Research Paper

Digital Signal Processing For Predicting Exchange Markets.

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ABSTRACT
This work is aimed at determining the digital signal processing (DSP) for predicting exchange markets. Where the statistical models have been useful in solving a variety of tasks. However, in online exchange rate predictions this is yet to be fully realized and avoid huge financial losses. These problems could the tackle with the following objectives to understand the existing DSP statistical model for predicting online exchange rate trends and to simulate software for monitoring and control of online exchange rate markets using Simulink Matlab. That was simulated giving appropriate graphs to buttress the effectiveness of using DSP for predicting exchange market.
KEYWORDS: *Digital Signal Processing, Prediction, Market Stock*

I.   INTRODUCTION

The use of digital signal processing as a tool for prediction has become demanding in building application areas in recent times on stock prices, industrial control, wireless communication, audio and video processing in core communication technology (Berson, 2015). This has greatly affected the constant rise and fall of the global market in the use of common prediction approaches that has worked for many companies and organizations. Thus, Stock marketers have device a means of using robot and other mirror monitoring gadgets to study and trade in stocks. With the outburst of the online selling and buying technologies invoke, one require intelligent systems or monitoring devices to understand when to buy or sell at every particular time to maximize profit.

There are various approaches used in monitoring stock prices available online but my studies choose the stochastic oscillator approach that uses momentum indicator to compares the closing prices of a stock for a range of its prices over a certain period of time. The sensitivity of this oscillator to market movements is reducible by adjusting that time period or by taking an average movement of the result. This will be used to generate overbought and oversold trading signals, utilizing a 0-100 bounded range of values (Investopedia, 2019). Sometimes, post implementation requirements crop up making modifications to already developed applications inevitable or engendering the need for a new application that encompasses all the requirements altogether (Charles, 2001).

Worthy of note also is the fact that business decision making relies heavily on market competition, this makes market forecasting very important in business planning. Market forecasting projects future numbers, characteristics and trends in your target market. It is of great importance to business owners, market practitioners, etc.

In a survey by Dalrymple (1975), he stated that 93 percent of companies indicated that market forecasting was one of the most crucial aspects of their company's success. Market forecasting can be quite a daunting task for businesses especially small ones as a result of changing consumer preferences, product array and increased competition. They may need to forecast the size and the growth of a market or product category.

In this work, we are going to develop an intelligent system that forecasts online markets with the aid of statistical models that will help business owners make better business decisions.

Exchange markets have gained in popularity with the FOREX markets top on the list of trades that have been widely utilized. More formally, online marketing refer to any form of trading i.e. buying and selling including advertising that take place over the internet. Online markets are a way of making business more convenient for businesses which may be far away from one another. Through distant communication networks

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such as telecommunication, sub-sea optical fiber links and web programs over the internet framework these form of marketing have been made possible. In recent times there have been calls to make online marketing more intelligent, in particular helping businesses to survive stiff competition over the internet. We see this as a challenge since there is vast amount of online markets with a heavy presence on the internet.

II. Research Review

Several DSP statistical models have been used in forecasting online markets like electricity price market, stock markets, crude oil markets, widget market etc.

Kuang, et. al. (2009) used the moving average autoregressive exogenous (ARX) prediction model and combined it with grey system theory and rough set theory to create an automatic stock market forecasting mechanism. The financial data used were collected automatically every quarter and were used in the ARX prediction model to forecast the future trends.

Silva et al. (2010) investigated the performance of the hidden Markov model (HMM) to forecast the medium term future crude oil price movements. Their approach was based on a nonlinear time-series model which uses past time-series data to predict future oil prices.

Wang et al. (2005) used ARIMA (autoregressive integrated moving average) to model the linear component of monthly WTI crude oil data from January 1970 through December 2003. From out-of-sample forecasts indicators, it was discovered that linear ARIMA models exhibits poor prediction power when compared to the nonlinear artificial neural network and the nonlinear integrated fuzzy expert system approaches.

Luckyn, et. al. (2018) The research work is focused on the application of time series and survival analysis to forecast future values from previous values to assist government or organization, plan ahead with precise data using the Kaplan Meier survival method of different classification of time series data to obtain the desired objectives. The results obtained from the implemented standalone software application, were validated with other proven data and results

Weron (2006) reviewed statistical approach for day ahead forecasting such as the ARMA (autoregressive moving average) type, ARMAX, GARCH type, regime-switching etc.

Cheema et al (2008) developed an online web based front-end interface using the PHP/MySQL Language for the forecasting of stock market data for small-time daily and weekly stock market investors. The system employed data mining, a web services program and neural network based stock prediction algorithm in Matlab. In addition 10popular technical indicators were investigated and they reported reasonable recommendation system for investors using the system.

III. SYSTEM ANALYSIS AND DESIGN
A.   MATHEMATICAL FORMULATIONS AND ALGORITHMIC DESIGN
This work presents the algorithmic mathematical formulation of the DSP system employed which is based on the moving averages principle. This is essential for a successful systems development and analysis.

In building algorithm for DSP based systems, the underlying theory of operation needs to be clearly understood. Here we focus on the DSP system prediction based on Moving Averages since this is a popular technical indicator particularly useful for time series exchange market predictions or foercasts. Statistical models derived from these indicators include the Simple Moving Average, the Weighted Moving Average and the Autoregressive Integrated Moving Average Models (the ARIMA models).
B.   Moving Averages
Moving averages are generally used to measure momentum and define areas of possible support and resistance. They are used to emphasize the direction of a trend and to smooth out price and volume fluctuations, or "noise", that can confuse interpretation. Typically, upward momentum is confirmed when a short-term average (e.g.2 or 3 weeks) crosses above a longer-term average (e.g. 10-weeks). Downward momentum is confirmed when a short-term average crosses below a long-term average. The most common way to interpreting the price moving average is to compare its dynamics to the price action. When the instrument price rises above its moving average, it means the price is high and the buyer can choose to buy or not, but if the instrument price falls below the moving average it means the price is low.
C.   Moving Averages Forecast Algorithm
1.   Initialize tma = today's moving average, yma = yesterday's moving average to 0
2.   Find tma as average of prices of last N days.
3.   Find yma as average of prices of last N days starting from yesterday.
4.   If (tma>yma), predict increase in impending price Else if (tma<yma), predict decrease in impending price.

D.   System Analysis

This will include system breakdown into component parts or models and a descriptive study of the subsequent parts. The logic behind this is that when a larger system is broken into small manageable parts, it is easier and simpler to decode the underlying principles and theories guiding each sub-model.

IV. Proposed System

The proposed forecasting system has been developed in MATLAB SIMULINK. The system uses an embedded MATLAB function block as DSP processing engine and accesses weekly exchange rate prices continually from the MATLAB workspace. In particular, the system uses a moving average DSP based statistical model as shown in Fig.1.
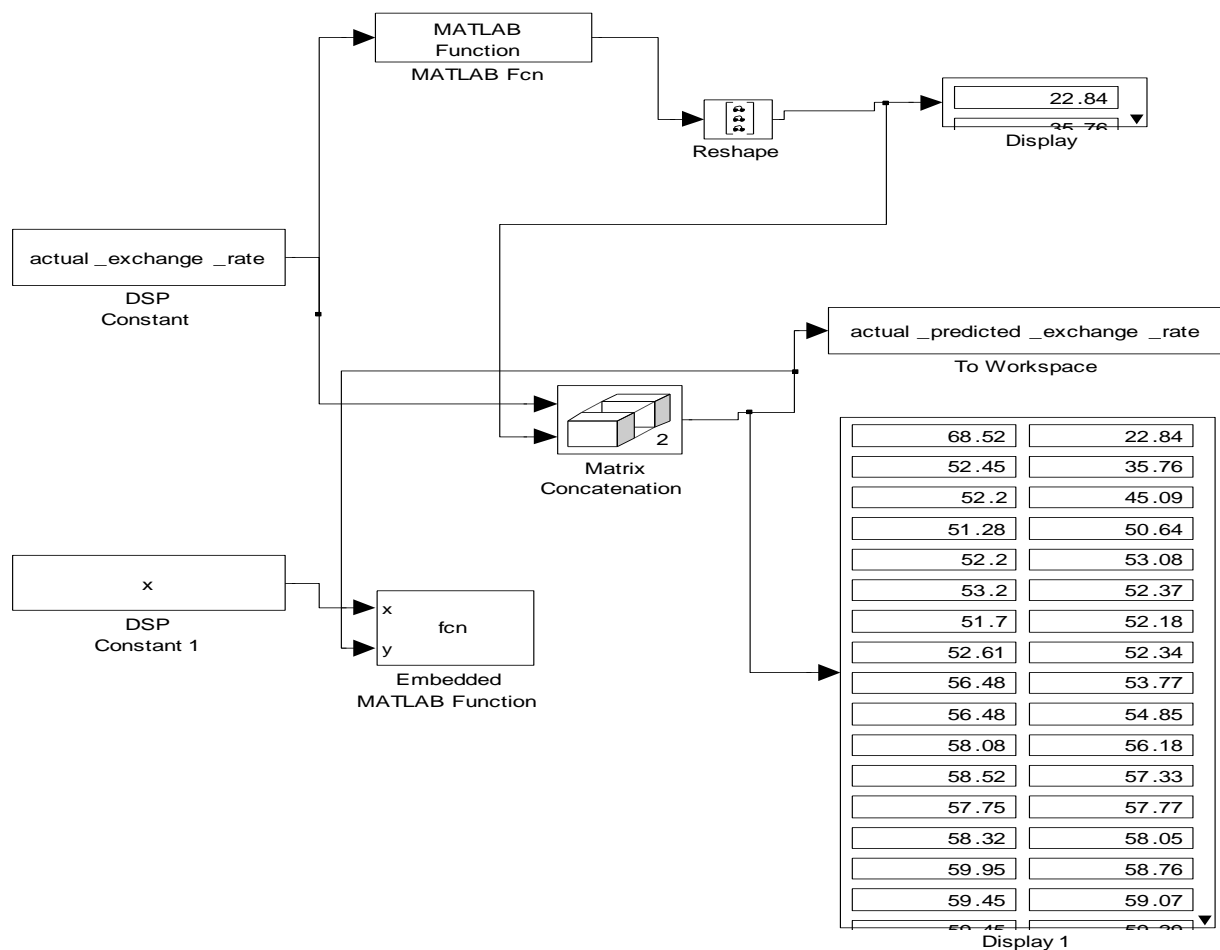

Fig.1. Architecture of Proposed System Model

A.   Dataset

The dataset are weekly prices from an exchange trading market company. The data is as shown in Table 1.1.

TABLE 1.1: WIDGET_PRICES.

Market Weeks	Time series price values(USD)
1	68.52
2	52.45
3	52.20
4	51.28
5	52.20
6	53.20

7	51.70
8	52.61
9	56.48
10	56.48
11	58.08
12	58.52

V. RESULTS

After developing the DSP moving average system model it was simulated considering different parameter settings of alpha i.e. the moving average type. The results are depicted graphically in Fig.2.
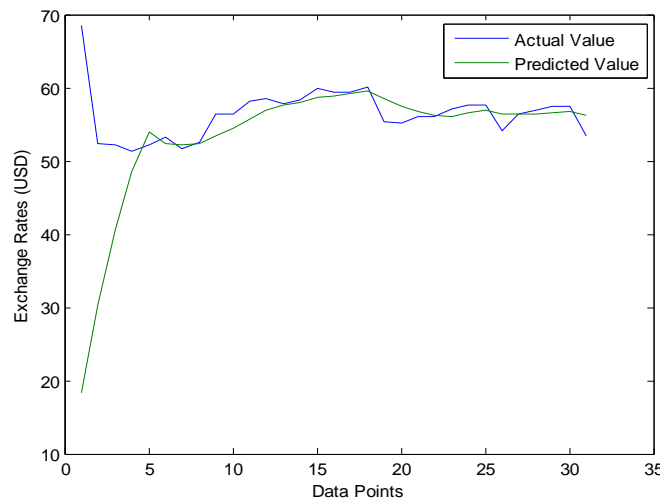
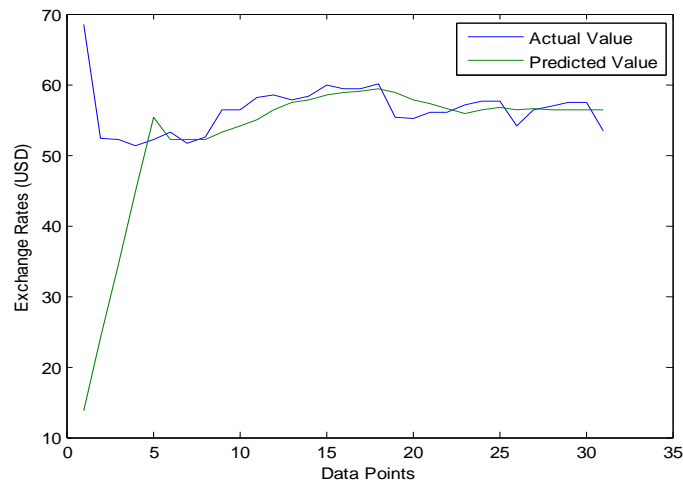Fig.2. Result at the default moving average – simple moving average

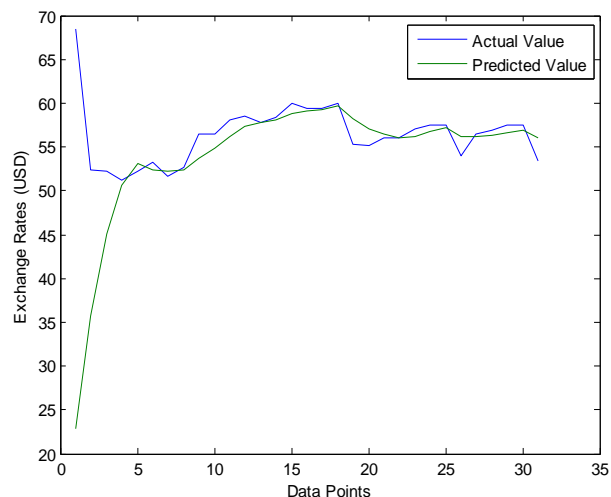Fig.3. Result at the default moving average – square root weighted moving average

Fig.4. Result at the default moving average – linear moving average

VI. DISCUSSIONS

As can be seen from the simulated results, there are rough similarities between the predicted responses of the various techniques. However, for the simple moving and square rooted types, there are noticeable sharp spikes between the data points 2 and 5 when compared to the linear moving average type.

VII. CONCLUSION

The system was thus used as a proof of concept for statistical learning of time series market data particularly when large variations exist. The proposed system has been implemented as a SIMULINK application. Using the system, online (continual) exchange rate market predictions can be carried out with minimum effort. The system is also adaptable to regular updates since it employs robust dynamic system model.

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