Application of a supervised learning model to assess the ideal environmental conditions for growing coffee

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Abstract

In this project we apply machine learning to precision agriculture, in order to analyze the behavior of certain environmental variables in the sowing and cultivation of grain and predict future conditions or behaviors that could affect crop production and therefore its quality final. In addition, aspects such as the appearance of pests and diseases, humidity and the control of environmental and soil temperature can be controlled, and correctors or actions to be taken can be established in case the allowed parameters are exceeded.

Introduction:

Precision agriculture has become one of the areas where Wireless Sensor Networks (WSN) have been widely and successfully implemented. This type of technology favors the reduction of water consumption and the use of pesticides and fertilizers, favoring the preservation of the ecosystem. Additionally, it allows generating alerts on the arrival of frost, floods, fires, variation in the behavior of environmental variables, etc. Precision agriculture encompasses multiple practices related to the management of crops and crops, trees, flowers and plants, livestock, etc.

Overall Objective

Design and configure a wireless network of sensors that allows the collection and sending of data to an IoT platform where said information is received and processed and subsequently a supervised learning model is applied to evaluate the information and determine the actions or corrective measures to take.

Specific Objectives

- Determine the main physical environmental variables related to the cultivation of coffee.
- Establish how these variables affect or not the quality and production of the grain.
- Design and Configuration of the wireless sensor network (WSN)
- Design and configure the sensor network to record the measurement of physical environmental variables in coffee cultivation.
- Transmit the information generated by the sensors to an IoT platform in the cloud, to be processed and stored.
- Analyze the measurements received by applying a learning model that allows evaluating the reliability of said data and allows adequate decision-making

Research Methodology

The development of the project is framed within the type of experimental applied research, in fig. 1 we can visualize its stages:

- Design and Configuration of the wireless sensor network (WSN)
- Data collection and sending
- Sending data to the IoT platform
- Upload data to the Machine Learning platform
- Data transformation and application of the supervised model

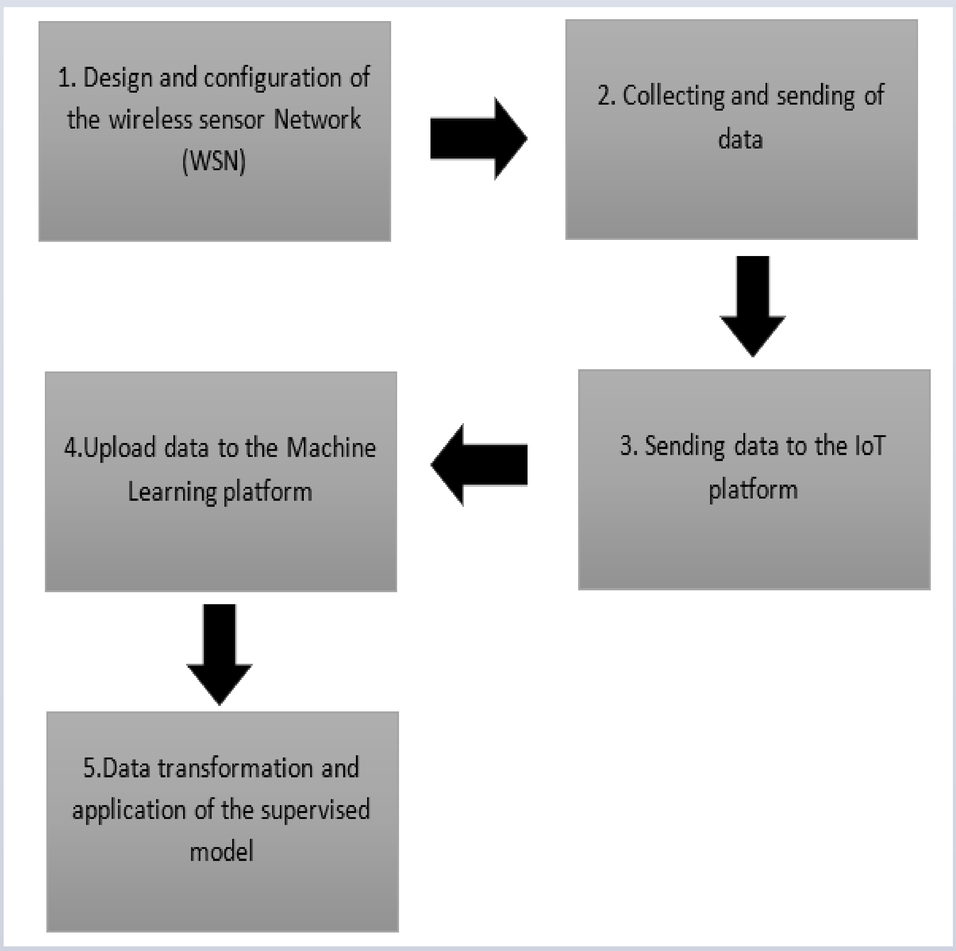

Fig. 1 Methodology used for the development of the Project

Expected Results

Applying the supervised model with classification through decision trees, we were able to establish that as the environmental humidity increases, the number of instances decreases and the soil humidity remains up to 79.69%, in conclusion, the higher the humidity of the environment, the soil moisture tends to decrease. In figure 2. we can see a decision tree taking the environmental humidity variable as a pivot.

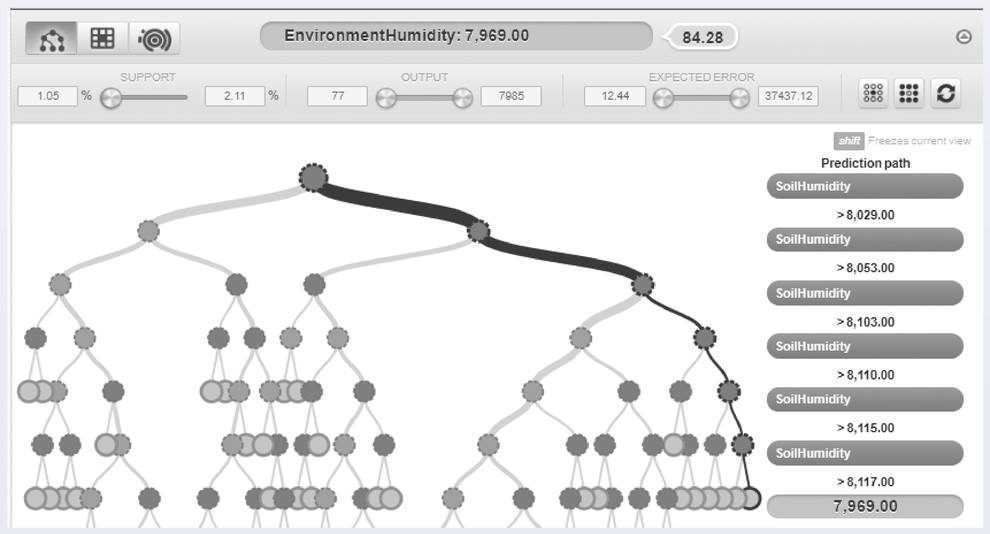

Fig. 2 Decision tree taken as reference environmental humidity

In other model we take as reference soil humidity variable, It was shown that as the temperature and environmental humidity increase, the number of instances decreases and the soil humidity increases until reaching 81.16%, In conclusion, In conclusion, the two previous variables are directly proportional to the soil moisture reached, that is, a higher temperature and relative humidity produce drying out of the ground. In figure 3. we can see a decision tree taking the soil moisture variable as a reference

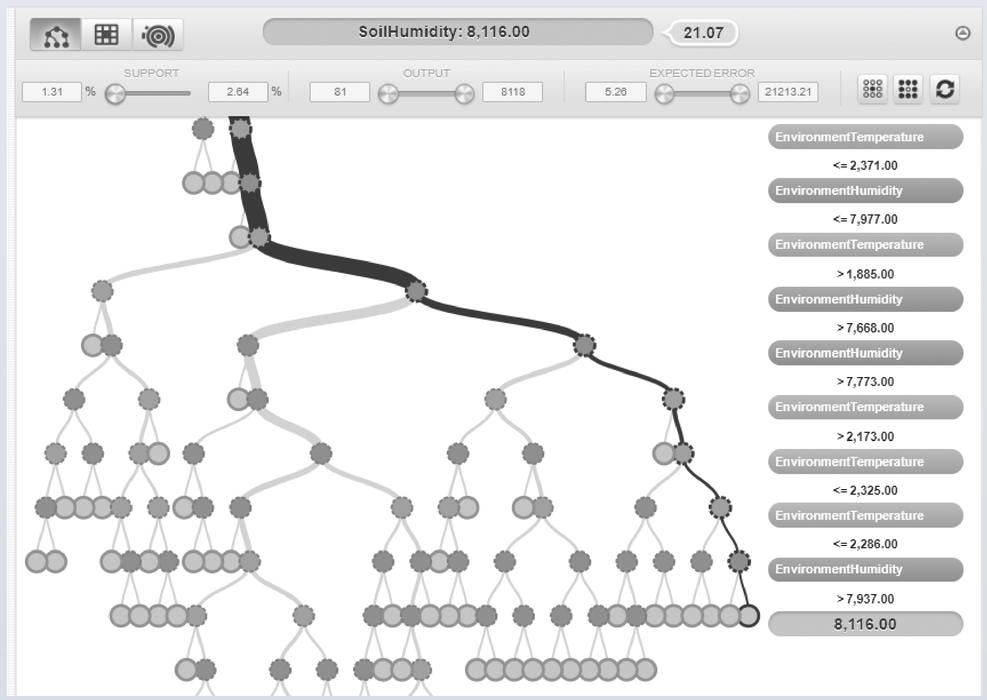

Fig. 3 Decision tree taken as reference soil humidity

Conclusions:

- The little knowledge of coffee farmers in technology and its possible applications in agriculture was evidenced, due in part to their lack of knowledge and their roots in traditional methods of growing and producing coffee.
- It was established that the same problem can be treated with different models of supervised learning. There are combinations of decision trees, such as the assembly of repeated samples and random decision forests) that can improve the results obtained. Another type of model called logistic regression can also be used for the classification problem.

References:

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