Satellite, Drone, Vision based Summarization

Problem Statements

1. Using satellites/drones to get grazing patterns, to prevent erosion and desertification of soil. Understanding the boundaries of a crop using satellite imagery and GIS

2. Using drones for automated detection of diseases for apple trees

3. Drone survey based crop loss detection to evaluate and verify compensation amount of crop loss for individual land, crop type using Computer Vision

4. Satellite images to identify missed fertilizer stripes and pest damage So as to take preventive measures

5. Erosion detection using drones and open CV for farms,

6. Drone Deep CNN based land area, crop type, crop growth stage detection

7. Leaf disease stage detection, soil problems detection and quick action using drone based pesticides spray

8. Understanding the boundaries of a crop using satellite imagery and GIS

9. Water body detection using satellite imagery for planning purposes

10. Pest detection using satellite imaging (Ex Locusts

11. A precise and real time application for herbicides spraying

12. A precise and real time application for herbicides spraying

13. Plant Stress Classification for Smart Agriculture utilizing CNN – SVM

14. Crop health monitoring using remote sensing and using drone for spraying fertilizers

15. Yield estimation by looking at plant health and fruit-bearing

Themes

1. Satellite imagery(High Resolution image dataset)

2. GIS(Maps, Images)

3. Drone based CV

4. Drone based Machine Vision

5. Drone based mapping(2D/3D mapping)

6. CV based Classification, Detection, Segmentation, Attention map generation

Summary:

Centralized Cloud based Vision APP

System architecture:

System 1.(Cloud based only with some seasonality)

Application related to GIS, Satellite imagery based application. This section works in cloud and continuously monitor (or analyze on request) and analyze the satellite imagery, GIS data from satellites. Purpose and implementation:

Model deployment for

- Grazing pattern, Boundaries of crop
- Crop-loss detection(accuracy is questionable using only satellite or GIS, need literature review)
- Crop type detection(accuracy is questionable using only satellite or GIS, need literature review)
- Missed fertilizer stripes
- Farm-land area
- Erosion detection
- Water-body detection
- Pest-detection(using GIS or satellite only here, but drone image for this purpose can be incorporated here)
- Yield estimation

System 2. (Cloud based but data fetching from real-world drone, farmers phone data)

Application related to Drone imagery based application. This section works in cloud and continuously monitor (or analyze on request) and analyze the imagery and provides real-time response, Purpose and implementation:

Model deployment for

- Vision based leaf disease stage detection**(Pestiside spray based actuation, done by control node)**
- Water-body detection**(during drone survey with some routine-basis)**
- Real-time vision based crop, fruit health monitor(2d/3d mapping or image based strategy)
- Plant stress classification
- Real-time analysis of leaf or crop health from the uploaded image by farmers-friendly app.
- Crop, fruit count, quantity, type detection in real-time for crop or fruit collection in real-time.

System 3.

A. Mobile Apps for Farmers:

Case a (Where no issue in Internet):

Farmers can upload images of crops, leafs etc. for obtaining real-time analytics based on real-time cloud program through their id, which can get real-time verification, identification and recommended solution too.

Case b (A real-time device having wireless connectivity with phones, can work without Internet):

Farmers can upload images of crops, leafs etc. for obtaining real-time analytics based on real-time program running on that master device in nearby operating units through their id, which can get real-time verification, identification response, and recommended solution too.

B. Deployed Vision system in Drones or bots that are used in real-time while surveying

1. Vision Unit(or say ROS node)

Does all vision based applications mentioned above from analytics to precise image captures(regarding efficient homography estimation in real-time),**[autonomous path planning though out of scope here],** deployed in the drone computer.

2. Control unit

Takes analytics result from vision node for actuating motors to conduct pitch, roll, yaw, and from past analysis or the code involved for domain analysis to perform efficient, and precise application of following

- Herbiside spray
- Pestiside spray
- Watering or other necessary drone based application

Note: Based on the application or purpose

1. Drone can perform, image, analytics in real-time on-board, specially the actuation based problem like spraying something in field.

2. The drone can capture images only for crop type, area, boundary etc. analysis in routine basis, this analytics application can be done later by a code running on cloud to save n-board battery power.

References: 1. Irrigation Water Management **2.** Smart Water Management Technology and IoT **3.** IRRIGATION WATER MANAGEMENT USING SMART CONTROL SYSTEMS: A REVIEW

Excel sheet summary

Themes: 1. Satellite imagery(High Resolution image dataset), 2. GIS(Maps, Images), 3. Drone based CV, 4. Drone based Machine Vision, 5. Drone based mapping(2D/3D mapping), 6. CV based Classification, Detection, Segmentation, Attention map generation Centralized Cloud based Vision APP System architecture: System 1.(Cloud based application + storage for that) Application related to GIS, Satellite imagery based application. This section works in cloud and continuously monitor(or analyze on request) and analyze the satellite imagery, GIS data from satellites. Purpose and implementation: Model deployment for • Grazing pattern, Boundaries of crop • Crop-loss detection(accuracy is questionable using only satellite or GIS, need literature review) • Crop type detection(accuracy is questionable using only satellite or GIS, need literature review) • Missed fertilizer stripes • Farm-land area • Erosion detection • Water-body detection • Pest-detection(using GIS or satellite only here, but drone image for this purpose can be incorporated here) • Yield estimation **System 2. (Cloud based but data fetching from real-world drone, farmers phone data) Application related to Drone imagery based application. This section works in cloud and**

continuously monitor (or analyze on request) and analyze the imagery and provides real-time response, Purpose and implementation: Model deployment for • Vision based leaf disease stage detection(Pestiside spray based actuation, done by control node) • Water-body detection(during drone survey with some routine-basis) • Real-time vision based crop, fruit health monitor(2d/3d mapping or image based strategy) • Plant stress classification • Real-time analysis of leaf or crop health from the uploaded image by farmers-friendly app. • Crop, fruit count, quantity, type detection in real-time for crop or fruit collection in real-time. **System 3. Applications at consumer end A. Mobile Apps for Farmers: Case a (Where no issue in Internet):** Farmers can upload images of crops, leafs etc. for obtaining real-time analytics based on real-time cloud program through their id, which can get real-time verification, identification and recommended solution too. **Case b (A real-time device having wireless connectivity with phones, can work without Internet):** Farmers can upload images of crops, leafs etc. for obtaining real-time analytics based on real-time program running on that master device in nearby operating units through their id, which can get real-time verification, identification response, and recommended solution too. **B. Deployed Vision system in Drones or bots that are used in real-time while surveying 1. Vision Unit(or say ROS node)** Does all vision based applications mentioned above from analytics to precise image captures(regarding efficient homography estimation in real-time),**[autonomous path planning though out of scope here]**, deployed in the drone onboard computer. **2. Control unit(or say ROS node)** Takes analytics result from vision node for actuating motors to conduct pitch, roll, yaw, and from past analysis or the code involved for domain analysis to perform efficient, and precise application of following • Herbiside spray • Pestiside spray • Watering or other necessary drone based application **Note: Based on the application or purpose 1. Drone can perform, image, analytics in real-time on-board, specially the actuation based problem like spraying something in field. 2. The drone can capture images only for crop type, area, boundary etc. analysis in routine basis, this analytics application can be done later by a code running on cloud to save onboard battery power. References: * EarthStat - GIS data for agriculture and the environment * Yield Estimation and Prediction * Deep Learning for Plant Stress Phenotyping: Trends and Future Perspectives5 * Using Geospatial Technology for Pest Monitoring and Detection**