

# Support vector regression methodology for prediction of output energy in rice production

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**Abstract** The increase in world population has led to a significant increase in food demand throughout the world, so agricultural policy makers in all countries try to estimate their annual food requirements in advance in order to provide food security for their people. In order to achieve this goal, this study developed a novel predictive model based on the energy inputs employed during the production season. Rice caters more than 30 % of the calorie requirement for the Asian countries. In Iran too rice is one of the most important agricultural products. Therefore, objective of this study was to develop a model based on artificial intelligence for predicting the output energy in rice production. Such a model could help farmers and policy makers. This model employed the polynomial and radial basis function (RBF) as the kernel function for support vector regression (SVR). The input energies from different sources used during rice production were given as the inputs to the model, and the output energy was chosen as the output of the model. In order to achieve generalized performance,  $SVR_{poly}$  and  $SVR_{rbf}$  tried to minimize the

generalization error bound, instead of minimizing the training error. The results show that the proposed model improves the predictive accuracy and capability of generalization. Results show that SVRs can serve as a promising alternative for existing prediction models.

**Keywords** Support vector machine · Support vector regression · Rice · Energy

## 1 Introduction

Food security is defined as availability, access and utilization of food, which means people should have sufficient food for meeting their daily diet and preferences for an active and healthy life (FAO 2013). According to the definition of food security, policy makers of each country should make sure to supply adequate amounts of food in order to quench people food requirements. In other words, policy makers should focus on food system which embraces the production, processing, distribution, marketing, acquisition, and consumption of food.

Rice (*Oryza sativa*) is among most essential agricultural products in the world. In year 2011 rice held first position among all agricultural crops (FAO 2013). Worldwide, rice provides more than 70 % of human caloric intake, especially in Asia rice provides over 30 % of the required calories (Pishgar-Komleh et al. 2011). Likewise rice cultivation is important in Iran, due to high demand for rice as Iranian people consume it as their main meal. The statistics of Iranian agriculture organization reveals that annually Iran produces approximately 3 million tonnes of rice with average yield of  $5.3 \text{ t ha}^{-1}$  (Anonymous 2011). Despite this annually Iran imports 1.7 Mt of rice, because present rate of rice production cannot fulfil their domestic demand.

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