CLAIMS

1. An apparatus for classification of a soil mass including

an image acquisition module;

a soil parameter measurement device to measure a parameter associated with a soil type,

a drive operable to move the image acquisition module and/or soil parameter measurement device along at least one axis; and

a data analysis module arranged in data communication with the image acquisition module, the data analysis module operable to extract an RGB (red, green, blue) value of the acquired image, convert the image to a greyscale image of a particular resolution, analyse the greyscale image using a statistical texture method, and classify the soil mass into one of at least two soil types based on the greyscale image and the measured soil parameter.

2. The apparatus of claim 1, wherein the acquired image is converted to an 8-bit greyscale image based on the following mathematical expression: -

$$8bit = 0.299 * Red + 0.587 * Green + 0.114 * Blue$$

where

Red is the red value of a pixel

$Green$ is the green value of the pixel

$Blue$ is the blue value of the pixel.

3. The apparatus of claim 1 or 2, wherein the statistical texture method is a Grey Level Co-Occurrence Matrix (GCLM).

4. The apparatus of any one of the preceding claims, wherein the image acquisition module includes a camera and a distance sensor.

5. The apparatus of any one of the preceding claims, further including a white light source with a colour temperature of between 3000 K and 4000 K.

6. The apparatus of claim 5, wherein the white light source includes a plurality of LED flood lights.

7. The apparatus of claim 4, wherein the distance sensor is a laser distance sensor.

8. The apparatus of claim 7, wherein the distance sensor is operable to detect distances of between 0.5 metres (m) and 1.2 m.

9. The apparatus of claim 1, wherein the soil parameter measurement device is a soil electrical resistivity sensor having a plurality of probes.

10. The apparatus of claim 9, wherein the plurality of probes includes a first set of two probes for sending an electrical current into a soil, and a second set of two probes for measuring the electrical potential between the second set of two probes.

11. The apparatus of claim 1, wherein the soil parameter measurement device includes a moisture probe.

12. A system for classification of soil mass including

an image acquisition module for obtaining at least one image of a soil mass;

a soil parameter measurement module for measuring a parameter of the soil mass; and

a processor operable to receive the at least one image and the soil parameter measurement(s);

wherein the processor is operable to extract an RGB value from the at least one image, convert the at least one image to a greyscale image of a particular resolution, and analyse the greyscale image using a statistical texture method, the processor further including a classification module operable to classify the soil mass to one of

at least two soil types based on the greyscale image and the measured soil parameter.

13. The system of claim 12, wherein the at least one image is converted to an 8-bit greyscale image based on the following mathematical expression: -

$$8bit = 0.299 * Red + 0.587 * Green + 0.114 * Blue$$

where

Red is the red value of a pixel

$Green$ is the green value of the pixel

$Blue$ is the blue value of the pixel.

14. The system of claim 12 or 13, wherein the statistical texture method is a Grey Level Co-Occurrence Matrix (GCLM).

15. The system of any one of claims 12 to 14, wherein the classification module includes a first module to classify the soil mass based on a machine learning algorithm, and a second module to classify the soil mass based on the soil parameter measurement.

16. The system of claim 15, wherein the machine learning algorithm is based on an artificial neural network.

17. The system of any one of claims 12 to 16, wherein the at least two soil types include Good Earth and Soft Clay.

18. The system of any one of claims 12 to 17, wherein classification of the soil mass based on the soil parameter measurement is activated if the machine learning algorithm is unable to classify the soil mass.

19. The system of any one of claims 12 to 18, wherein the soil parameter measurement module includes a moisture probe and a soil electrical resistivity sensor.

20. A method for classification of a soil mass including the steps of:- (a.) moving an image acquisition module and a soil parameter measurement device towards a soil mass ; (b.) acquiring an image of the soil mass ; (c.) measuring the soil parameter of

the soil mass ; (d.) sending the image and parameter measurement to a processor; (e.) conducting data analysis, the data analysis including extracting an RGB value from the image of the soil mass, converting the image of the soil mass to a greyscale image of a particular resolution, and analysing the greyscale image using a statistical texture method; and (f.) classifying by the processor the soil mass based on the greyscale image and the measured soil parameter; wherein the classification step includes classifying the soil mass to one of at least two soil types.

21. The method of claim 20, wherein the image is converted to an 8-bit greyscale image based on the following mathematical expression: -

$$8bit = 0.299 * Red + 0.587 * Green + 0.114 * Blue$$

where

Red is the red value of a pixel

$Green$ is the green value of the pixel

$Blue$ is the blue value of the pixel.

22. The method of claim 20 or 21, wherein the statistical texture method is a Grey Level Co-Occurrence Matrix (GCLM).

23. A processor having an input module to receive a first set of soil images and a second set of soil parameter measurements wherein the processor includes a classification module operable to classify the soil mass to one of at least two soil types, wherein the classification module is operable to extract an RGB value from each of the first set of soil images, convert each of the soil image to a greyscale image of a particular resolution, analyse the greyscale image using a statistical texture method, and classify the soil mass to one of at least two soil types based on the greyscale image and the measured soil parameter.

24. The processor of claim 23, wherein the soil image is converted to an 8-bit greyscale image based on the following mathematical expression: -

$$8bit = 0.299 * Red + 0.587 * Green + 0.114 * Blue$$

where

Red is the red value of a pixel

$Green$ is the green value of the pixel

$Blue$ is the blue value of the pixel.

25. The processor of claim 23 or 24, wherein the statistical texture method is a Grey Level Co-Occurrence Matrix (GCLM).

26. A non-transitory computer readable medium containing executable software instructions thereon wherein when executed performs the method of identifying and classifying a soil mass comprising the steps of:- (a.) moving an image acquisition module and a soil parameter measurement device towards a soil mass; (b.) acquiring an image of the soil mass; (c.) measuring the soil parameter of the soil mass; (d.) sending the image and parameter measurement to a processor; and (e.) classifying by the processor the soil mass; wherein the classification step includes extracting an RGB value from the image of the soil mass, converting the image of the soil mass to a greyscale image of a particular resolution, analysing the greyscale image using a statistical texture method, and classifying the soil mass to one of at least two soil types based on the greyscale image and the measured soil parameter

27. The non-transitory computer readable medium of claim 26, wherein the image is converted to an 8-bit greyscale image based on the following mathematical expression: -

$$8bit = 0.299 * Red + 0.587 * Green + 0.114 * Blue$$

where

Red is the red value of a pixel

$Green$ is the green value of the pixel

$Blue$ is the blue value of the pixel.

28. The system of claim 26 or 27, wherein the statistical texture method is a Grey Level Co-Occurrence Matrix (GCLM).