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GIS FOR AGRICULTURAL LAND

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Abstract - ***Crop identification and mapping is the need of the hour in today's world. Maps of crop are created by national and international agricultural agencies, and regional agricultural boards to prepare a record of what was grown in certain areas and system will be able to identify age of the crop. The most important activities include identifying the crop types and depict their extent (often measured in acres). The efficiency and accuracy of data are improved when remote sensing data products and GIS are used. In this paper, we have tried to study use of GIS (Geography Information System) in agriculture. We also are going to classify the remotely sensed image via satellite and digitize the image. And this digitized image is going to be used to train the existing system so that it can automatically sense the image in future. The main technologies to implement this system are described in detail.***

Key Words: *GIS, agriculture, satellite image,*

1. INTRODUCTION:

System serves the purpose of forecasting grain supplies, collecting crop production statistics, and monitoring farm activity. In national-scale inventory over several millions of hectares with a high resolution, satellite image based techniques are still the best choice because of the very low cost and high frequency of satellite imagery. The data obtained by GPS imagery correlates well with many agriculture inventory variables, such as the crop height, the grain volume, and the biomass. Predictions with an associated uncertainty can be calculated by the statistical extension of field variables or by mathematical models based on field measurements combined with remote sensing data. The main disadvantage of satellite images is less precision and the dearth fit of models to the data because of issues such as saturation. Another disadvantage is that satellite images provide little information about below-canopy attributes. In this paper, our focus is on average-scaled agriculture field.

In 1990's, the rapid progress in computer network technology, artificial intelligence technology, GIS technology provide strong technology support for intelligent decision support system. The application of ES can provide the implementary scheme for the agricultural production. GIS can synthetically manage the various space-time data to provide the decision and the consultation services for the agriculture production.

Combination of ES and Geographical Information System can make the geography information to bring into the ES's decision process. It can raise a question of the ES decision to use the analytical result of GIS. Meanwhile, Releasing the ES decision result by GIS can strengthen the visual display. The network technology can make the decision scheme faster and more conveniently send to the farmer. It is not only a key technological step how to make scientific decision and to obtain scientific prescription to guide farming, but also it is a key step whether or not to achieve the aim of precision. So far, it is a studying hotspot in information technology field how to build intelligent spatial decision support system by integration of GIS and ES technology. Therefore, it is not only has important theoretical significance to study and built agriculture intelligent spatial decision support system, but also it has important practical meaning.

2. LITERATURE SURVEY:

Basic methods of obtaining this information are census and ground survey. However, particularly for multinational agencies and consortium, remote sensing can provide common data collection and information collecting strategies. At present, there are three methods of collecting agricultural land based on remote sensing data. The first method is the visual interpretation method which needs to have professional knowledge and experience. However, as this method is limited by subjective factors of people. The randomness is large, and more time and effort will be spent [2]. The second method is automatic extraction method. This method is based on spectrometer data feature or spatial information of remote sensing image. Feature parameters are designed and all kind of classification models are made in order to achieve automatic classification [3]. The third method is

combination of both remote sensing data and non-remote sensing data. For example, the efficiency and accuracy of the information can be improved in support of GIS data.
Existing systems have a problem that we cannot differentiate between crops which give same color on sensing by satellite. Hence we need to overcome this drawback by developing a new algorithm which will be based on supervised learning algorithms.

Fig 1. Existing classified sample image

3. PROPOSED SYSTEM:

This system will include:
(1) Space database system. The spatial data includes the crop map data that are saved in the QGIS document and attribute data that are stored in the relation data document. The crop data are the diagram layer atlases that are made up of dot, line, area (polygon); the attributive data are made up of the basic information of the soil. Both of them are connected in the same serial number, constituting the space database together. All operations within the geography information system are completed on these data.

(2) The crop map controlling subsystem. The user can use the mouse to choose the target map to be the current map in the atlas and can also show all diagrams layer information of the current map, the user can use the mouse to set up visibility of map each diagram layer.

(3) The crop map showing subsystem. It includes many functions such as the map displaying, zooming in, zooming out, refreshing and so on.

(4) The crop map exporting subsystem. It can export the current map & can also print the current map.

(5) The searching and querying subsystem. It includes the choice search and the position search. The user can click the mouse to search crop information of the piece of certain spot, and can also search basic information of the piece of certain spot by position. The flow of our proposed system will be as follows:

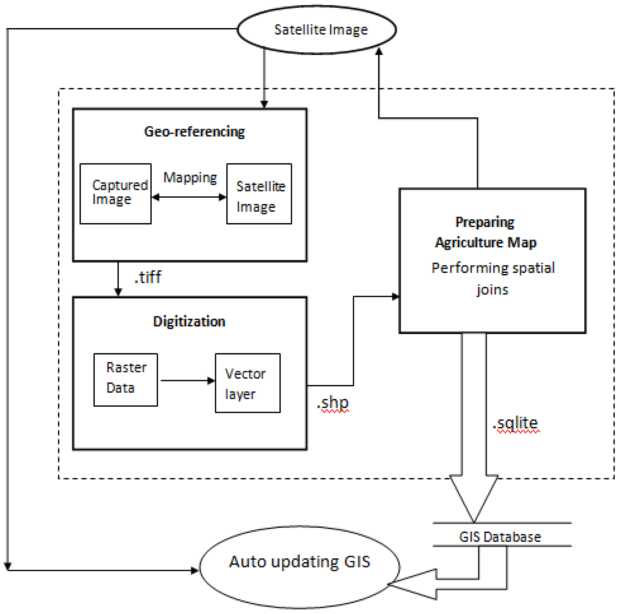

Fig 2. Flow of the system

The first thing will be an input satellite image from which we will georeference i.e. mapping of coordinates to the image. Then after this we will take control points during georeferencing to reference the image with original geographical location. This georeferenced image will then be sent in .tiff format to serve as input to digitization. In digitization we would create different datasets of the image based on type of data and classify different information layers by converting the raster layer into vector layer. Using this we will prepare an agricultural map i.e. our GIS and this will be the training data for our system.

4. IMPLEMENTATION:

We have selected Spiral model for our project as we need to train system for different time period. For that we need to repeat all steps i.e. geo-referencing, digitization on current satellite image after specific time period. So that system is updated with current data and we can get appropriate output after system is fully trained.

The implementation part of our system is based on decision tree learning algorithm which would help us to decide the measures to identify the crops. Decision tree learning is a method commonly used in data mining.[5] The goal is to create a model that predicts the value of a target variable based on several input variables. An example is shown on the right. Each interior node corresponds to one of the input variables; there are edges to children for each of the possible values of that input variable. Each leaf represents a value of the target variable given the values of the input variables represented by the path from the root to the leaf.

A decision tree is a simple representation for classifying examples. For this section, assume that all of the features have finite discrete domains, and there is a single target feature called the classification. Each element of the domain of the classification is called a class. A decision tree or a classification tree is a tree in which each internal (non-leaf) node is labelled with an input feature. The arcs coming from a node labelled with a feature are labelled with each of the possible values of the feature. Each leaf of the tree is labelled with a class or a probability distribution over the classes.

A tree can be "learned" by splitting the source set into subsets based on an attribute value test. This process is repeated on each derived subset in a recursive manner called recursive partitioning. The recursion is completed when the subset at a node has all the same value of the target variable, or when splitting no longer adds value to the predictions. This process of *top-down induction of decision trees* (TDIDT) [6] is an example of a greedy algorithm, and it is by far the most common strategy for learning decision trees from data.

In data mining, decision trees can be described also as the combination of mathematical and computational techniques to aid the description, categorisation and generalisation of a given set of data.

Data comes in records of the form:

$$(\mathbf{x}, Y) = (x_1, x_2, x_3, ..., x_k, Y)$$

The dependent variable, Y, is the target variable that we are trying to understand, classify or generalize. The vector **x** is composed of the input variables, x_1, x_2, x_3 etc., that are used for that task.

The agriculture area of interest can be conceptually divided into a grid of equally sized units. Crop identification and mapping of the benefits from the use of multi-temporal imagery system to facilitate classification by taking into account changes in reflects as a function of plant phrenology (stage of growth). This in turn requires calibrated sensors, and frequent repeat images throughout the growing season. For example, crops of canola may be easier to identify when they are flowering, because of both the spectral reflects change, and the time of the flowering. Remote Sensing is the technique of acquiring information about the Earth's surface without actually being in touch with it. This is done by sensing of the reflected or emitted energy, analyzing, and applying that information.

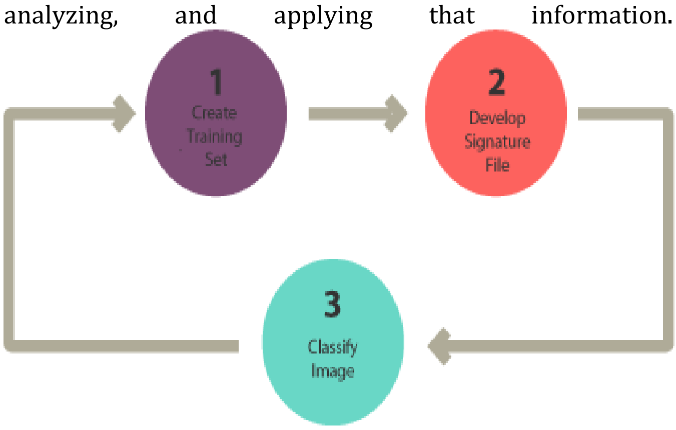

Fig 3. Development Process

Today, the use of orbiting satellite sensors and the satellite images they provide are changing how countries view about themselves & planet. Quantum GIS tool will be used to classify satellite images in different layers. Each layer will be of a different crop.

5. RESULTS:

The assessment results of agricultural land were grouped into classes using manual classification of crops. User can get information about crop such as yield prediction, collecting crop production statistics, facilitating crop rotation records, mapping soil productivity, assessment of crop damage due to storms and drought, and monitoring farming activity. Also we would be able to overcome the drawback of classification between sugarcane and turmeric crop.

6. CONCLUSIONS AND FUTURE SCOPE:

The GIS-based agriculture expert system is studied by combining network technology with ES and GIS technology together, which can provide the networking, intelligent, magic and visual information and decision service for agriculture manufacturer and the decision-making for the precision agriculture practice. This system will build up a farmland geography information system of Karnataka, and the model of variable-rate based on the farm crop yield, improve agricultural product quality, boost agricultural product market competition ability and enhance fertilizer utilization. This will change the traditional mode of agriculture production and realize the precision agriculture, for the modernization of our country agriculture and the continual development of agriculture.

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