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Proposed framework for implementing data mining techniques to enhance decisions in agriculture sector

Applied case on Food Security Information Center

Ministry of Agriculture, Egypt

Ayman E. Khedr[a], Mona Kadry[b], Ghada Walid[b]*

[a]Faculty of Computers and Information, Department of Information Systems, Helwan University, Cairo, Egypt
[b]Arab Academy for Science and Technology and Maritime Transport, Department of Information Systems, Cairo, Egypt

Abstract

Egypt is facing a problem of food insecurity combined with poverty especially in rural Upper Egypt. Food availability is one of the main pillars of food security including production and importation. Information about food availability is collected from different sources but prediction of the needed amounts of the main strategic crops for the upcoming years is not automatically calculated. This paper aims to predict the needed amount of crops to satisfy the Egyptian citizens' needs for the upcoming years by building process of Artificial Neural Networks (ANNs) via WEKA using Multilayer Perceptron (MLP) function as a data mining predictive technique. Results showed that using this data mining framework succeeded to predict the annual needed amounts of the main strategic crops (Wheat, Rice and Beans) up to the year 2020. The obtained results could help decision makers for achieving food security and the country's productivity for the upcoming years continuously.

Keywords: Data mining; Food Security; Artificial Neural Network (ANNs); Multilayer perceptron (MLP); Knowledge Discovery (KDD); Food Security Information Center (FSIC).

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 * Corresponding author: Ghada Walid. Tel.: +20 0100 301 9704.
   E-mail address: ghadawalid@aast.edu

1. Introduction

Food security achieving is a significant and growing challenge and highly critical to reduce poverty rate. Planners, researchers, development agencies, farmers and citizens require information on the production of crops and nutrition requirements for further studies and evolving realistic strategies for improvement of the Egyptian production and to protect the citizens' health from malnutrition and different diseases. Data is also required for monitoring the movement of production prices of crops compared to imports.

Food Security Information Center (FSIC) is responsible for collecting data about the three pillars of food security, analyzing and reporting to decision makers to act with solutions to improve nutritional and health status of Egyptian population especially those in Upper Egypt. In the meantime a lot of data are collected from different resources while they are facing a real problem in analyzing the available data†. Therefore, the study problem could be stated as the Difficulty in analyzing the massive data concerning food security in order to enable decision makers to take appropriate actions for solving problems of food security.

Accordingly this study attempts to implement data mining techniques on Food Security Information Center (FSIC) massive data in order that the Egyptian Ministry of Agriculture can obtain their benefits and predict the required quantities of food and cost to cover the needs for the upcoming years for a healthy life of Egyptian citizens according to the population growth. The analysis of these data sets obtained from FSIC with applying data mining technique (Artificial Neural Network and Visualization) may yield useful outcomes to researchers in the Agriculture Research Center and decision makers. The study applies WEKA application to conduct qualitative analysis and to create a benchmark for the analysis of the dataset. The dataset was then analyzed by building artificial neural network using Multilayer Perceptron (MLP) within the data mining software.

The remaining of this paper is organized as follows; Section 2 introduces theoretical background of study, it is divided into two main issues; first is about Food Security, second is for DM concepts. Section 3 introduces DM in Agricultural Sector. Section 4 presents the proposed Data Mining System. Section 5 shows findings analysis and discussion. Finally, section 6 presents the conclusion and future work.

2. Theoretical Background

This section will discuss the main concept of Food security, then a brief theoretical background on data mining and previous applications of data mining in agriculture sector and food security.

2.1. Food Security

Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."[2]

The main target of Food Security Information Center is to help decision makers in agriculture sector with acceptable information about the main pillars of food security which are[3]:

- Food availability: sufficient quantities of food available on a consistent basis.
- Food access: having sufficient resources to obtain appropriate foods for a nutritious diet.
- Food use: appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation.

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[1] Interviewing with Prof. Dr. Akila Saleh Hamza the founder and coordinator of Food Security Information Center[1]