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Research on Agricultural Monitoring System based on Convolutional Neural Network

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Abstract: With the rapid development of social media, fluctuations in the price of vegetables are passed on to the people through the Internet in real time, which will certainly attract widespread attention in China. Therefore, Public opinion in social media is regarded as a latent factor contributing to market fluctuation. To predict the vegetable price fluctuation in China's market, a hybrid prediction model combining convolution neural network with corpora is constructed. Although a direct causality test shows the uncertainty between the vegetable price and public opinion in social media, strong causality is found after removing the seasonal effect of price. This shows that the spread of public opinion through the Internet can strengthen the link between vegetable price changes and external events by affecting the expectations of market traders.

Keywords: social media; agricultural monitoring system; corpora; convolution neural network.

1. Introduction

Vegetables are a major life necessity for urban and rural residents, and the vegetable market massively supports rural economic development. Fluctuations in vegetable prices affect farmers' income, quality of life, and decision-making regarding vegetable planting. Therefore, issues regarding maintaining price stability have long been focused on government policies. In recent years, the price of vegetables has exhibited dramatic and frequent volatility, which caused a series of negative effects on stakeholders in the supply-chain, e.g., farmers, logistics, wholesale, retail, and consumers. In view of the above adverse effects on stakeholders, it is of crucial importance to filter out key factors that relate to price fluctuations, targeting effective monitoring of real-time abnormal fluctuations.

In the past twenty years, related research showed that the application of the price history has served well for predicting the future price and has helped in the decision-making regarding maintaining price stability. Drachal used the data of monthly spot oil prices between 1986 and 2015 to analyze the oil price changes and to predict the crude oil price based on the Dynamic Model Averaging (DMA) and Dynamic Model Selection (DMS) framework [1]. Sharma collected the monthly consumer price index and the London gold price from 54 countries and provided reasonable evidence that the CPI was useful to predict gold price returns [2]. Lahmiri presented a stock prediction system by using the S&P 500 price index and six stock prices [3]. Neupane et al. used the data from three different electricity markets, New York, Australia, and Spain, to provide a highly accurate means to forecast electricity price [4].

Later, factors such as logistics and supply were also proven to be relevant to the price-control of agricultural commodity. Sophie Mitra determined that storage is an effective factor in the volatility of agricultural commodity prices [5]. Saban Nazlioglu and Ugur Soytaş proved that world oil price changes have impacts on agricultural commodity prices [6].

However, it is worth noting a new factor, in terms of the existing traditional factors, which can be added into the analytic framework for correlating vegetable price changes. Furthermore, recent research reveals that public opinion has become a new emerging resource for driving the changes in vegetable prices. As early as the 20th century, Urban used the methodology of structural equation modeling (SEM) to quantify the public opinion [7]. Since the rapid development of the Internet and the arrival of the big data era, John found that public opinion extracted from social media produces significant effects on people's decision making; this makes network public opinion a new factor in the market [8]. Gruhl proved that the analysis of the content of an online chatbot serves in forecasting book sales [9]. Fujimaki et al., created a new quantitative indicator to measure public attitude towards biotechnology- and health-related scenes in movies [10]. Moreover, Valentine proposed that sentiment information collected from reviews and box office revenue can be applied to predict movie sales [11]. Additionally, Bollen proved that information from Twitter offers a novel means to predict the stock market [12]. Cho et al., analyzed the Twitter campaign of the Ministry of Agriculture, Forestry and Fisheries (MFAFF), one of the Korean government agencies, by using social network analysis and content analysis, and found that its Twitter account could be an effective channel for information distribution and that public opinions in its Twitter account can be used as an communication tool for

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