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An information system to early detect and control plant diseases and other causal agents of damage

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Short Abstract: The system diagnoses plant disease damages. First with the help of computational techniques the disease visual symptoms are assessed, then an expert system evaluates critical variables that affect the crop year-round, the result produces a diagnosis and the measures to control and eradicate the damage.

Long Abstract:

Plants, as well as humans and animals, are attacked by different kinds of agents that cause disease or damage. To counteract any attack, the best approach is to detect, on time, the presence of the causal agent, and apply the appropriate treatment to control its damage and transmission to other nearby crops.

The research developed offers the alternative of assessing automatically a crop in order to diagnose the causal agent that is affecting its normal growth and development. The strategy is based on what the expert, the farmer and the agricultural extension agent would do in real life. Thus, the first step is to identify the causal agent by analyzing an image that contains the visual symptoms of the damage. This is possible with the help of image processing techniques, which based on analyzing the image's intensities – behaviour and regularity in the histogram of frequencies - can finally extract, from the picture, the damaged region. The second stage is to classify the damaged region according to a set of features that characterize the image accurately (53 in total), some of these were: texture, lacunarity, grey scale and others that represent the image's shape. To do the classification, two techniques for pattern classification were researched: Support Vector Machine and Neural Networks, the former produced very good results despite its relative easy way of tuning the classifier's variables. Apart from this visual assessment, the exogenous and endogenous variables that have affected, positive or negatively, its development were also analyzed. To implement this stage an expert system with the ability to discern as to what is the crop current condition, in relation to a set of variables that described the historical and chronological events that surround the crop, was used. Finally, the results of the expert system were compared with those produced by the classifier, the diagnosis was sent to a database, which given the system output, searched for a suitable treatment to control and eradicate the potential or already-in-the-field damage. When no causal agent is identified, an alert is sent to a human expert, who ideally deals with the problem until he is able to send a satisfactory answer, in terms of possible crop treatment, that can possibly help the farmer to control the damage.

The system makes use of the Internet for data communication. The image and the variables, concerning the crop, are entered by users such as farmers or the agricultural extension

agent, and the results and suggestions for control are presented to them. The crops that can currently be assessed are cotton, banana/plantain, alfalfa and corn.

The generic approach developed can be applied to different crops and also to other areas e.g. medical diagnosis.

Keywords: Agriculture, plant disease diagnosis, image processing, pattern classification, expert systems, data mining