ShoveAId

A FARMER'S AI

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The Big Idea

A great thought from humble beginnings.

Automation is the key to the future but it is replacing many jobs, leading to not a positive future for some people. At ShoveAId, we understand people, and we love farmers! We want to help use powerful tools like AI and Machine Learning to create a farmer of the new age. As of today's date, farmers in most parts of the world have access to a phone. Leveraging the power of Machine Learning, we will create a service that helps farmers maximize their yield.

Executive Summary

ShoveAId is a multi-step service business. We have a hardware and a software component.

We are using a Supervised Learning Model for our Machine Learning Algorithm using a support vector machine approach. It uses a Decision Tree – A Binary Tree based data structure that splits inputs into a series of true and false values. Our Model learns, predicts and corrects mistakes using a Gini Index, a numerical value we obtain from our sample size of users, using probability to fix inaccuracies. We are taking 4 basic input variable types.
 The ML Model is created using Python. Libraries include: NumPy, TensorFlow and Matplotlib. Outputs include tips for farmers to improve their seasonal produce.

We use a cloud database and maintain a set of data for every approximate location. We divide land by acres in a field, for which we have our set of conditions.

Our hardware comprises of a testing kit of an array of sensors for onetime measuring and a shovel, which is dug in the ground for data collection on factors, making a grid of cells in a farmer's field.

How our service works

STEP 1 — **Sign-up**

Registration Process is done by farmers from where we receive a Pin Code.

STEP 2 — **Data Collection and Analysis**

We send an employee to the farmer's premises with a test kit including shoveAId for collecting information based on subject factors. Using publicly available weather patterns of the area through the Pin Code, we tune our inputs for accuracy and perform analysis.

STEP 3 — **Information Delivery**

After putting it through our machine learning model, we send the output to the farmer on their phone using SMS using a GSM based system covering a wide spectrum of farmers around the world without technology barriers.

Target Markets

The Humble Farmer

The first is the humble farmer, the backbone of our country's agriculture and rural economy. Small and mid-sized farmers contribute significantly to our economy, GDP, and food security. These farmers face issues arising from seasonal variations and climate change which affect crop yield, thus affecting their livelihood. With that scale of farming, there is a lack of technological understanding in effectively tracking soil health with a degree of scientific accuracy. The ShoveAId platform leverages ML, AI, and IoT technologies to solve soil health challenges. By putting the shovel in the ground for every acre of land, data based on input factors are taken, uploaded to our cloud, and analyzed, giving these farmers tips to maximize their yield.

Target Markets

The Boutique Farmer

The second is the local middle-class farmer, attempting to break into the boutique and exotic fruit and flower business. These include hyper-local, boutique, export and contract-based farmers, selling exotic fruits, vegetables and flowers like sellers of Durian, Dragon Fruit, FL 2027 Potatoes for Lays Chips, certain Lilies and Chrysanthemum flowers. Their produce requires very sensitive and specialised care with the most pristine growth conditions. ShoveAId helps find and mitigate issues that cost these farmers a lot of money due to their extremely high economic yield every harvest, owing to the nature of their crops.

India is growing and it is about time our business ideas grow too. ShoveAId envisions helping these farmers who sell commodity items diversify, branch out and sell higher-end fruits and vegetables to turn higher profits. Contract-based farmers who cater their products to companies like Lays and Nestle have stringent quality checks. It is common for products to be discarded in this field. A lot of farms also exist for export. ShoveAId can analyze and alter growth conditions to maximize crop yields.

Soil Moisture

1

Describe how you envision to solve the problems you previously shared.

Soil pH

2

Describe how you envision to solve the problems you previously shared.

Infiltration

3

Describe how you envision to solve the problems you previously shared.

PNK Monitor

4

Describe how you envision to solve the problems you previously shared.

HOVEA

Factors for Data Analysis

Previously mentioned are the sensors we deploy in our hardware for collecting information. Fortunately, we can derive a lot more data points for analysis in our machine learning model by using subject factors like Electrical Conductivity, Rain patterns, Soil Nitrates and more using the aforementioned sensors. Here is the complete list of Subject Factors we will use -

1. Geographic Location - Geographical Location (Determined by Pin Code entered by Farmer). Using publicly available data (Weather APIs) about geographical location over the past 25 years, we analyze Rain, Wind and Temperature patterns in the area.

2. Bulk Density - The bulk density of soil reflects the mass or weight of a certain volume of soil. Soil bulk density determines the infiltration, available water capacity, soil porosity, rooting depth/restrictions, soil microorganism activity, root proliferation, and nutrient availability.

3. Water retention - Through Moisture and Infiltration sensors

4. Electrical Conductivity - Through pH and PNK sensors

Factors for Data Analysis

5. Soil Microbe Habitation - Soil microbial processes are mediated by enzymes and thus are affected by environmental factors affecting enzymatic activities, such as temperature, water content, pH, and seasonality, but also by factors affecting diversity and abundance of microorganisms, such as nutrient availability, amount of soil organic matter, or presence of the symbiotic tree. These factors are analysed using the PNK sensor.

6. Soil pH - Determined through pH sensor on shovel

7. Soil Nitrates - Nitrogen is an essential element for plant growth. The concentration in the soil is measured using the PNK monitor.

8. Water Movement - Using water infiltration sensor

9. Organic Matter - Measured by employee visually and derived using PNK sensor.

Marketing Strategy

Marketing is about playing up your strengths and advantages relative to the industry and competitors. Conducting market research helps you assess what customers truly want from a solution and how your brand is perceived in its ability to meet those expectations.

Marketing informs your customers about the products or services you're offering them. Through marketing, the customers get to know about the value of the products, their usage and additional info that might be helpful to the customers. It creates brand awareness and makes the business stand out.

Our Techniques -
- Newspaper
- Radio
- Catalogs
- Election-like marketing
- Online platforms such as Instagram Facebook YouTube
- Direct mail
- SMS

Employees and Specialized Farmers

We will be sending our employees to the different parts of India to aware the farmers about our company and how we can actually help them and they still have the basic equipment such as radios newspapers where we can post ads

We are not only targeting poor farmers but also the middle class farmers which are present and thus we can reach out to them by the means of social media platforms such as Instagram,facebook, YouTube

Problems we faced on the way

Problem 1

To measure Soil health, for every factor we need a sensor. Large tractions of land will require a lot of sensors since factors are variable and it will be very costly.

Problem 2

Using Artificial Intelligence for training a model tens of factors over a long duration of time will require insane amounts of computing resources.

Our Land Testing System

We create a sensor array. For every acre of land, we place a module consisting of an Arduino board with a 5-sensor package covering every factor, connected by Satellite Wi-Fi and fed into the cloud database. We send over an employee with a kit with one module with a 5-sensor package covering the field of the farmer. Inputting the size of the field in the database, it will divide the area into $\sqrt{N}$ x $\sqrt{N}$ cells where N are the acres of the field dimensionally.

This map of cells is used for analysis and prediction. The employee digs the 'shovel' into the ground for each cell and allows the sensors to collect the data. Using those values, we send the output to the farmer.

Step 1. Employee places kit in land
Step 2. Measured data is uploaded to an online database via Wi-Fi.
Step 3. Machine learning model analyses data and provides output
Step 4. Output is sent via SMS to farmer

Our Factor Analysis System

Analyzing 25 years of climate data is an infeasible approach for analysis. We counter this issue in a variety of ways:

- Geographical Location based Climate Variations like Rain and Wind Patterns are not used as one of the main (4) factors in the decision tree model. The output from the ML Model is tuned i.e made more accurate and in accordance with real life observations.

- We use publicly available historical weather tracking APIs taking the smallest data point as the average temperature (°C) and rainfall (cm) over a **month** long period, easing the calculations. The calculations are performed on Professional Grade GPUs.

- We do not cache the entirety of India's weather data, instead begin with the regions we roll out our product in, for example, Punjab and Haryana. Other areas are surveyed on demand.

SWOT Analysis

Strength

1. ShoveAId allows farmers to maximise their yield using our comprehensive reports.
2. Our company bridges the gap between uneducated farmers and technology.
3. A Supervised machine learning model helps us to optimise performance criteria through previous user experience.
4. Our land testing system requires low annual maintainance.
5. Our product is highly reusable
6. We have the first mover advantage.

Weakness

1. Our entire business will be loss-making in the short run due to initial machine manufacturing costs, regional employee costs, etc.
2. Difficulty in maintenance of servers for data storage as well as maintenance of technical chain of components.

Opportunity

1. Further expansion after initial launch and setup in Punjab and Haryana is efficient.
2. Our database of potential customers/farmers will increase overtime which would help us grow our business and make us profitable in the long run.

Threats

Technical difficulty due to a complex supply chain.

Thank You

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