A Cognitive Plant Disease Detector

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Agriculture nowadays is gifted with many advanced technologies to facilitate the farmers in doing the cultivation-related tasks. Plant disease diagnosis is an essential agricultural task which the farmer needs to perform in an efficient way. Detection of diseases in the early stages enables the farmers to protect their plants for giving better yields. Many existing plant disease detection and diagnosis tools are image based. Most of the farmers are unable to use the technology due to their inability to type or because of unawareness. This inability can be overcome by speaking to the system. A cognitive application is one which provides necessary guidance to be taken based on the conditions to the users. The present paper focuses on developing a cognitive agricultural application that enables the farmer to easily communicate with the application even if he or she is an uneducated person and is unable to type. The major goal is to develop an agricultural application which interacts with the farmer to take the symptoms of the plant, and then process and provide the necessary solutions to the farmers in an efficient and a cost-effective manner.

Cognitive Science is an emerging field in multiple disciplines. The use of cognition allows a machine to take the decisions rationally. Human intelligence and machine intelligence are merged together to give the most effective results to the most complex situations. This is the motivation behind the usage of cognition in plant disease detection.

Agriculture is the major habituate of human beings which is the major source of food. A number of advanced technologies are used in agriculture to increase the productivity and decrease human labor. But, these technologies can be used only by those farmers who are educated or

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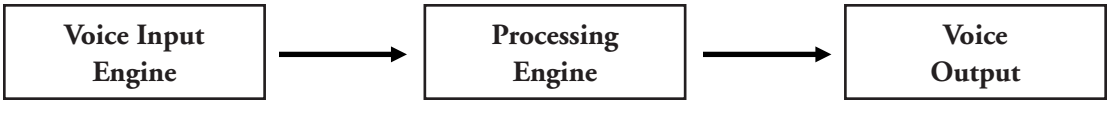
trained with the technology. Unfortunately, in most of the developing countries, those who rely on cultivation are far from education. They are unable to use the advanced technologies either due to their unawareness or because they are not trained. One major problem in plant cultivation is the detection and diagnosis of diseases. There are so many mobile applications available for the plant disease prediction and analysis. The major problem faced by the farmers in using these applications is the above-mentioned problem.

Many plant disease-detecting systems are available which are based on image processing techniques. These applications are faced with storage problems in reality due to the large computer storage requirements of the images. Many text processing applications need the user to type the information. There is a need to develop a text-based application where the user need not type but can simply give voice command to the system.

The present work focuses on development of an application which can listen to user's voice inputs (plants symptoms), analyze user's requirements (finding out the causes and solutions) and give possible outputs (reading out the findings). There are two ways to implement the system either with pure machine learning implementation or by just using voice analysis engine. Machine learning implementation would be quite complex and would take a long time to implement whereas voice analysis engine can be done in short time but would not be as effective as machine learning implementation.

The difference between machine learning implementation and voice analysis is quite subtle both require a pre-defined data samples. Machine learning would require such data samples in large quantity. The model has to be designed and trained with as many samples as possible (symptoms, causes, and solutions correlations). It would then automatically give possible causes and solutions when symptoms queried to the model. Voice analysis, on the other side, is plain and simple. All we need is to store the symptoms, causes and solutions relationships in the database and read the symptoms and query for the causes and solutions from the database.

The framework of the present system should support the farmer to interact with the system orally and get the results again by speech. The simple architecture contains three components as given in the figure. It gives the sequence in which the various operations will take place in the system.



The Voice Input Engine is the first module of the system which receives the human speech (the farmer giving the symptoms of the plant), recognizes the symptoms and sends it to the Processing Engine. It is the second module and it receives the symptoms and finds the related disease and measures to be taken. The Voice Output module conveys the information to the user.

The cloud engines such as Google Speech API or Amazon Alexa can be used as Voice Input Engine which can recognize the voice and perform speech analysis. The Processing Engine finds the disease that matches to the given symptoms and also finds the necessary actions to be taken.

The Voice Output module's work is to convey the information to the user in voice by converting the text again to speech.

The system is coded with Java. The database has been taken from the Web for testing. Later, the real-time data will be taken and experimented. The questions format looks as follows:

What is the name of the plant?

What are the symptoms?

What is the frequency or intensity of disease?

How many days?

How old is the plant?

Most of the answers were recognized. Appropriate solutions were found. Individual parts were tested and found to be effective. The system needs to be integrated and tested.

A plant disease diagnosis system which can interact with the farmers would facilitate the farmers to feel free to express their feelings and get quick solutions. A Cognitive Plant Disease Detector thus provides an environment where the farmers can interact with the system orally. It also encourages the youth for cultivation.

The developed system is implemented in a generic way. The present system faces some problems with the ambiguity in speech and implemented in English. In future, it can be modified to support the regional languages also. At present, only a few plant diseases have been considered, but it can be enhanced with all the possibilities.