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Precision Agriculture System

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Abstract

The purpose of this project is Agricultural Land Suitability Evaluation for crop production. According to the weather condition and type of soil this system will predict whether crop is suitable for their land or not. Normally, when soil testing is performed that time farmers only get to know about land properties and what kind of fertilizers they have to use to increase their crop production. So they do not get to know is the crop they are going to produce in their land is suitable or not. Our system will tell them their land suitability level with respect to environmental factors and crop type. It is data mining software which will analyze all data which consist land properties and environmental properties for crops. And after applying data mining algorithm on that data user will get the land suitability level for that crop which farmer want to produce in his land. Our project is user friendly interface so user can easily use it and it is cost efficient.

Keywords: *Data mining, selection of crop type, prediction, classification techniques*

INTRODUCTION

Our Project is under Data Mining domain. This project is belongs to agriculture field. Normally, when farmers want to get to know about their land properties they perform soil testing. From that soil testing they get know that is their land has enough capacity to produce good amount of crop production. But they do not get know which crop is suitable for their land. So we are going to develop a system which will tell them land suitability level of their land for particular type of crop which they want to produce in their land [1]. Our system will take land properties means value of all soil components, environment properties of farmers region and crop type which they want to produce, our system will have one database which will consist land properties and environmental properties

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with their values for all type of crops. So after entering information into system, system will perform fetch data from database and will perform computation with respect to that entered data and as result system will display land suitability level of that land for a particular type of crop. We have divide suitability level in 4 levels s1 , s2 , s3 and N. s1 is highest level means land is fully suitable for that crop and N is lowest level means land is not suitable for that crop [2].

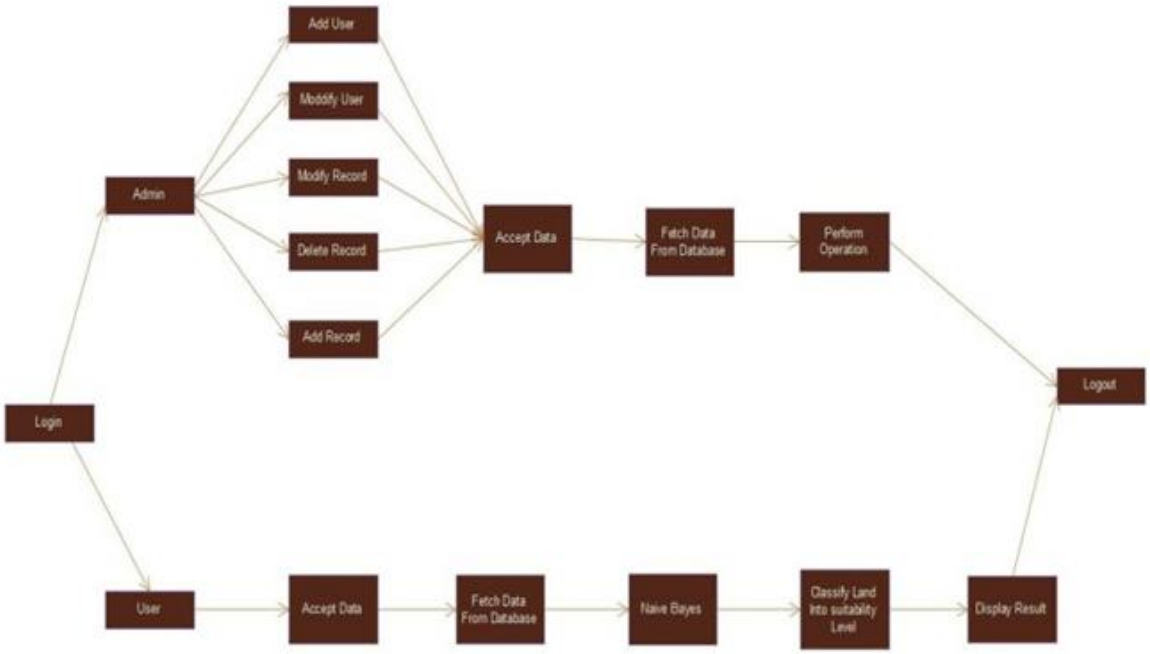

Fig. 1: *Flowchart.*

LITERATURE SURVEY

There are various existing systems for land evaluation. The Micro-LEIS is for land data transfer and agro-ecological land evaluation (Rosa *et al*. 1992, 2004, 2009). It is important components consists of land evaluation using the following literal units: place (climate), soil (site-soil), land (climate, site, soil) and field (climate, site, soil, management) data and knowledge of engineering through the use of a variety of geo-referenced databases, computer programs and boolean, statistical, embedded system and neural network modeling techniques (Rosa *et al.* 2004, 2009). But system gives a disadvantage that this system does not allow the user to build a personal expert system (Nwer, 2006).

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LIMEX is an integrated expert system with multimedia that was developed to assist lime growers and extension agents in the cultivation of lime for the purpose of improving their yield (Mahmoud *et al*. 1997). The scope of the LIMEX expert system includes assessment, irrigation, utility of fertilizers and pest control [3]. Expert system was augmented with multimedia capabilities by the integration of text, image, sound, video and data which allows for a good feedback from users, assists in better understanding of the system and allows more flexibility in the interactive. System has as input a digital map of an area and its geographical database, displays this map, evaluates the land units selected by the user and at last shows the results of the land units in color (Tsoumakas and Vlaha-Vas, 1999). In the point of view of constraint of this system is that it does not support wide range of problems in land evaluation.

LEIGIS it is software application resulting from invented by Kalogirou (2002). It is designed to support rural planners with the first view of the land suitability for cultivation of certain crops. The aim of this work was to produce a physical evaluation of land capabilities and to use this to provide an economic evaluation of land for different types of agriculture. The implementation of LEIGIS includes models for general cultivation and for specific crops (wheat, barley, maize, seed cotton and sugar beet) (Kalogirou, 2002). This system is limited to five crops and does not include characteristics such as climate.

In VEGES expert system the diagnosis and treatment of pests, diseases and nutrient disorders of certain vegetable species (Yialouris *et al*. 1997). This method of representation easily fits into any rule based ES development tool, and thus is anbenifit of the system. The advantages of this method are that it is simple, easy to understand and has a graphical presentation. However, it has the disadvantage in that it cannot account for interactions between land characteristics

PROPOSED METHODOLOGY

In this paper, we have studied different methodologies which can be useful to complete the given problem. Recent research in computer vision has increasingly focused on building systems for effective land evaluation and predicting suitable crop. So that we require suitable database of land properties and environmental factors [4].

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Software Description: It is data mining application. This will predict the crop type and suitability level for that land on the basis of land properties and environmental properties. We are going to develop software using java technology for front end and to implement business logic. And SQL for back end. There is around 9 inputs value. From which PH value, EC value, K value, N value, P value, Temperature, Moisture of soil, Rainfall are at value and crop type is string.

Size and Bound of Inputs:

Values	Range
pH Value	1.0 to 9.0
EC Value	1.0 to 6.0
K Value	1 to 500
P Value	1 to 500
N Value	1 to 500
Temperature	15 to 50
Moisture of Soil	10 to 100
Rainfall	10 to 100

DATASET DESCRIPTION

Crop	Temp	Rainfall	Moisture	N	P	K	EC	Ph
Rice	20	175	60	100	50	50	20	5
Rice	20	175	60	100	50	50	20	6
Rice	20	175	60	100	50	50	21	5
Rice	20	175	60	100	50	50	21	6
Rice	20	175	61	100	50	50	20	5
Rice	20	175	61	100	50	50	20	6
Rice	20	175	61	100	50	50	21	5
Rice	20	175	61	100	50	50	21	6
Rice	20	176	60	100	50	50	20	5
Rice	20	176	60	100	50	50	20	6
Rice	20	176	60	100	50	50	21	5
Rice	20	176	60	100	50	50	21	6
Rice	20	176	61	100	50	50	20	5
Rice	20	176	61	100	50	50	20	6

Input:

Case 1)

Crop: Rice

Temp: 20

Rain: 175

Moisture: 60

K: 100

N: 50

P: 50

Ec: 2.1

Ph: 5

Solution:

- No. of records which has crop type as Rice: 32.
- No. of records which has crop type as Rice and Temp as 20:16.

  So probability of temp for yes is: 16/32=0.5. and for No. is: 16/32=0.5.
- No. of records which has crop type as Rice and Rainfall is 175=16.

  So probability of rainfall for yes is: 16/32= 0.5, and for No. is: 16/32=0.5.
- No. of records which has crop type as Rice and Moisture is 60=16.

  So probability of 60 for yes is: 16/32=0.5, and for No. is: 16/32=0.5.
- No. of records which has crop type as Rice and N is 100=32.

  So probability of rainfall for yes is: 32/32= 1, and for No. is: 0/32=0.
- No. of records which has crop type as Rice and P is 50=32.

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So probability of rainfall for yes is: 32/32= 1, and for No. is: 0/32=0.

- No. of records which has crop type as Rice and K is 50=32.

  So probability of rainfall for yes is: 32/32= 1, and for No. is: 0/32=0.

- No. of records which has crop type as Rice and Eke is 2.1=16.

  So probability of rainfall for yes is: 16/32= 0.5, and for No. is: 16/32=0.5.

- No. of records which has crop type as Rice and pH is 5=16.

  So probability of rainfall for yes is: 16/32= 0.5 and for No. is: 16/32=0.5.

Final probability for yes is

P (yes) = 0.5 *0.5 *0.5 *1*1*1*0.5*0.5

P (yes) = 0.03125

Final probability for no is

P (No) = 0.5 *0.5 *0.5 *0*0*0*0.5*0.5

P (No) = 0

Here P (yes) > P (No) so land is suitable

And suitability level of land is S1 because all properties are suitable for that crop.

Case 2)

Crop: Jowar

Temp: 30

Rain: 51

Moisture: 61

K: 100

N: 50

P: 50

Ec: 2.3

pH: 6

Crop	Temp	Rainfall	Moisture	N	P	K	EC	Ph
Jowar	27	50	61	60	30	30	23	7
Jowar	27	50	61	60	30	30	24	6
Jowar	27	50	61	60	30	30	24	7
Jowar	27	51	60	60	30	30	23	6
Jowar	27	51	60	60	30	30	23	7
Jowar	27	51	60	60	30	30	24	6
Jowar	27	51	60	60	30	30	24	7
Jowar	27	51	61	60	30	30	23	6
Jowar	27	51	61	60	30	30	23	7
Jowar	27	51	61	60	30	30	24	6
Jowar	27	51	61	60	30	30	24	7
Jowar	28	50	60	60	30	30	23	6
Jowar	28	50	60	60	30	30	23	7
Jowar	28	50	60	60	30	30	24	6

Solution:

- No. of records which has crop type as Jowar: 32.
- No. of records which has crop type as Jowar and Temp as 30:00.

  So probability of temp for yes is: 0/32=0, and for No. is: 32/32=0.5.

- No. of records which has crop type as Jowar and Rainfall is 51=16.

  So probability of rainfall for yes is: 16/32= 0.5, and for No. is: 16/32=0.5.

- No. of records which has crop type as Jowar and Moisture is 61=16.

  So probability of 60 for yes is: 16/32=0.5, and for No. is: 16/32=0.5.

- No. of records which has crop type as Jowar and N is 60=32.

  So probability of rainfall for yes is: 32/32= 1, and for No. is: 0/32=0.

- No. of records which has crop type as Jowar and P is 30=32.

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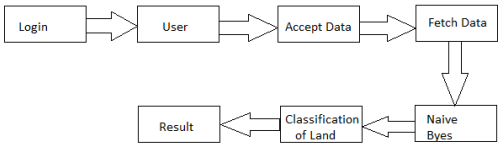
So probability of rainfall for yes is: 32/32= 1, and for No. is: 0/32=0.

- No. of records which has crop type as Jowar and K is 30=32.
  So probability of rainfall for yes is: 32/32= 1, and for No. is: 0/32=0.
- No. of records which has crop type as Jowar and Ec is 2.3=16.
  So probability of rainfall for yes is: 16/32= 0.5, and for No. is: 16/32=0.5.
- No. of records which has crop type as Jowar and pH is 6=16.
  So probability of rainfall for yes is: 16/32= 0.5, and for No. is: 16/32=0.5.

Here, temperature is not suitable for crop and we cannot manipulate it so land suitability level of this land is N, i.e., this land is not suitable for jowar.

Same for rainfall and moisture if these properties of that land are not suitable for crop if other properties are suitable for crop then also land is not suitable for that crop.

GRAPHICAL USER INTERFACE OF PROPOSED SYSTEM



The user must have to login into the system. The system is accessible to only administrator and user. The customer will provide necessary information. This information in the type of values is entered by the user in the mandatory fields of the system then the system accepted those values and starts the actual process. The process of consultant result is made by the comparisons of the values present in the database and the values given by the customer. The result is nothing but the land evaluation suitability level. These levels are of different types according to the ruled database the result is displayed.

ALGORITHM

S= (C1, C2, C3....., Cn)

Where S is the sensitivity analysis is used to determine the level of importance of each criteria. C1, C2.., Cn are the criteria (e.g., Crop, temp, rain, moisture, N, P, K, Ec, pH).

S takes values form 0 till 100 where,

S1= highly suitable,

S2= moderately suitable,

S3= marginally suitable and

S4 (N) = not suitable.

For finding the suitability level we have to calculate the probability. Calculate probability of number of records which has crop type with its criterions. Compare the probability values with it is suitability

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level. The aim of each scenario is to identify criteria that are sensitive. Hence level of importance for each criterion can be determined. Different weighting scheme were applied for the suitability criteria.

1 Accept Input From user.
2 Get the number of records for that input crop.
3 Calculate probability for each property. In that calculate p (yes) and p (no) for that crop.
4 Check p (yes) for temperature, rainfall and moisture.
a If it is greater than 0 then go to 5.
b If it is less than 0 then go to 7.
5 Multiply all the p (yes) and p (no) of all attribute.
a If p(yes) > p(no) then go to
b If p(yes) < p(no) then go to
c If p(yes) = p(no) then go to
6 Land suitability level is S1. Go to 11.
7 Land suitability level is N. Go to 11.
8 If p (yes) of 1 or 2 attribute is 0 then categorize land into S2 go to 11.
9 If p (yes) of 3 or 4 attribute is 0 then categorize land into S3, go to 11.
10 If p (yes) of 5 attribute is 0 then categorize land into N, go to 11.
11 Display result.
12 Exit.

Output:

Crop: Jowar

Temp: 30

Rain: 51

Moisture: 61

K: 100

N: 50

P: 50

Ec: 2.3

pH: 6

Solution:

- No. of records which has crop type as Jowar: 32.
- No. of records which has crop type as Jowar and Temp as 30:00.
  So probability of temp for yes is: 0/32=0, and for No. is: 32/32 = 0.5
- No. of records which has crop type as Jowar and Rainfall is 51=16.
  So, probability of rainfall for yes is: 16/32= 0.5, and for No. is: 16/32=0.5.
- No. of records which has crop type as Jowar and Moisture is 61=16.
  So probability of 60 for yes is: 16/32=0.5,
  and for No. is: 16/32=0.5.

Here, temperature is not suitable for crop and we cannot manipulate it so land suitability level of this land is N, i.e., this land is not suitable for jowar.

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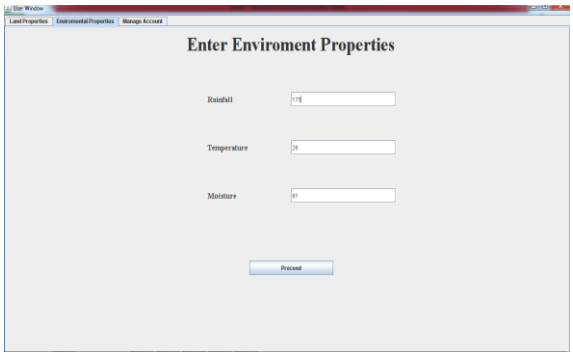
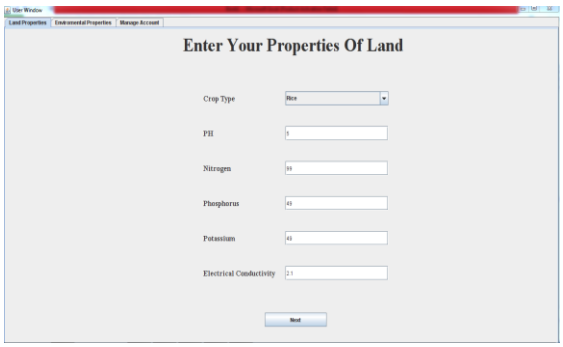
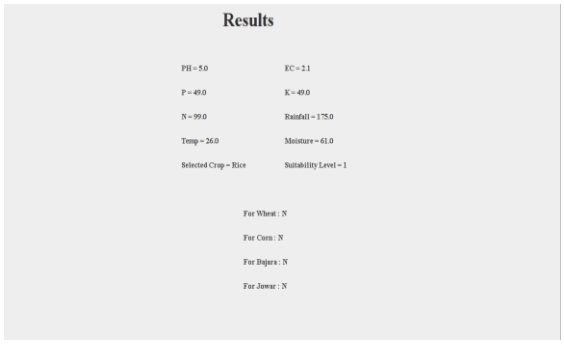
Same for rainfall and moisture if these properties of that land are not suitable for crop if other properties are suitable for crop then also land is not suitable for that crop.

OUTPUT







1	Crop Type	PH	N	P	K	EC	Rain	Temp	Moisture	bility Level
2	Rice	5	99	49	49	2.1	175	26	61	1
3	Rice	5	100	51	49	2.2	170	27	60	N
4	Rice	7	100	49	50	2.3	176	20	61	N
5	Rice	6	101	51	51	2.2	178	26	55	N
6	Rice	6	101	49	55	2.3	177	25	62	2
7	Rice	7	102	48	49	2.2	178	26	63	2
8	Rice	5	101	56	55	2.5	180	26	63	3
9	Rice	5	105	56	76	2.7	183	24	60	3
10	Rice	10	107	56	66	2.9	181	26	61	N
11										
12	Whea	5	119	59	39	1.1	45	16	17	1
13	Whea	8	120	59	40	1.3	80	18	19	N
14	Whea	6	121	61	41	1.2	59	26	20	N
15	Whea	8	120	61	41	1.4	65	19	30	N
16	Whea	6	124	59	41	1.3	67	17	19	2
17	Whea	7	121	63	55	1.4	68	18	16	2
18	Whea	9	127	56	39	1.2	66	18	19	3
19	Whea	7	105	56	76	1.9	183	24	60	3
20	Whea	10	107	56	66	1.9	181	26	61	N

	A	B	C	D	E	F	G	H	I	J	K
22	Jowar	7	59	29	30	2.4	55	28	63	1	
23	Jowar	7	60	30	31	2.5	70	27	64	N	
24	Jowar	6	61	31	31	2.3	60	35	65	N	
25	Jowar	6	59	30	31	2.3	55	27	80	N	
26	Jowar	6	45	29	29	2.3	58	28	60	2	
27	Jowar	9	59	29	31	2.3	60	31	63	2	
28	Jowar	6	41	56	55	2.5	66	29	64	3	
29	Jowar	7	56	67	44	1.1	70	27	65	3	
30	Jowar	9	55	66	77	1	70	27	65	N	
31											
32	Corn	6	40	60	40	1.7	55	25	45	1	
33	Corn	7	41	61	40	1.6	67	26	44	N	
34	Corn	6	39	59	39	1.6	57	35	46	N	
35	Corn	5	40	60	40	1.7	60	29	66	N	
36	Corn	7	41	61	41	1.3	55	27	44	2	
37	Corn	6	40	55	45	1.9	58	28	45	2	
38	Corn	5	66	55	66	1.8	59	24	47	3	
39	Corn	4	23	45	76	1.7	60	29	46	3	
40	Corn	9	67	78	98	1.1	59	29	44	N	
41											
42	Bajara	6	50	25	25	1.3	145	26	44	1	
43	Bajara	7	51	24	26	1.4	100	25	41	N	
44	bajara	6	49	25	24	1.3	147	31	46	N	
45	Bajara	6	50	25	24	1.2	149	28	55	N	

CONCLUSION

We successfully implement a system for the agriculture which accept land properties and environmental properties from farmer and when the values enter it into system then system will identify the suitability level of that land for that crop which farmer want to produce based on properties entered by user. The result of the system is based on or not on the assessment of the land. The main benefit of the system is that it not takes time for the results and assurance.

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FUTURE SCOPE

The proposed system of prediction of crops are for the limited crops only hence next step would be to extend its scope for the other crops also. By using different types of hardware tools or machines the most appropriate suitability level will be detected and if a particular land is not suitable then different artificial resources would be suggested by the system.

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