim 1, further comprising a positioning device operative to reposition the living body.

26. A method of determining presence or absence of a thermally distinguishable object in a living body, the method comprising: combining non-thermographic three-dimensional data of a three-dimensional tissue region in the living body with thermographic two-dimensional data of said tissue region so as to generate three-dimensional temperature data associated with said three-dimensional tissue region, thereby determining the presence or absence of the thermally distinguishable object.

27. The method of claim 26, further comprising using said three-dimensional temperature data for determining the location and/or orientation of the thermally distinguishable object in the three-dimensional tissue region.

28. The method of claim 27, further comprising providing a visibly sensible three-dimensional output indicating said location and/or orientation.

29. The method of claim 26, further comprising comparing said three-dimensional temperature data to at least one three-dimensional model.

30. The method of claim 26, wherein said non-thermographic three-dimensional data are obtained by combining a plurality of two-dimensional images.

31. The method of claim 26, wherein said non-thermographic three-dimensional data comprise a three-dimensional image acquired using a visible light camera.

32. The method of claim 26, further comprising acquiring said non-thermographic three-dimensional data using at least one non-thermographic image data acquisition functionality.

33. The method of claim 32, wherein said acquiring said non-thermographic three-dimensional data comprises a plurality of sequential data acquisition steps, and the method further comprises repositioning at least one of said data acquisition functionality and the living body between successive data acquisition steps.

34. The method of claim 33, wherein said plurality of sequential data acquisition steps comprises a first two-dimensional data acquisition step performed at a first perspective view and a second two-dimensional data acquisition step performed at a second perspective view, and the method further comprises combining two-dimensional data from said first step and said second step so as to form said non-thermographic three-dimensional data.

35. The method of claim 32, wherein said acquiring said non-thermographic three-dimensional data comprises simultaneously acquiring non-thermographic two-dimensional datasets from a plurality of perspective viewpoints with respect to the surface of said three-dimensional tissue region, and the method further comprises combining said plurality of non-thermographic two-dimensional datasets so as to form said non-thermographic three-dimensional data.

36. The method of claim 26, further comprising acquiring said thermographic two-dimensional data, using at least one thermographic image data acquisition functionality.

37. The method of claim 36, wherein said acquiring said thermographic two-dimensional data comprises a plurality of sequential data acquisition steps, and the method further comprises repositioning at least one of said data acquisition functionality and the living body between successive data acquisition steps.

38. The method of claim 36, wherein said acquiring said thermographic two-dimensional data comprises simultaneously acquiring thermographic two-dimensional datasets from a plurality of perspective viewpoints with respect to the surface of said three-dimensional tissue region, and the method further comprises combining each thermographic two-dimensional dataset with said non-thermographic three-dimensional data.

39. The method of claim 37, wherein said combining is performed such that data acquired at each thermographic two-dimensional data acquisition step is combined with said non-thermographic three-dimensional data.

40. The method of claim 26, wherein said combining comprises computing a non-thermographic three-dimensional model, and computing spatial data of said non-thermographic three-dimensional model so as to generate spatial data pertaining to the location and/or orientation of the thermally distinguishable object within the living body.

41. The method of claim 40, wherein said combining comprises computing spatial temperature data of said non-thermographic three-dimensional model.