CLAIMS

1. A method of estimating crop type and/or sowing date, the method comprising:

providing a historical crop growth time series for an area of interest based on remote sensor data, wherein the remote sensor data include a time series of image data of the area of interest, and wherein the historical crop growth time series includes one or more elements including one or more crop-specific parameters; wherein the historical crop data include crop types historically grown in a crop growth region associated with the area of interest during at least one previous crop cycle and a sowing calendar for each of those crop types;

determining, for each crop type/sowing date combination within a set of one or more crop types and one or more sowing dates, a simulated crop growth time series for the area of interest using a crop growth simulation model and based on historical crop data, geospatial data, and weather data, wherein the geospatial data include agricultural information characterizing the area of interest, wherein the weather data include a weather time series representative of one or more weather conditions in a weather region associated with the area of interest, and wherein the simulated crop growth time series includes one or more elements including the one or more crop-specific parameters;

determining, for each crop type/sowing date combination within a set of one or more crop types and one or more sowing dates, a simulated crop growth time series includes:

determining an initial simulated crop growth time series for each crop type/sowing date combination within a set of the crop types historically grown in the crop growth region and an initial sowing date within the sowing calendar for each of those crop types; and

matching the historical crop growth time series against each instance of the simulated crop growth time series to determine an estimated crop type and/or sowing date.

2. The method as claimed in claim 1, wherein matching the historical crop growth time series against each instance of the simulated crop growth time series to determine an estimated crop type and/or sowing date includes:

computing, for each crop type/sowing date combination within the set of crop types historically grown in the crop growth region and the initial sowing date within the sowing date calendar for each of those crop types, a difference between each element of the one or more elements of the initial simulated crop growth time series and each corresponding element of the one or more elements of the historical crop growth time series;

computing, for each crop type/sowing date combination within the set of crop types historically grown in the crop growth region and the initial sowing date within the sowing date calendar for each of those crop types, a difference score by summing each difference computed for that crop type/sowing date combination;

storing the difference score computed for each crop type/sowing date combination within the set of crop types historically grown in the crop growth region and the initial sowing date within the sowing date calendar for each of those crop types;

ranking the stored difference scores to identify a lowest difference score;

determining the estimated crop type based on the crop associated with the lowest difference score.

3. The method as claimed in claim 2, wherein determining, for each crop type/sowing date combination within a set of one or more crop types and one or more sowing dates, a simulated crop growth time series further includes:

determining a temporally-shifted simulated crop growth time series for each crop type/sowing date combination within a set of the estimated crop type and a plurality of sowing dates within the sowing calendar for the estimated crop type.

4. The method as claimed in claim 3, wherein matching the historical crop growth time series against each instance of the simulated crop growth time series to determine an estimated crop type and/or sowing date further includes:

computing, for each crop type/sowing date combination within the set of the estimated crop type and the plurality of sowing dates within the sowing calendar for the estimated crop type, a difference between each element of the one or more elements of the temporally-shifted simulated crop growth time series and each corresponding element of the one or more elements of the historical crop growth time series;

computing, for each crop type/sowing date combination within the set of the estimated crop type and the plurality of sowing dates within the sowing calendar for the estimated crop type, a difference score by summing each difference computed for that crop type/sowing date combination;

storing the difference score computed for each crop type/sowing date combination within the set of the estimated crop type and the plurality of sowing dates within the sowing calendar for the estimated crop type;

ranking the stored difference scores to identify a lowest difference score;

determining the estimated sowing date based on the sowing date associated with the lowest difference score.

5. The method as claimed in claim 1, wherein the one or more crop-specific parameters is/are selected from the group consisting of leaf area index (LAI) and normalized difference vegetation index (NDVI).

6. The method as claimed in claim 1, wherein the one or more crop-specific parameters include(s) leaf area index (LAI).

7. The method as claimed in claim 1, wherein the agricultural information is/are selected from the group consisting of elevation, soil moisture, and soil type.

8. The method as claimed in claim 1, wherein the image data is captured by a satellite, an aerial drone, and/or an aircraft.

9. The method as claimed in claim 1, wherein the image data is captured by a satellite.

10. A system for estimating crop type and/or sowing date, comprising:

a server device, wherein the server device comprises one or more processors, one or more computer readable storage devices, and program instructions stored on at least one of the one or more computer readable storage devices for execution by at least one of the one or more processors, the program instructions executable to:

provide a historical crop growth time series for an area of interest based on remote sensor data, wherein the remote sensor data include a time series of image data of the area of interest, and wherein the historical crop growth time series includes one or more elements including one or more crop-specific parameters; wherein the historical crop data include crop types historically grown in a crop growth region associated with the area of interest during at least one previous crop cycle and a sowing calendar for each of those crop types;

determine, for each crop type/sowing date combination within a set of one or more crop types and one or more sowing dates, a simulated crop growth time series for the area of interest using a crop growth simulation model and based on historical crop data, geospatial data, and weather data, wherein the geospatial data include agricultural information characterizing the area of interest, wherein the weather data include a weather time series representative of one or more weather conditions in a weather region associated with the area of interest, and wherein the simulated crop growth time series includes one or more elements including the one or more crop-specific parameters;

determine, for each crop type/sowing date combination within a set of one or more crop types and one or more sowing dates, a simulated crop growth time series includes:

determine an initial simulated crop growth time series for each crop type/sowing date combination within a set of the crop types historically grown in the crop growth region and an initial sowing date within the sowing calendar for each of those crop types, match the historical crop growth time series against each instance of the simulated crop growth time series to determine an estimated crop type and/or sowing date.

11. The system as claimed in claim 10, wherein to match the historical crop growth time series against each instance of the simulated crop growth time series to determine an estimated crop type and/or sowing date, the program instruction further executable to:

compute, for each crop type/sowing date combination within the set of crop types historically grown in the crop growth region and the initial sowing date within the sowing date calendar for each of those crop types, a difference between each element of the one or more elements of the initial simulated crop growth time series and each corresponding element of the one or more elements of the historical crop growth time series;

compute, for each crop type/sowing date combination within the set of crop types historically grown in the crop growth region and the initial sowing date within the sowing date calendar for each of those crop types, a difference score by summing each difference computed for that crop type/sowing date combination;

store the difference score computed for each crop type/sowing date combination within the set of crop types historically grown in the crop growth region and the initial sowing date within the sowing date calendar for each of those crop types;

rank the stored difference scores to identify a lowest difference score;

determine the estimated crop type based on the crop associated with the lowest difference score.

12. The system as claimed in claim 11, wherein to determine, for each crop type/sowing date combination within a set of one or more crop types and one or more sowing dates, a simulated crop growth time series, the program instructions further executable to:

determine a temporally-shifted simulated crop growth time series for each crop type/sowing date combination within a set of the estimated crop type and a plurality of sowing dates within the sowing calendar for the estimated crop type.

13. The system as claimed in claim 12, wherein to match the historical crop growth time series against each instance of the simulated crop growth time series to determine an estimated crop type and/or sowing date, the program instructions further executable to:

compute, for each crop type/sowing date combination within the set of the estimated crop type and the plurality of sowing dates within the sowing calendar for the estimated crop type, a difference between each element of the one or more elements of the temporally-shifted simulated crop growth time series and each corresponding element of the one or more elements of the historical crop growth time series;

compute, for each crop type/sowing date combination within the set of the estimated crop type and the plurality of sowing dates within the sowing calendar for the estimated crop type, a difference score by summing each difference computed for that crop type/sowing date combination;

store the difference score computed for each crop type/sowing date combination within the set of the estimated crop type and the plurality of sowing dates within the sowing calendar for the estimated crop type;

rank the stored difference scores to identify a lowest difference score;

determine the estimated sowing date based on the sowing date associated with the lowest difference score.

14. A computer program product for estimating crop type and/or sowing date, the computer program product comprising a computer readable storage medium having program code embodied therewith, the program code executable by one or more processors, to perform a method comprising:

providing a historical crop growth time series for an area of interest based on remote sensor data, wherein the remote sensor data include a time series of image data of the area of interest, and wherein the historical crop growth time series includes one or more elements including one or more crop-specific parameters; providing a historical crop growth time series for an area of interest based on remote sensor data, wherein the remote sensor data include a time series of image data of the area of interest, and wherein the historical crop growth time series includes one or more elements including one or more crop-specific parameters; wherein the historical crop data include crop types historically grown in a crop growth region associated with the area of interest during at least one previous crop cycle and a sowing calendar for each of those crop types;

determining, for each crop type/sowing date combination within a set of one or more crop types and one or more sowing dates, a simulated crop growth time series for the area of interest using a crop growth simulation model and based on historical crop data, geospatial data, and weather data, wherein the geospatial data include agricultural information characterizing the area of interest, wherein the weather data include a weather time series

representative of one or more weather conditions in a weather region associated with the area of interest, and wherein the simulated crop growth time series includes one or more elements including the one or more crop-specific parameters;

determining, for each crop type/sowing date combination within a set of one or more crop types and one or more sowing dates, a simulated crop growth time series includes:

determining an initial simulated crop growth time series for each crop type/sowing date combination within a set of the crop types historically grown in the crop growth region and an initial sowing date within the sowing calendar for each of those crop types; and

matching the historical crop growth time series against each instance of the simulated crop growth time series to determine an estimated crop type and/or sowing date.

15. The computer program product as claimed in claim 14, wherein matching the historical crop growth time series against each instance of the simulated crop growth time series to determine an estimated crop type and/or sowing date includes:

computing, for each crop type/sowing date combination within the set of crop types historically grown in the crop growth region and the initial sowing date within the sowing date calendar for each of those crop types, a difference between each element of the one or more elements of the initial simulated crop growth time series and each corresponding element of the one or more elements of the historical crop growth time series;

computing, for each crop type/sowing date combination within the set of crop types historically grown in the crop growth region and the initial sowing date within the sowing date calendar for each of those crop types, a difference score by summing each difference computed for that crop type/sowing date combination;

storing the difference score computed for each crop type/sowing date combination within the set of crop types historically grown in the crop growth region and the initial sowing date within the sowing date calendar for each of those crop types;

ranking the stored difference scores to identify a lowest difference score;

determining the estimated crop type based on the crop associated with the lowest difference score.

16. The computer program product as claimed in claim 15, wherein determining, for each crop type/sowing date combination within a set of one or more crop types and one or more sowing dates, a simulated crop growth time series further includes:

determining a temporally-shifted simulated crop growth time series for each crop type/sowing date combination within a set of the estimated crop type and a plurality of sowing dates within the sowing calendar for the estimated crop type.

17. The computer program product as claimed in claim 16, wherein matching the historical crop growth time series against each instance of the simulated crop growth time series to determine an estimated crop type and/or sowing date further includes:

computing, for each crop type/sowing date combination within the set of the estimated crop type and the plurality of sowing dates within the sowing calendar for the estimated crop type, a difference between each element of the one or more elements of the temporally-shifted simulated crop growth time series and each corresponding element of the one or more elements of the historical crop growth time series;

computing, for each crop type/sowing date combination within the set of the estimated crop type and the plurality of sowing dates within the sowing calendar for the estimated crop type, a difference score by summing each difference computed for that crop type/sowing date combination;

storing the difference score computed for each crop type/sowing date combination within the set of the estimated crop type and the plurality of sowing dates within the sowing calendar for the estimated crop type;

ranking the stored difference scores to identify a lowest difference score;

determining the estimated sowing date based on the sowing date associated with the lowest difference score.

18. A method of estimating crop type and sowing date, the method comprising:

receiving remote sensor data including a time series of image data of an area of interest captured during a current crop cycle;

computing a time series of one or more crop-specific parameters based on the time series of image data;

determining a historical crop growth time series for the area of interest during the current crop cycle with one or more elements including the one or more crop-specific parameters;

receiving historical crop data including a plurality of crop types grown in a crop growth region associated with the area of interest during at least one previous crop cycle and a sowing calendar for each of the plurality of crop types;

receiving geospatial data including agricultural information characterizing the area of interest;

receiving weather data including a current-crop-cycle weather time series representative of one or more weather conditions in a weather region associated with the area of interest during the current crop cycle;

determining, for each crop type/sowing date combination within a set of the plurality of crop types and a plurality of sowing dates within the sowing calendar for those crop types, a simulated crop growth time series for the area of interest during the current crop cycle using a crop growth simulation model and based on the historical crop data, the geospatial data, and the weather data, wherein the simulated crop growth time series includes one or more elements including of the one or more crop-specific parameters;

computing, for each crop type/sowing date combination within the set of the plurality of crop types and the plurality of sowing dates within the sowing calendar for those crop types, a difference score based on one or more differences each computed as a distance between an element of the one or more elements of the simulated crop growth time series and a corresponding element of the one or more elements of the historical crop growth time series;

determining an estimated crop type and sowing date based on the crop and sowing date associated with the simulated crop growth time series that produces the lowest difference score.

19. A system for estimating crop type and sowing date, comprising:

a server device, wherein the server device comprises one or more processors, one or more computer readable storage devices, and program instructions stored on at least one of the one or more computer readable storage devices for execution by at least one of the one or more processors, the program instructions executable to:

receive remote sensor data including a time series of image data of an area of interest captured during a current crop cycle;

compute a time series of one or more crop-specific parameters based on the time series of image data;

determine a historical crop growth time series for the area of interest during the current crop cycle with one or more elements including the one or more crop-specific parameters;

receive historical crop data including a plurality of crop types grown in a crop growth region associated with the area of interest during at least one previous crop cycle and a sowing calendar for each of the plurality of crop types;

receive geospatial data including agricultural information characterizing the area of interest;

receive weather data including a current-crop-cycle weather time series representative of one or more weather conditions in a weather region associated with the area of interest during the current crop cycle;

determine, for each crop type/sowing date combination within a set of the plurality of crop types and a plurality of sowing dates within the sowing calendar for those crop types, a simulated crop growth time series for the area of interest during the current crop cycle using a crop growth simulation model and based on the historical crop data, the geospatial data, and the weather data, wherein the simulated crop growth time series includes one or more elements including the one or more crop-specific parameters;

compute, for each crop type/sowing date combination within the set of the plurality of crop types and the plurality of sowing dates within the sowing calendar for those crop types, a difference score based on one or more differences each computed as a distance between an element of the one or more elements of the simulated crop growth time series and a corresponding element of the one or more elements of the historical crop growth time series;

determine an estimated crop type and sowing date based on the crop and sowing date associated with the simulated crop growth time series that produces the lowest difference score.