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Innovation The Research Concept

Remote Sensing in Agriculture (Challenges and Opportunities)

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Abstract

Precision Agriculture is one of the top ten revolution in agriculture. A precision agriculture system is that in which farmer can monitor his crop remotely. One can get the output of Precisionfarming if he is able to decode the data, with the help of Precision farming makes farming both easier and more complex. Research Scientist are focusing on remote sensing in agriculture. Remote Sensing means getting near real time information. Researchers are doing hyper spectral remote sensing of data, these techniques are nondestructive and spatial estimates. The spectral properties and vegetation are strongly determined by biophysical and biochemical attributes such as leaf area Index. Remote sensing is the measurement of reflected radiations rather than transmitted or absorbed radiations.There is huge map data is available to us to utilize in determining crop sown area estimation, Normalized difference vegetation index (NDVI), crop disease identification, soil properties, flood impact, controls, salinity controls, Drone image analysis and crop damage assessment. Agriculture drought has been studied using NDVI and vegetation condition Index derived from NDVI.But as the amount of data grows, more work is needed to interpret the data and this increases the risk of misinterpretation. Farmers implementing precision farming will likely work closer with several professionals in the agricultural, GPS and computing sciences. The value of integrating GPS with remote sensing and GIS is the greatest in applications that require comprehensive, dereferenced, real-time or almost real-time data. These applications include mobile mapping, disaster mitigation, and emergency response. The future prospects for integrating GPS with remote sensing and GIS are in the development of enhanced location-aware multi-media PDA systems.

Keywords: Remote sensing, GPS, GIS, Drones, Smart Farming, UAV, Real Time Data.

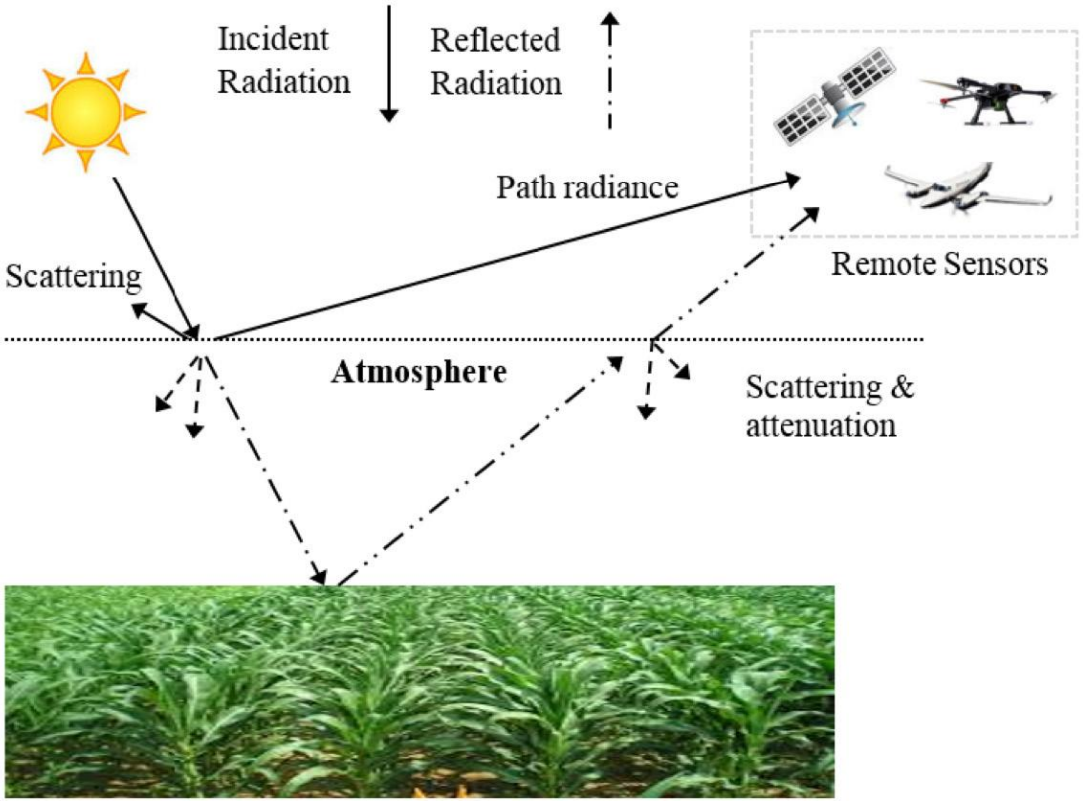
Introduction

The use of remote sensing is very urgent as the monitoring the agriculture faces a special problem that is not common to any other sector [1].The need of timeliness is also the important factor for data analysis.The global smart agriculture market is expected to reach $ 15.3 billion by the end of 2025 compared to 5 billion dollar in 2016.The main modern information technology used in precision agriculture is “3S technology” means like remote sensing ,Geographical information System and global positioning System. Researchers have focused on Hyper Spectral remote sensing of agriculture and applied different method to reduce the data dimension.

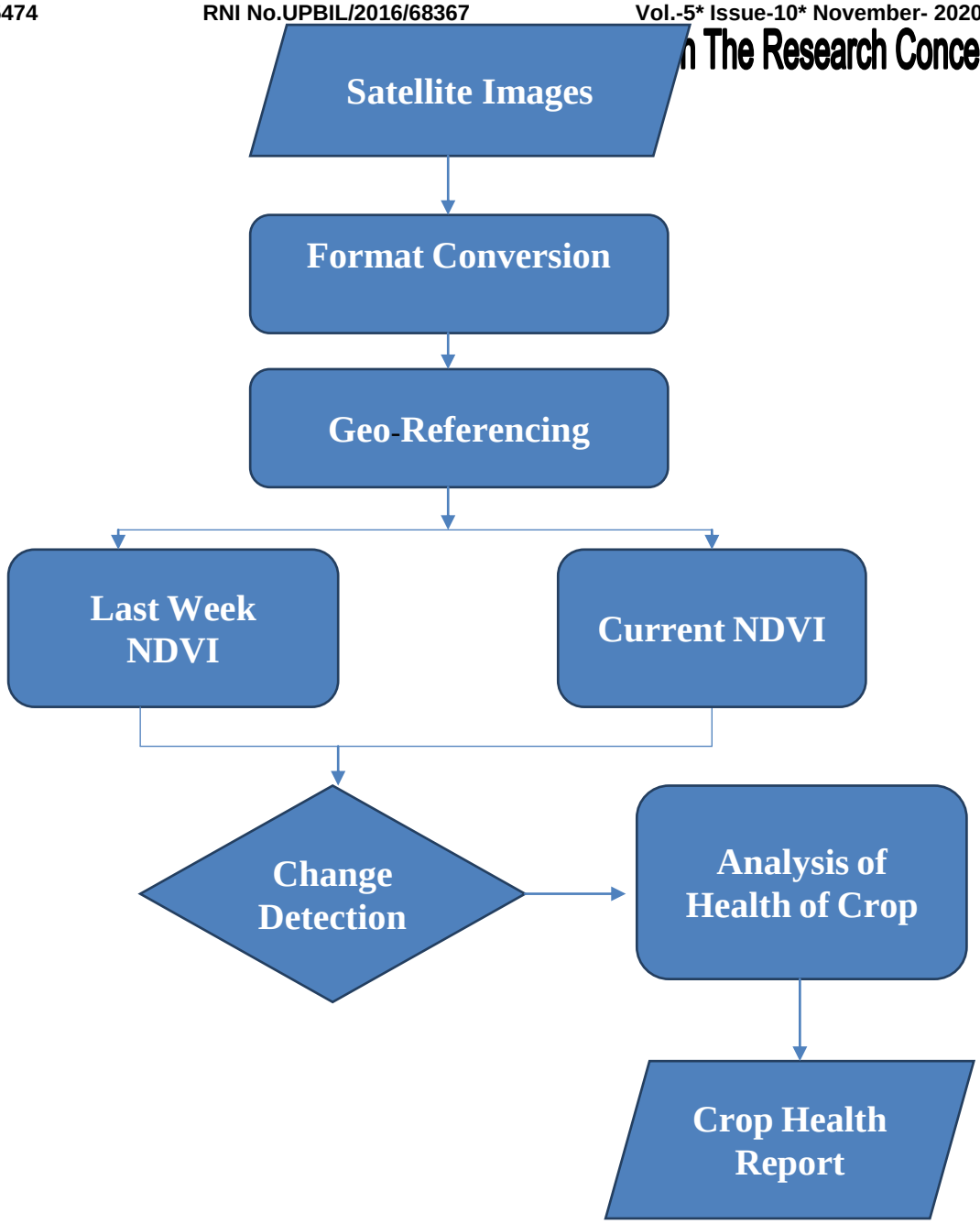
Hyper Spectral data collected over the large no of narrow bands in continuous spectral coverage are voluminous and more complex than multispectral data posting great challenges in data handling and analysis. It demands methods and techniques be advanced and developed to handle high dimensional dataset. This paper presents an overview of how remote sensing can be applied for agriculture. The most remarkable application of GPS in precision agriculture is agriculture drones. Currently there are three main ways for obtaining aerial images. Satellite, planes and unmanned vehicle. Using Satellite image has an extremely high cost for small farmers and has very low availability mainly due to the small no of satellite and dependency on the weather when it covers the area of interest. Satellite imaginary in the visible and NIR bands are limited to cloud free days. For this reason satellite images becomes unpractical. Only radar images collected using satellite and airplane is unaffected by the cloud cover.

Until recently commercial flight have been the most feasible way of obtaining aerial images but they are still very costly and have lowavailability due to the small number of companies dedicated for this kind of business. More-over that is also highly dependent on weather. The reduction in the cost of high precision GPS receiver and the development of small integrated inertial sensor have boosted the creation of several companies dedicated for developing small UAV .Initially UAV were based on helicopter. But most of them are now based on quad copters.

Remote sensing is the science of accessing information about objects without touching it physically, and this happens via aircraft or satellite that is revolving around the earth. Remote sensing in agriculturethere are numerous applications of RS and it would be quite lengthy to list up all if possible. But this paper is trying to list up some of the major applications & I guess which can make u feel more excited knowing about satellites or remote sensing and improve or change your view for satellites.



1. Arial photography for military surveillance: satellites do help monitoring the movement of enemies over territories, as some of the satellites are there in low altitude with respect to the ground.
2. Assessment of fuel economy: satellite have now capable of measuring vehicle emissions including CO, NO, etc.
3. Building base map for visual references: modern mapping technologies are based on remote sensing satellites, including Google maps, bing maps, open Street maps, and most importantly NASA's global view purpose. Pokémon go is another example
4. To understand snow melt ratio: as its prime concern to know about snow melt ratio, NASA uses LIDAR to calculate it.
5. Detecting land cover and land use : land cover are generally the physical properties of soil and land use is what being used, so Satellites are used to observe an area land cover and land use ratio.
6. Improving air traffic control: satellite based GPS system used to maintain the flow of air traffic, and avoid ground base radar to spend less money.
7. Predicting the occurrence of dinosaurs: RS satellite helps tracking the place and the fossils, footsteps of dinosaurs.
8. Last but not the least: knowing your position on earth, it's all about GPS that helps knowing our position, where you are standing and where I am sitting down and trying to answer this question. :



Challenges Faced by Remote Sensing using satellite

Remote sensing is not affordable method of analysis when measuring or analyzing very small area. Remote sensing needs a special type of training to analyze the images it is therefore really expensive to use remote sensing .Extra training must be required for the users of the technology. Powerful active remote sensing system such as radar that emit their own electromagnetic radiations can be intrusive affect the phenomena being investigated. The items required in remote sensing needs periodic maintenance.Due to the faulty instruments used in remote sensing perhaps uncelebrated which may lead to uncelebrated remote sensing data. This is not used for any purpose. Sometimes different situations that are being analyzed may look the same during remote sensing which may lead to classification error. The information provided by the remote sensing data may not be complete and accurate and may be temporary. Many a times full engineering map cannot be prepared from satellite data which makes remote sensing data collection incomplete.Remote sensing technology can be used to survey only large and easily accessible areas.

Remote Sensing Using Drone

Drones are very useful it is havingnumerous sensing equipment which can perform any number of functions. Some of them are like Geological surveying, agriculture, archeology, and several other sector that can harness benefit from the large number of sensors that can be packed into a drone. Here are just a few examples of how the agricultural industry, for example, uses aerial sensors:

Drones can use Lidar sensor to measure the height of crops. This is to give an idea whether the

crop is mature or not. Lidar is a remote sensing technology that measures distance by illuminating an object with a laser light (near-infrared or UV) and then measuring what is reflected back. Heat sensors detect the temperature of livestock, the presence of water, water temperature, and for surveillance and emergency response in case of animal is feeling ill. Multi-spectral instruments crop density, check the health of plants, and even assess water quality. Visual spectrum sensors can be used to survey and map land. Biological sensors are used to take air quality measurement and check for the presence of certain micro-organisms or organic compounds.

When we hear surveillance, we need a system that can catch lawbreakers or can perform spying and monitoring of your personal movements and actions. Here may be the ways that aerial surveillance can be helpful:

1. Farmers can use drones to monitor their animals onlarge areas of land.
2. Fire departments can use a drones to track a fire in jungle.
3. Private companies can use drones for various purpose like: agriculture data surveying, monitor their infrastructure such as pipelines, buildings, and so on.
4. Drones is used to inspect riots in a certain area, power lines, towers in a certain area, tall structures like chimneys and roofs etc.
5. Remote sensing data are now used in radioactivetransfer and crop functioning. However, algorithms are still dedicatedto a single given scale, which generates large discrepancies betweendata sources and models used across different scales. The transferabilityof methods across scales is still an on-going research objective(Wu and Li, 2009). Indeed, fine and local scales should help deeplyrefining the algorithms based on radioactive transfer model inversion andimprove the coupling with crop functioning model for data assimilation.

Use case of remote sensing in agriculture

Some important applications of remote sensing in agriculture mayinclude:

Crop& soil monitoring for

Remote sensing can be used for many ways like Planttype, Distribution of crops, crop yield prediction, crop stress level, LAI estimation etc. It is really a very important GIS is becoming a hot topic in recent times as 2020 has started. It is further predicted that growth in the GIS sector will boom in the coming future.

But the question is, will GIS prove to solve the existing problems in the agricultural sector? Like GIS in construction and other sectors, agriculture has also been impacted by geographic information systems. Moreover, there are a number of advantages of utilizing GIS in agriculture and our objective is howwe can increase productivity drastically.

GIS applications are definitely be the solution if we want to move forward and step into a more data-driven economy. This time data is the fuel.Since GIS is all about managing and analyzing use of space in lived environment and built environment, the impact of GIS in agriculture will benefits farmers or people who work in agriculture sectors greatly. In agriculture, GIS can assess soil erosion, terrain topography, managing use of space, and water system like irrigation into one database.

The impact will go into positive direction, definitely.

Following are the components of a remote sensing system:

1. Energy source or illumination –There are two types of sensors used in the remote sensing System. It is the source of electromagnetic radiation which is incident on the object. The sensors can have the external source of illumination (i.e. the Sun) or can have their own source of illumination. Sensors which have their own energy source are called active remote sensors while the sensors which use the external source of energy are called the passive remote sensors. In general, sensors use the solar radiation reflected from the Earth.
2. Interaction with the atmosphere - The energy that is emitted from the source reaches to the target by passing through the earth's atmosphere which contains obstructions such clouds, haze, smog, etc.
3. Interaction with the target - When the electromagnetic radiations interact with the target, there are numerous possibilities in the way they might behave. They can get reflected, refracted, absorbed & diffused.
4. Recording of energy by the sensor - Once the energy has strike with the target under study it is recorded by the sensor. Generally the reflectance values are recorded.
5. Transmission, Reception and Processing - After recording the reflectance values, these are processed to remove any inconsistencies, converted to raster images and transmitted to ground station.
6. Interpretation & Analysis - These raster images are then visually analyzed and interpreted.
7. Application – The Visual interpretation then used for numerous applications in various fields.

There are plenty of use cases in surveying for GPS Data. Every farm should be surveyed before planning earthwork changes, locating irrigation, planting, or even putting a tractor on the land. When GPS is linked to topography software, you can export the data to design software in order to plan and maintain infrastructure and earthworks. In other words, farmers should start with GPS before they even think about precision farming.

GPS tracking systems can also be used in agriculture sector. Today they allow performing various useful functions:

1. Online Agricultural vehicle tracking(fleet management);
2. Working area estimation of a big farm.
3. Guidance to the driver of agriculture vehicle;
4. Agricultural vehicle detection;
5. Logistics optimization in an agriculture field.

6. Real time Reports on agricultural vehicle performance and cultivation of land ;

Aim of the Study

Purpose of study is to get real time information of crops and to take timely action in order to increase the production.

Conclusion

During the last two decades, numerous progress has been made in the field of remote sensing around the world, Still it is very difficult to rely on this technology by the small landowners. Remote sensing is very much required in the evaluation and monitoring of our agriculture farms, numerous natural resources of our planet for long lasting development, particularly with respect to environmental issues. Remote sensing provides the necessary information to its stakeholders and decision makers to understand burning issues, and take appropriate decisions and develop relevant policies. Such technologies has the potential to reduce government costs by providing information necessary to make geoscience interventions in a timely manner, thereby increasing productivity and quality of life for human and livestock. Agriculture is one of the major sectors in Indian economy. India being a world's largest producer of rice, wheat and pulses, must keep up its focus with growing digital technologies. Every penny spend in the technologies will return more than that of investment. Over the last two decades, Remote Sensing and GIS have grown exponentially in many sectors for visualization, monitoring, management and potential development. Remote Sensing and GIS technology enable agencies to get reliable information of natural and man-made features, or processed and interpreted appropriately phenomenon occurring over the earth's surface without making any physical contact. Nowadays, farmers have started relying on these technological improvements.

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