SPECIALIZED TRAP FOR GROUND TRUTHING AN INSECT RECOGNITION SYSTEM

BACKGROUND

[0001] The present disclosure relates in general to sensors, and in particular to sensors for insect traps.

[0002] Conventional methods for accurately classifying an insect have been very labor intensive and inefficient, for example, by requiring an entomologist to visually inspect each insect as it is trapped by a trap.

BRIEF SUMMARY

[0003] Various examples are described for systems and methods of ground truthing an insect recognition system. According to a first aspect of the present invention, there is provided an apparatus for ground truthing an insect recognition system, the apparatus comprising: a roll of substrate material, the substrate material having upper and lower surfaces and an adhesive applied to at least one of the upper or lower surfaces; a motor coupled to the roll of substrate material and configured to rotate the roll of substrate material to dispense the substrate material into an insect trap; a sensor positioned along a dispensing path of the substrate material and configured to capture information associated with the surface of the dispensed substrate having the adhesive, the sensor further configured to output sensor signals based on the captured information; and a computing device including one or more processors, the computing device configured to cause the motor to rotate the roll at a continuous rate or at predetermined intervals, to track times at which portions of the substrate material are exposed for trapping insects, to receive the sensor signals from the sensor, to transmit at least a portion of the captured information to a remote computing device and a corresponding time at which the portion of the substrate material was exposed for trapping insects, to receive classifications of insects based on the captured information from the remote computing device, and to train a machine-learning insect classifier based on the classifications.

[0004] According to a second aspect of the present invention, there is provided an apparatus for ground truthing an insect recognition system, the apparatus comprising: an insect trap enclosure defining a trap volume and having at least one opening to enable insects to enter the trap volume from an environment; a sensor positioned proximate to the insect trap enclosure and configured to capture information about insects that enter the trap volume from the environment and to transmit sensor signals comprising the captured information; a computing device in communication with the sensor and configured to: receive the sensor signals; recognize, using an object

WHAT IS CLAIMED IS:

1. An apparatus for ground truthing an insect recognition system, the apparatus comprising:

a roll of substrate material, the substrate material having upper and lower surfaces and an adhesive applied to at least one of the upper or lower surfaces;

a motor coupled to the roll of substrate material and configured to rotate the roll of substrate material to dispense the substrate material into an insect trap;

a sensor positioned along a dispensing path of the substrate material and configured to capture information associated with the surface of the dispensed substrate having the adhesive, the sensor further configured to output sensor signals based on the captured information; and

a computing device including one or more processors, the computing device configured to cause the motor to rotate the roll at a continuous rate or at predetermined intervals, to track times at which portions of the substrate material are exposed for trapping insects, to receive the sensor signals from the sensor, to transmit at least a portion of the captured information to a remote computing device and a corresponding time at which the portion of the substrate material was exposed for trapping insects, to receive classifications of insects based on the captured information from the remote computing device, and to train a machine-learning insect classifier based on the classifications.

2. The apparatus of claim 1, the apparatus further comprising:

a timestamp mechanism positioned proximate to the roll of substrate material and configured to periodically apply a mark to the dispensed substrate material, wherein the sensor is further configured to capture information associated with the marks.

3. The apparatus of claim 1, wherein the computing device is further configured to determine a time associated with an insect based on a movement rate of the roll of substrate material and elapsed time from an initial time when the roll of substrate material began dispensing.

4. The apparatus of claim 1, further comprising:

a coating dispenser comprising a coating container and a coating dispensing vessel, a first end of the coating dispensing vessel coupled to an orifice in the coating container and a second end of the coating dispensing vessel movable to be proximate to an adhesive surface of the substrate material to dispense a coating from the coating dispensing vessel at the adhesive surface of the substrate material.

5. The apparatus of claim 4, wherein the coating is a preservative for preserving at least a portion of one or more insects that land on the insect trap.

6. The apparatus of claim 1, wherein the sensor includes at least one of an image sensor or a microphone.

7. The apparatus of claim 1, wherein the computing device is further configured to classify, using the insect classifier, one or more insects based on the captured information, and wherein the machine-learning insect classifier is trained further based on the classified one or more insects.

8. A method for ground truthing an insect recognition system, comprising:

dispensing a substrate into an insect trap, the substrate comprising upper and lower surfaces and an adhesive applied to at least one of the upper or lower surfaces;

periodically applying marks to the substrate as it is dispensed, the marks indicating time periods;

capturing, using the adhesive, one or more insects on the substrate;

capturing data associated with the one or more captured insects and the marks;

transmitting the captured data to a computing device;

recognizing, using an object recognition process, one or more of the one or more captured insects;

receiving, via user input, indications of insect types for one or more of the one or more captured insects; and

training the object recognition process based on the indications of insect types and the recognized captured insects.

9. The method of claim 8, wherein the captured data includes at least one or more of image data or sound data.

10. The method of claim 8, wherein the one or more insects are identified by an entomologist using the captured data at the computing device.

11. A method for ground truthing an insect recognition system, comprising:

capturing one or more insects;

capturing a time associated with a capture of each of the one or more insects;

capturing data associated with each of the one or more insects;

transmitting the data and the times to a computing device;

recognizing, using an object recognition process, one or more of the one or more captured insects;

receiving, via user input, indications of insect types for one or more of the one or more captured insects; and

training the object recognition process based on the indications of insect types and the recognized captured insects.

12. The method of claim 11, wherein training the object recognition process includes:

comparing the recognized one or more of the one or more captured insects against the received indications of insect types for one or more of the one or more captured insects; and

adjusting the object recognition process based on the comparison.

13. The method of claim 12, further comprising:

analyzing the insect data using the insect recognition algorithm; and

determining, based on the analysis, one or more insects and a confidence level associated with each of the one or more insects,

wherein sending the insect data includes providing the one or more determined insects and the confidence level associated with each of the one or more insects to an entomologist via a user interface associated with the computing device.

14. An apparatus for ground truthing an insect recognition system, the apparatus comprising:

an insect trap enclosure defining a trap volume and having at least one opening to enable insects to enter the trap volume from an environment;

a sensor positioned proximate to the insect trap enclosure and configured to capture information about insects that enter the trap volume from the environment and to transmit sensor signals comprising the captured information;

a computing device in communication with the sensor and configured to:

receive the sensor signals;

recognize, using an object recognition process, at least one insect based on the captured information;

receive an indication of a type of insect based on the displayed captured information; and

train the object recognition process based on the recognized insect and the indication of the type of insect.

15. The apparatus of claim 14, further comprising:

a roll of substrate material, the substrate material having upper and lower surfaces and an adhesive applied to at least one of the upper or lower surfaces;

a motor coupled to the roll of substrate material and configured to rotate the roll of substrate material to dispense the substrate material into the trap volume;

a timestamp mechanism positioned proximate to the roll of substrate material and configured to periodically apply a mark to the dispensed substrate material; and

wherein the sensor is positioned along a dispensing path of the substrate material and configured to capture information associated with (i) the surface of the dispensed substrate having the adhesive and (ii) the marks.

16. The apparatus of claim 14, further comprising:

a plurality of vessels disposed within the trap volume, each of the vessels having an insect attractant substance within the vessel,

and wherein the sensor is positioned proximate to at least one of the vessels and configured to capture information about one or more insects captured within the at least one vessel.

17. The apparatus of claim 14, wherein the sensor comprises a camera and the captured information comprises one or more of an image or a video.