

CLAIMS

1. An active infrared thermography system, comprising:
one or more excitation sources;
5 an infrared camera;
one or more portable power sources arranged to power the one or more excitation sources and the infrared camera; and
a housing, wherein the one or more excitation sources and the one or more portable power sources are received in the housing.
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2. The active infrared thermography system according to claim 1, wherein each of the one or more excitation sources has a radiative power of less than 500 watts (W).
3. The active infrared thermography system according to claim 2, wherein the radiative
15 power of each of the one or more excitation sources is between about 100 W and about 450 W.
4. The active infrared thermography system according to any one of the preceding claims, wherein each of the one or more excitation sources has a mass of less than 400
20 grams (g).
5. The active infrared thermography system according to claim 4, wherein the mass of each of the one or more excitation sources is between about 200 g and about 300 g.
- 25 6. The active infrared thermography system according to any one of the preceding claims, further comprising one or more shutters arranged to at least partially block off the one or more excitation sources.
7. The active infrared thermography system according to any one of the preceding
30 claims, further comprising a visible camera powered by the one or more portable power sources and received in the housing.

8. The active infrared thermography system according to any one of the preceding claims, wherein the active infrared thermography system has a mass of between about 0.5 kilogram (kg) and 5 kg.
- 5 9. The active infrared thermography system according to claim 8, wherein the mass of the active infrared thermography system is between about 1 kg and about 2 kg.
10. The active infrared thermography system according to any one of the preceding claims, further comprising a non-transitory computer-readable memory storing computer
10 program instructions executable by one or more computer processors to perform operations for generating a thermal image, the operations comprising:
- acquiring thermal image data on a subject;
 - activating one or more excitation sources to radiate the subject;
 - ending acquisition of the thermal image data on the subject when a cooling pattern
15 is captured;
 - determining a cooling curve of each pixel of the thermal image data;
 - calculating a cooling coefficient of each pixel of the thermal image data; and
 - scaling the cooling coefficient of each pixel of the thermal image data to a colour
palette to produce a heat map.
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11. The active infrared thermography system according to claim 10, wherein the one or more excitation sources are to be activated after a predetermined delay.
12. The active infrared thermography system according to claim 11, wherein the
25 operations further comprise:
- performing background subtraction using the thermal image data acquired during the predetermined delay.
13. The active infrared thermography system according to claim 10, wherein the
30 thermal image data is to be acquired in video form.
14. The active infrared thermography system according to claim 13, wherein the operations further comprise:

converting the thermal image data in the video form into a three-dimensional (3D) array.

15. The active infrared thermography system according to any one of claims 10 to 14,
5 wherein the operation of determining the cooling curve of each pixel of the thermal image data comprises:

extracting a temporal temperature profile of each pixel of the thermal image data.

16. The active infrared thermography system according to claim 15, wherein the
10 operation of determining the cooling curve of each pixel of the thermal image data further comprises:

offsetting a starting time of the temporal temperature profile of each pixel of the thermal image data to a start of a cooling down process.

17. The active infrared thermography system according to any one of claims 10 to 16,
15 wherein the operation of calculating the cooling coefficient of each pixel of the thermal image data comprises:

fitting the cooling curve of each pixel of the thermal image data to Newton's cooling model.

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18. The active infrared thermography system according to any one of claims 10 to 17,
wherein the operations further comprise:

applying at least one of a Gaussian sharpening filter and a convolution filter to the heat map.

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19. The active infrared thermography system according to any one of claims 10 to 18,
wherein the operations further comprise:

fusing the heat map to a visual image of the subject.

20. The active infrared thermography system according to claim 19, wherein the
30 operation of fusing the heat map to the visual image of the subject comprises:

identifying coordinates of at least three sets of matching feature points on each of the heat map and the visual image.

21. The active infrared thermography system according to claim 20, wherein the operation of fusing the heat map to the visual image of the subject further comprises:
- calculating a transformation matrix with the coordinates of the at least three sets of
 - 5 matching feature points on each of the heat map and the visual image using least square optimisation; and
 - applying the transformation matrix onto the heat map to generate a corrected heat map.
- 10 22. The active infrared thermography system according to claim 21, wherein the operation of fusing the heat map to the visual image of the subject further comprises:
- increasing a transparency of the corrected heat map; and
 - overlaying the corrected heat map with increased transparency over the visual image of the subject.
- 15 23. A computer-implemented method for generating a thermal image, comprising executing on one or more processors the steps of:
- acquiring thermal image data on a subject;
 - activating one or more excitation sources to radiate the subject;
 - 20 ending acquisition of the thermal image data on the subject when a cooling pattern is captured;
 - determining a cooling curve of each pixel of the thermal image data;
 - calculating a cooling coefficient of each pixel of the thermal image data; and
 - scaling the cooling coefficient of each pixel of the thermal image data to a colour
 - 25 palette to produce a heat map.
24. The computer-implemented method for generating a thermal image according to claim 23, wherein the one or more excitation sources are activated after a predetermined delay.
- 30 25. The computer-implemented method for generating a thermal image according to claim 24, further comprising:

performing background subtraction using the thermal image data acquired during the predetermined delay.

26. The computer-implemented method for generating a thermal image according to claim 23, wherein the thermal image data is acquired in video form.

27. The computer-implemented method for generating a thermal image according to claim 26, further comprising:
converting the thermal image data in the video form into a three-dimensional (3D) array.

28. The computer-implemented method for generating a thermal image according to any one of claims 23 to 27, wherein the step of determining the cooling curve of each pixel of the thermal image data comprises:
extracting a temporal temperature profile of each pixel of the thermal image data.

29. The computer-implemented method for generating a thermal image according to claim 28, wherein the step of determining the cooling curve of each pixel of the thermal image data further comprises:
offsetting a starting time of the temporal temperature profile of each pixel of the thermal image data to a start of a cooling down process.

30. The computer-implemented method for generating a thermal image according to any one of claims 23 to 29, wherein the step of calculating the cooling coefficient of each pixel of the thermal image data comprises:
fitting the cooling curve of each pixel of the thermal image data to Newton's cooling model.

31. The computer-implemented method for generating a thermal image according to any one of claims 23 to 30, further comprising:
applying at least one of a Gaussian sharpening filter and a convolution filter to the heat map.

32. The computer-implemented method for generating a thermal image according to any one of claims 23 to 31, further comprising:
fusing the heat map to a visual image of the subject.
- 5 33. The computer-implemented method for generating a thermal image according to claim 32, wherein the step of fusing the heat map to the visual image of the subject comprises:
identifying coordinates of at least three sets of matching feature points on each of the heat map and the visual image.
- 10 34. The computer-implemented method for generating a thermal image according to claim 33, wherein the step of fusing the heat map to the visual image of the subject further comprises:
calculating a transformation matrix with the coordinates of the at least three sets of
15 matching feature points on each of the heat map and the visual image using least square optimisation; and
applying the transformation matrix onto the heat map to generate a corrected heat map.
- 20 35. The computer-implemented method for generating a thermal image according to claim 34, wherein the step of fusing the heat map to the visual image of the subject further comprises:
increasing a transparency of the corrected heat map; and
overlaying the corrected heat map with increased transparency over the visual
25 image of the subject.