CLAIMS

1. An active infrared thermography system, comprising:

one or more excitation sources;

an infrared camera;

one or more portable power sources arranged to power the one or more excitation sources and the infrared camera;

a housing, wherein the one or more excitation sources and the one or more portable power sources are received in the housing; and

a processor configured to:

acquire thermal image data on a subject;

activate the one or more excitation sources to radiate the subject;

end acquisition of the thermal image data on the subject when a cooling pattern is captured;

scale a cooling coefficient of each pixel of the thermal image data to a colour palette to produce a heat map; and

fuse the heat map to a visual image of the subject to form a fusion image where the thermal image data overlays the visual image.

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 power of each of the one or more excitation sources is between 100 W and 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 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 200 g and 300 g.

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 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 0.5 kilogram (kg) and 5 kg.

9. The active infrared thermography system according to claim 8, wherein the mass of the active infrared thermography system is between 1 kg and 2 kg.

10. The active infrared thermography system according to any one of the preceding claims, wherein the processor is further configured to:

determine a cooling curve of each pixel of the thermal image data; and

calculate the cooling coefficient of each pixel of the thermal image data.

11. The active infrared thermography system according to any one of the preceding claims, 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 processor is further configured to:

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

13. The active infrared thermography system according to any one of the preceding claims, wherein the thermal image data is to be acquired in video form.

14. The active infrared thermography system according to claim 13, wherein the processor is further configured to:

convert 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, wherein the processor is further configured to:

extract a temporal temperature profile of each pixel of the thermal image data to determine the cooling curve of each pixel of the thermal image data.

16. The active infrared thermography system according to claim 15, wherein the processor is further configured to:

offset 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, wherein the processor is further configured to:

fit the cooling curve of each pixel of the thermal image data to Newton's cooling model to calculate the cooling coefficient of each pixel of the thermal image data.

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

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

19. The active infrared thermography system according to any one of the preceding claims, wherein the processor is further configured to:

identify coordinates of at least three sets of matching feature points on each of the heat map and the visual image to fuse the heat map to the visual image of the subject.

20. The active infrared thermography system according to claim 19, wherein the processor is further configured to:

calculate a transformation matrix with the coordinates of the at least three sets of matching feature points on each of the heat map and the visual image using least square optimisation; and

apply the transformation matrix onto the heat map to generate a corrected heat map.

21. The active infrared thermography system according to claim 20, wherein the processor is further configured to:

increase a transparency of the corrected heat map; and

overlay the corrected heat map with increased transparency over the visual image of the subject.

22. 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;

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 palette to produce a heat map; and

fusing the heat map to a visual image of the subject to form a fusion image where the thermal image data overlays the visual image.

23. The computer-implemented method for generating a thermal image according to claim 22, wherein the one or more excitation sources are activated after a predetermined delay.

24. The computer-implemented method for generating a thermal image according to claim 23, further comprising:

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

25. The computer-implemented method for generating a thermal image according to claim 22, wherein the thermal image data is acquired in video form.

26. The computer-implemented method for generating a thermal image according to claim 25, further comprising:

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

27. The computer-implemented method for generating a thermal image according to any one of claims 22 to 26, 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.

28. The computer-implemented method for generating a thermal image according to claim 27, 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.

29. The computer-implemented method for generating a thermal image according to any one of claims 22 to 28, 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.

30. The computer-implemented method for generating a thermal image according to any one of claims 22 to 29, further comprising:

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

31. The computer-implemented method for generating a thermal image according to any one of claims 22 to 30, 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.

32. The computer-implemented method for generating a thermal image according to claim 31, 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 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.

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 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.