

What is claimed is

1. An inventory, growth, and risk prediction using image processing system comprising:

an image pre-processor, executed by at least one hardware processor, to

receive a plurality of images captured by a vehicle during movement of the vehicle along a vehicle path, where the plurality of images include a plurality of objects, and where the plurality of objects include at least one of trees or crops, and

pre-process the plurality of images for feature extraction from the plurality of images;

a feature extractor, executed by the at least one hardware processor, to extract a plurality of features of the plurality of objects from the plurality of pre-processed images by using a combination of computer vision techniques that includes at least two of

Canny edge detection,

signal processing based feature extraction,

template matching and color segmentation,

histogram back projection,

watershed, and

texture analysis, where for the plurality of objects that include trees, the feature extractor is to use a machine learning technique to determine the combination of computer vision techniques to identify a function that separates individual trees and identifies a crown of each of the trees;

an object level parameter generator, executed by the at least one hardware processor, to determine at least one parameter related to the plurality of objects from the plurality of extracted

features, where the at least parameter is related to at least one of a number of trees or crops, a distribution of trees or crops, or a growth of trees or crops; and

a partition level output generator, executed by the at least one hardware processor, to generate, based on the at least one determined parameter and the plurality of extracted features, a spatial density model to provide at least one of

a visual indication of density of distribution of the plurality of objects related to a portion of at least one of the plurality of images, or

an alert corresponding to the plurality of objects related to the portion of the at least one of the plurality of images.

2. The inventory, growth, and risk prediction using image processing system according to claim 1, where the at least one parameter related to the plurality of objects includes at least one location related to the plurality of objects, further comprising:

a model corrector, executed by the at least one hardware processor, to utilize information related to a previous image to increase an accuracy of the at least one location related to the plurality of objects, wherein the previous image represents an image of a specific location acquired at a previous time.

3. The inventory, growth, and risk prediction using image processing system according to claim 1, where the vehicle includes an unmanned aerial vehicle (UAV).

4. The inventory, growth, and risk prediction using image processing system according to claim 1, where the image pre-processor is to pre-process the plurality of images for feature extraction from the plurality of images by at least one of

removing shadows and highlight details from the plurality of images, or

applying local adaptive histogram equalization to modify a local contrast of the plurality of images.

5. The inventory, growth, and risk prediction using image processing system according to claim 1, where the image pre-processor is to pre-process the plurality of images for feature extraction from the plurality of images by

applying low pass filtering for noise removal from the plurality of images, and

applying high pass filtering for identification of edges of the plurality of objects.

6. The inventory, growth, and risk prediction using image processing system according to claim 1, where the image pre-processor is to pre-process the plurality of images for feature extraction from the plurality of images by

utilizing thresholding to create binary images of the plurality images by turning pixels below a predetermined threshold to a first value and pixels above another predetermined threshold to a second value, and

applying morphological transformations on the binary images to refine boundaries of foreground objects.

7        The inventory, growth, and risk prediction using image processing system according to claim 1, where the feature extractor is to use the machine learning technique to determine the combination of computer vision techniques to identify the function that separates individual trees and identifies the crown of each of the trees by

          using a semi-supervised machine learning technique based on past planting information related to a likely location of each of the trees.

8.       The inventory, growth, and risk prediction using image processing system according to claim 1, where for the plurality of objects that include trees, and where the object level parameter generator is to determine the at least one parameter that includes

          a crown size of each of the plurality of trees based on convex hull analysis, and

          a location of each of the plurality of trees.

9.       The inventory, growth, and risk prediction using image processing system according to claim 1, where the visual indication of density of distribution of the plurality of objects related to the portion of the at least one of the plurality of images includes

          a display of low density and high density areas related to the portion of the at least one of the plurality of images.

10.      The inventory, growth, and risk prediction using image processing system according to claim 1, where for the plurality of objects that include trees, and where the visual indication of density of

distribution of the plurality of trees related to the portion of the at least one of the plurality of images includes

a display related to a height of the plurality of trees, where the height of the plurality of trees is determined based on a crown size of each of the plurality of trees.

11. The inventory, growth, and risk prediction using image processing system according to claim 1, where the alert corresponding to the plurality of objects related to the portion of the at least one of the plurality of images includes

an indication of a low density area in the portion based on existence of the low density area for greater than a predetermined time period.

12. The inventory, growth, and risk prediction using image processing system according to claim 1, where for the plurality of objects that include trees, and where the partition level output generator is to

use color segmentation to identify changes in chlorophyll levels of the plurality of trees, where the alert corresponding to the plurality of trees related to the portion of the at least one of the plurality of images includes an indication of possible pests based on changes in the chlorophyll levels of the plurality of trees.

13. A method for inventory, growth, and risk prediction using image processing, the method comprising:

receiving a plurality of images captured by a vehicle during movement of the vehicle along a vehicle path, where the plurality of images include a plurality of objects, and where the plurality of objects include at least one of trees or crops;

pre-processing, by a hardware processor, the plurality of images for feature extraction from the plurality of images;

extracting a plurality of features of the plurality of objects from the plurality of pre-processed images by using a combination of computer vision techniques by using a machine learning technique to determine the combination of computer vision techniques to identify a function that separates individual objects;

determining at least one parameter related to the plurality of objects from the plurality of extracted features, where the at least parameter is related to at least one of a number of trees or crops, a distribution of trees or crops, or a growth of trees or crops; and

generating, based on the at least one determined parameter, the plurality of extracted features, historical data related to consumption of the plurality of objects at different ages of the plurality of objects, sand external effect data related to external effects on the plurality of objects, a risk prediction model to simulate effects of the historical data and the external effect data on the consumption of the plurality of objects.

14. The method according to claim 13,

where for the plurality of objects that include trees, the historical data includes tree density at different ages and yield at harvest, and the external effect data includes at least one of weather or pest related effects on the plurality of trees, and

where generating, based on the at least one determined parameter, the plurality of extracted features, the historical data, and the external effect data, the risk prediction model to simulate effects of the historical data and the external effect data on the consumption of the plurality of trees further comprises:

generating, based on the at least one determined parameter, the plurality of extracted features, the historical data, and the external effect data, the risk prediction model to simulate yield and loss related to the plurality of trees.

15. A non-transitory computer readable medium having stored thereon machine readable instructions for inventory, growth, and risk prediction using image processing, the machine readable instructions when executed cause at least one hardware processor to:

receive a plurality of images captured by a vehicle during movement of the vehicle along a vehicle path, where the plurality of images include a plurality of objects, and where the plurality of objects include at least one of trees or crops;

pre-process the plurality of images for feature extraction from the plurality of images;

extract a plurality of features of the plurality of objects from the plurality of pre-processed images by using a combination of computer vision techniques by using a machine learning technique to determine the combination of computer vision techniques to identify a function that separates individual objects

determine at least one parameter related to the plurality of objects from the plurality of extracted features, where the at least parameter is related to at least one of a member of trees or crops, a distribution of trees or crops, or a growth of trees or crops;

generate, based on the at least one determined parameter and the plurality of extracted features, a spatial density model to provide at least one of

a visual indication of density of distribution of the plurality of objects related to a portion of at least one of the plurality of images, or

an alert corresponding to the plurality of objects related to the portion of the at least one of the plurality of images; and

generate, based on the at least one determined parameter, the plurality of extracted features, historical data related to consumption of the plurality of objects at different ages of the plurality of objects, and external effect data related to external effects on the plurality of objects, a risk prediction model to simulate effects of the historical data and the external effect data on the consumption of the plurality of objects.

16. The non-transitory computer readable medium according to claim 18, where the at least one parameter related to the plurality of objects includes at least one location related to the plurality of objects, the machine readable instructions when executed further cause the at least one hardware processor to:

utilize information related to a previous image to increase an accuracy of the at least one location related to the plurality of objects, wherein the previous image represents an image of a specific location acquired at a previous time.