

Price Prediction System of Basic Commodities Using Long Short-Term Memory Method: Analysis and Implementation for Future Projections

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Abstract: The uncontrollable prices of basic commodities, especially food commodities, have resulted in losses for producers and consumers in the city of Cirebon. To be able to bridge these problems, it is necessary to make the right decisions. A prediction system is one of the elements that can be used to support the right decision-making. With an accurate price prediction system for staple food commodities, it is hoped that decision-making will be able to decide on good policies from the Cooperative, Small and Medium Enterprises Service for Trade and Industry (DKUKMPP) for the people of Cirebon City. The method used is Long Short-Term Memory (LSTM). The data used for the basic prices of food commodities, namely the last 3 years in 2020 - 2022, are sourced from the official website of the Ministry of Trade's Market Monitoring System and Basic Needs using Google Colab tools. 3. Predictions for staple food prices over the last 3 years include rice experiencing an increase of Rp. 275 per percentage of 2.35%, Granulated Sugar experienced an increase of Rp. 1000 with a percentage of 7.7%, Cooking Oil experiencing an increase of Rp. 1200 percent of 9.2%, Flour experienced a difference in the increase of Rp. 3500, a percentage of 50%, Beef Rp. 30,000 a proportion of 26%, Chicken Rp. 0, a percentage of 0%, Chicken Eggs, Rp. 9,000, a percentage of 45%, Red Chilies, Rp. 1,0,000, a percentage of 25%, Shallots, Rp. - 2,700 percent - 9.9%, Garlic IDR 11000 percentage 36.5%.

Keyword: Prediction, Price, Food, LSTM, Google Collab

INTRODUCTION

DKUKMPP explains that the needs for clothing, food and shelter are three important basic human needs. Of

the three basic needs, there is one basic need that is very important, namely the need for food. Food needs themselves refer to human needs for adequate and

balanced nutrition every day. The price of basic food commodities is one of the problems currently being faced, where this problem is caused by data on prices of basic food commodities which are uncertain and not presented well because they are in the form of estimates from sellers to consumers with prices that may vary [1].

Prices of basic commodities related to food commodities that will be predicted in this research are 10 commodities including rice, granulated sugar, cooking oil, wheat flour, beef, chicken meat, chicken eggs, red chilies, shallots, and garlic. Of the 10 basic commodities, these basic commodities are an initial reference that the price of basic commodities is an important thing in people's lives in Cirebon City. Where the need for basic food commodities for the community will continue to increase every day, month, and year. So, the Cirebon City DKUKMPP needs a price prediction system for basic commodities in Cirebon City with the aim of deciding on the exact price of basic food commodities whether they are rising, falling or stable.

In previous research entitled "Prediction of Food Commodity Prices Using the Long Short-Term Memory Algorithm" [2], the research explains that predictions of food commodity prices

have been carried out and can help farmers in knowing fluctuating food prices, especially commodity prices in traditional markets such as Sweet Market and Wage Market. In other research, "Short Term National Staple Material Price Prediction Using ARIMA" with ARIMA results can be used to predict national staple food prices in the short term between 1 to 30 days in the future. Experiments show that the ARIMA model built is able to predict prices of basic commodities quite accurately with an average error of 2.22% [3].

This research aims to produce a prediction system for 10 staple food commodities in Cirebon City with data used from January 1, 2020, to July 31, 2023. The resulting predictions can be used by the Cirebon City DKUKMPP for decision making in determining the prices of these 10 staple food commodities.

METHOD

Data Collection

The data used in this study is secondary data in the form of time series data, namely data on 10 prices of basic food commodities in DKUKMPP Cirebon City starting from January 1, 2020 – July 31, 2023.

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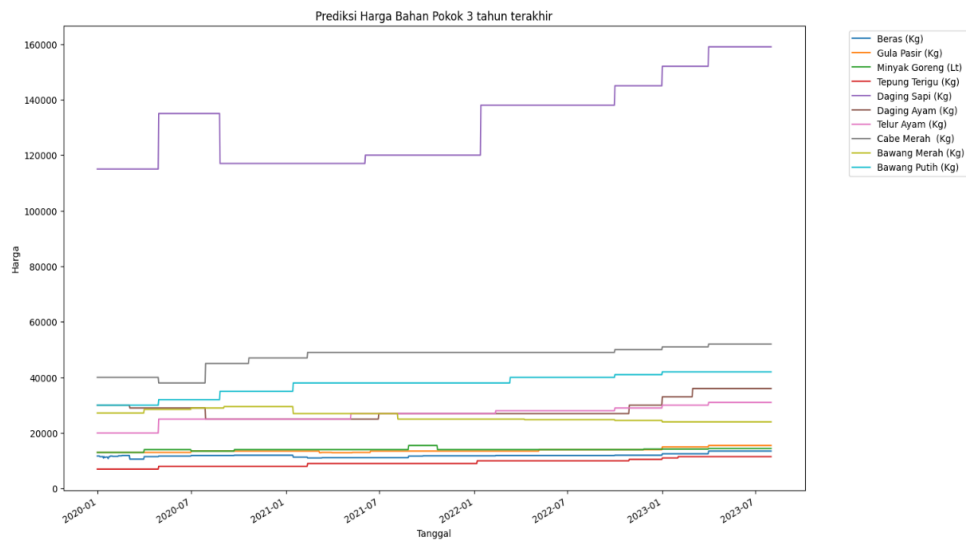


Figure 1. Graph Dataset 10 Prices of Food Commodity Staples

The data collection methods used by the author are as follows:

Observation

Observation (observation) is an activity on a process or object that is running, so that then it can understand knowledge from a known situation to obtain the information needed to continue research. The observation activity of this research is to collect data on the prices of food commodity staples, the data comes from the official website of the Ministry of Trade's Basic Needs Monitoring System (SP2KP) which is currently needed to continue the research study.

Student Literature

Literature study is a way used to collect sources related to the topic or method raised in a study. At this stage of activity is carried out by studying and reading scientific journal literature, reference books, documentation and theoretical sources owned by the campus related to the research theme raised and carried out by the author.

Software development methods

The software development method used in this study uses the *waterfall* method which is a *linear sequential software development method* or *classic life cycle* [4]. This method has 5 (five) interrelated stages, can be seen in Figure 2.

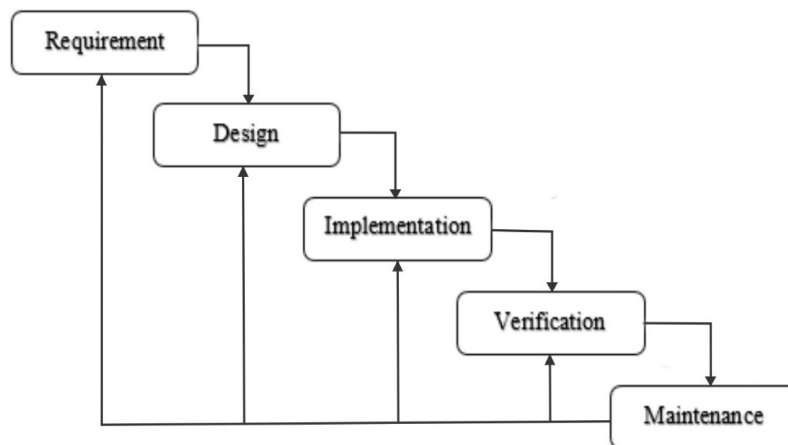


Figure 2. Waterfall Development Method

Information:

Requirements (System Requirements Analysis)

At this stage, observations and literature studies will be carried out on the things needed in the system to be built. The author conducted a literature study from various sources on studying data science, python programming language, *Long Short Term Memory* (LSTM) method.

Design

At this stage, an analysis and design will be carried out on the things needed in the system to be built. From the results of the analysis, a system design will be made using a *flowchart* diagram that will be used as a reference to develop a price prediction system for food commodities.

Implementation (Implementasi)

The next stage is the implementation stage, where at this stage is the process of translating the entire system design that has been

designed into program codes to produce a system as a whole.

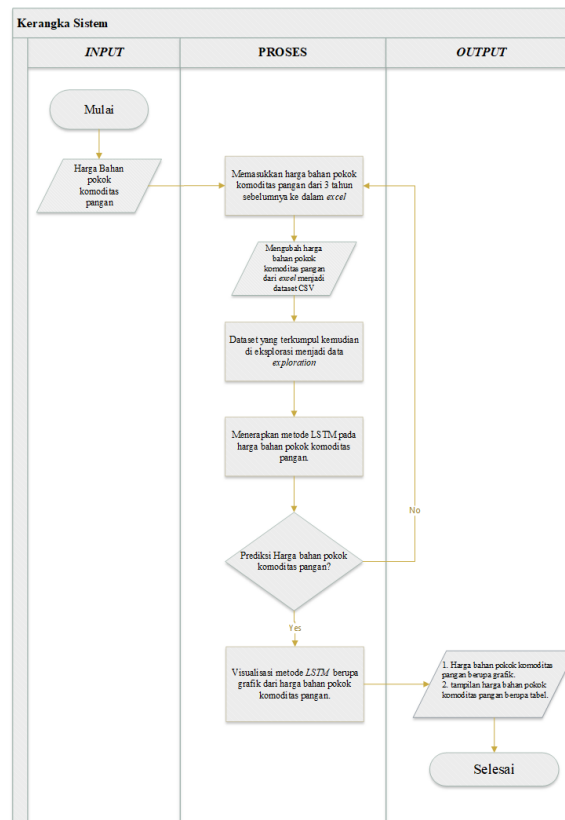
Verification

The next stage is the verification stage, at the stage of testing the price prediction system of food commodities at DKUKMPP by simulating the price prediction system of staples using the *Long Short-Term Memory* (LSTM) method. Then see whether the input data from the food commodity price prediction system can predict and distinguish between the price of staples or not. Furthermore, the data will be presented in the form of a test graph of the price of food commodity staples.

Maintenance

The last stage is the maintenance or maintenance stage of the system, in which there is an installation process and the process of repairing the system to predict the price of food commodities if errors are found that are not detected at the verification stage. After passing this last stage will result in a better system.

System Framework



In making the "Basic Commodity Price Prediction System Using the LSTM Method (Case Study: DKUKMPP Cirebon City)", the first process is to take the price of food commodities which then the results of taking the prices of food commodities will be entered in excel and convert csv files and will be analyzed by applying the *Long Short Term Memory* method (LSTM) to determine the price of

food commodity staples in the form of food commodity charts or not. The results of these calculations will be used as parameters to determine the prediction of prices of basic commodities. Graphs and tables of basic food prices will rise or fall when food commodities are predicted using the *Long Short-Term Memory* (LSTM) method.

RESULTS AND DISCUSSION

This section explains the results of the design that has been made and the discussion of the data used in this study.

Staple

Staples are basic food needs for human survival. The existence of staples

is influenced by production and selling prices. In each region, usually the need for main food ingredients also varies.

Food Commodities

Food commodities are superior trade goods to support the economy of a community in an agricultural country. A country's export activities can be

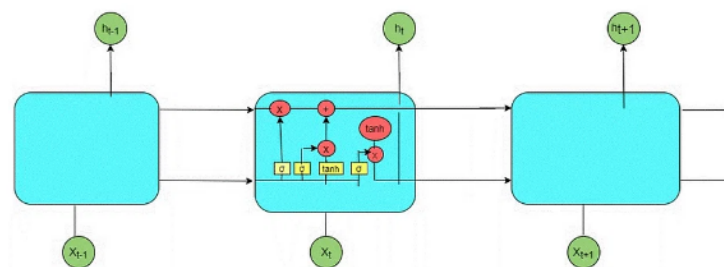
dominated by commodities in the form of agricultural food. In a broad sense, food is another term for food.

Prediction System

A system is an order consisting of several functional components (with specific tasks or functions) that are interconnected and together aim to fulfill a certain process / work. Prediction is something that is done systematically to predict something that may happen in the future based on past and present information, so that the difference between something that happens, and the expected outcome can be minimized. Predictions don't have to give a definitive answer to an upcoming event but try to find the answer as close to what will happen as possible.

Long Short-Term Memory (LSTM)

Long Short-Term Memory (LSTM) is a popular *Deep Learning algorithm* that is suitable for making predictions and classifications related to time. This algorithm can be said to be a development or one type of RNN (*Recurrent Neural Network*) algorithm. In the RNN algorithm, *the output* from the last step is fed back as input on the currently active step. However, the RNN algorithm has the disadvantage that it cannot predict words stored in long-term memory. The structure of the LSTM algorithm consists of *a neural network* and several different memory blocks. These memory blocks are referred to as *cells*. The state of the cell and the hidden state will be passed to the next cell. below, the blue rectangular shape is an illustration of *the LSTM cell*.



Sumber: projectpro.io

Figure 3. LSTM architecture

The information collected by the LSTM algorithm is then stored by the cell and memory manipulation is carried out by a component called a gate. There are three types of gates in the LSTM algorithm, including *Forget gate*, *Input gate*, and *Output gate*.

Test Results

The results obtained from the implementation of the LSTM algorithm in predicting the price of basic commodities will be explained in the section below. This testing process uses 1044 data records. After the dataset is determined, it will enter the next process, namely the pre-processing

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stage, if the dataset is good, then proceed to divide it into 80% training data and 20% testing data.

Table 1. Training and Testing

| No | Data | Jumlah |
|----|-----------------|--------|
| 1. | <i>Training</i> | 1044 |
| 2. | <i>Testing</i> | 261 |

From the results of experiments conducted on the dataset of 10 prices of food commodities with a total of 1305

commodities. Then the difference and price shown in the picture are as follows:

| | Bahan Pokok | mean | min | max | 2020/01/01 | 2022/12/31 | Selisih | Persentase Selisih (%) |
|---|--------------------|---------------|----------|----------|------------|------------|---------|------------------------|
| 0 | Beras (Kg) | 11668.968893 | 10580.0 | 12000.0 | 11725 | 12000 | 275.0 | 2.345416 |
| 1 | Gula Pasir (Kg) | 13476.761208 | 12900.0 | 14000.0 | 13000 | 14000 | 1000.0 | 7.692308 |
| 2 | Minyak Goreng (Lt) | 13961.756633 | 13000.0 | 15500.0 | 13000 | 14200 | 1200.0 | 9.230769 |
| 3 | Tepung Terigu (Kg) | 8874.656908 | 7000.0 | 10500.0 | 7000 | 10500 | 3500.0 | 50.0 |
| 4 | Daging Sapi (Kg) | 126684.354986 | 115000.0 | 145000.0 | 115000 | 145000 | 30000.0 | 26.086957 |
| 5 | Daging Ayam (Kg) | 27002.744739 | 25000.0 | 30000.0 | 30000 | 30000 | 0.0 | 0.0 |
| 6 | Telur Ayam (Kg) | 25934.126258 | 20000.0 | 29000.0 | 20000 | 29000 | 9000.0 | 45.0 |
| 7 | Cabe Merah (Kg) | 46672.461116 | 38000.0 | 50000.0 | 40000 | 50000 | 10000.0 | 25.0 |
| 8 | Bawang Merah (Kg) | 26558.005489 | 24500.0 | 29500.0 | 27200 | 24500 | -2700.0 | -9.926471 |
| 9 | Bawang Putih (Kg) | 36708.142726 | 30000.0 | 41000.0 | 30000 | 41000 | 11000.0 | 36.666667 |

Figure 4. The Price of Tree Materials

The results that have been done show that the price of staples has increased and there are also staples, namely shallots, which have decreased every time due to the ease of cultivation

and results obtained. By entering it into the *website* to make it easier for the people of Cirebon City to know the price of basic commodities.

Home Page

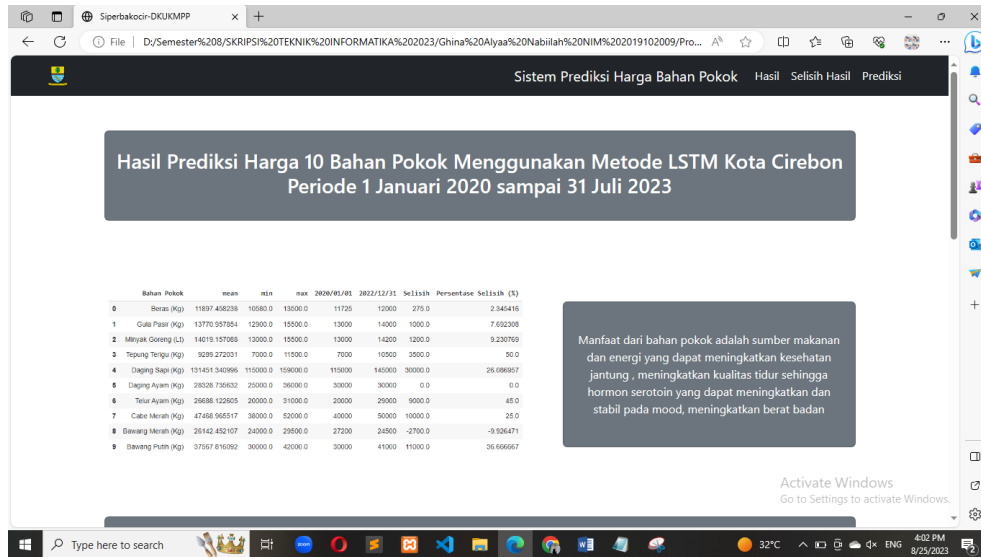


Figure 5. Home Page

On the main screen that will first appear when the user accesses the siperbakocir program, with the following information:

1. The results feature section will display an explanation of the price prediction results of 10 staples from January 1, 2020, to July 31, 2023.
2. The table features section explains the names of the staples of 10 staples, the mean or average of the price, the

minimum price, the maximum price, data from the first price to be predicted and finally price data, price differences, and price percentages that function to find out all the results of the predicted prices of staples.

3. And The benefits feature section explains that staples have benefits not just necessities.

Difference Display Page

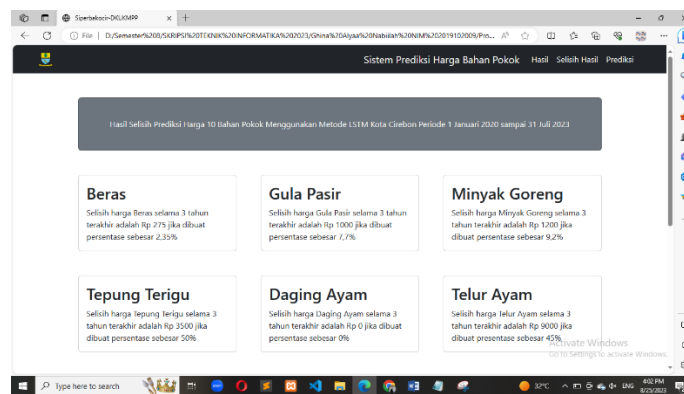


Figure 6. Difference Display Page

Display of price differences in the siperbakocir program, with the following information:

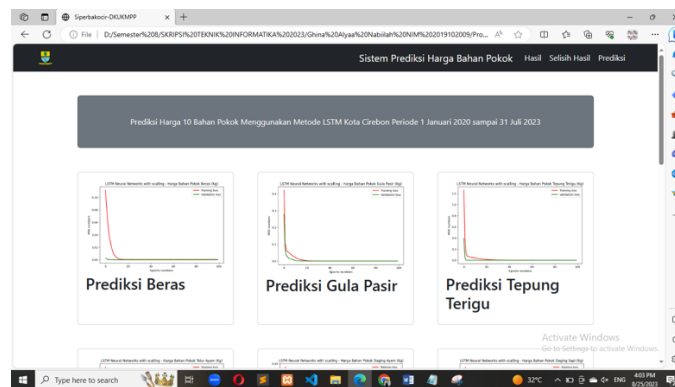
1. The price difference feature section is an explanation of the difference in the price of basic commodities for 3 years

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with 10 staples of food commodities whether they increase or decrease.

2. The price percentage is an explanation that the price increases or decreases based on percent.

Price Prediction Display Page



Display predictions of prices on the siperbakocir program, with the following information:

1. The prediction feature part of the price is an explanation of the prediction of 10 staples for 3 years.

CONCLUSION

Based on the test results from implementing the Long Short Term Memory algorithm, in predicting the price of basic food commodities using the Long Short Term Memory (LSTM) method, it can be concluded that predicting prices of basic commodities using historical data from January 1 2020 - July 31 2023 is able to provide information to DKUKMPP and the people of Cirebon City in the form of accurate predictions of 10 prices of basic food commodities so that they know the exact price of these basic commodities

using the Long Short Term Memory (LSTM) algorithm. Predictions of prices of basic commodities for the last 3 years, including rice, have experienced differences. an increase of IDR 275 with a percentage of 2.35%, Granulated Sugar experienced a difference of increase of IDR 1000 with a percentage of 7.7%, Cooking Oil experienced a difference of increase of IDR 1200 with a percentage of 9.2%, Flour experienced a difference of increase of IDR 3500 with a percentage of 50%, Beef, IDR 30000 percentage 26%, Chicken Eggs Rp 9000 percentage 45%, Red Chili Rp 10000 percentage 25%, Shallots Rp - 2700 percentage -9.9%, Garlic Rp 11000 percentage 36.5% . Accurate predictions of prices of basic commodities will have a good and positive influence on planning strategies for DKUKMPP and the people of Cirebon City regarding

purchasing prices of basic food commodities.

This research can be further developed by adding food commodities to predict and adding better variables to obtain more accurate predictions. Before selecting the method to be used, testing must be done with the data pattern to determine another better method such as Exponential Smoothing Holt-Winters (EST).

REFERENCE

- [1] F. I. Sanjaya, Prediksi Rerata Harga Beras Tingkat Grosir Indonesia Dengan Long Short Term Memory, Vol. 7 No.2, P. 12, 2020.
- [2] R. M. S. Adi, Prediksi Harga Komoditas Pangan Menggunakan Algoritma Long Short-Term Memory (Lstm), Vol. 4 No.2, P. 9, 2022.
- [3] P. Sokibi, Sistem Prediksi Penjualan Barang Furniture Dengan Metode Trend Linier (Studi Kasus : Cv. Independent Furniture), Vol. 4 No.11, P. 11, 2022.
- [4] M. Ihsan, Lstm (Long Short Term Memory) For Sentiment Covid-19 Vaccine Classification On Twitter, Vol. 13 No.1, P. 11, 2022.
- [5] N. O. Syamsiah, Peramalan Harga Telur Ayam Ras Di Jakarta Timur Berbasis Jaringan Syaraf Tiruan, Vol. 5 No.1, P. 5, 2020.
- [6] Sugianto, Peramalan Data Indeks Harga Konsumen Berbasis Time Series Multivariate Menggunakan Deep Learning, Vol. 5 No.1, P. 7, 2021.
- [7] M. R. S. Putra, Estimasi Harga Kebutuhan Pokok Di Kota Bandung Dan Provinsi Jawa Barat Menggunakan Metode Lstm, Vol. 7 No.1, P. 5, 2020.
- [8] M. Owen, Implementasi Metode Long Short Term Memory Untuk Memprediksi Pergerakan Nilai Harga Emas, Vol. 5 No.1, P. 9, 2022.
- [9] Y. Novialdi, Prediksi Harga Minyak Goreng Curah Dan Kemasan Menggunakan Algoritme Long Short-Term Memory (Lstm), Vol. 9 No.2, P. 9, 2022.
- [10] M. L. Ashari, Prediksi Data Transaksi Penjualan Time Series Menggunakan Regresi Lstm , Vol. 9 No.1, P. 10, 2020.



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