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APPLICATION OF WEB-BASED SIMPLE LINEAR REGRESSION ALGORITHM FOR FORECASTING GOODS STOCK IN RETAIL SMALL AND MEDIUM ENTERPRISES USING PHP PROGRAMMING LANGUAGE

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ABSTRACT

Inventory management is a critical challenge for Micro, Small, and Medium Enterprises (MSMEs). A common issue faced is the imbalance of stock (overstock or stockout), which directly impacts financial stability. This study aims to apply the Simple Linear Regression algorithm as a forecasting tool, integrated directly into a PHP-based Point of Sale (POS) system. Unlike common machine learning implementations that require Python or separate servers, this research focuses on a native PHP implementation suitable for shared hosting environments used by MSMEs. Data was collected from historical sales records and processed through calculation stages: variable determination, slope and intercept calculation, and forecasting. The results show that this lightweight implementation successfully provides accurate stock recommendations for the next period without burdening the server infrastructure. This confirms that basic predictive analytics can be effectively implemented in a web-based environment for low-resource businesses.

Keywords: Forecasting, Simple Linear Regression, PHP, Inventory Management, Web Engineering

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1. INTRODUCTION

The development of information technology requires business actors, including Micro, Small, and Medium Enterprises (MSMEs), to transition from manual record-keeping to computerized systems. However, many Point of Sale (POS) applications currently used by MSMEs only function as transaction recording tools, without having intelligent features to assist in strategic decision-making.

In the retail sector, fluctuations in market demand often cause inventory management problems. Stock shortages (stockouts) result in the loss of potential profits. Meanwhile, excess

inventory (overstock) increases storage costs and the risk of product expiration. Therefore, a forecasting method is needed to predict future stock requirements based on historical data. Turban, Aronson, and Liang (2005) state that a Decision Support System (DSS) must be able to utilize data and models to solve unstructured problems, such as uncertainty in market demand.

The main technical challenge is integration. Most modern Machine Learning algorithms are implemented using Python, which requires special server configurations (VPS/Cloud) that are expensive and difficult for MSMEs to manage. In contrast, most MSME websites run on shared hosting using the PHP language.

This research aims to bridge this gap by implementing the Simple Linear Regression algorithm natively using PHP. This approach enables the prediction feature to be embedded directly into the existing web-based cashier application without requiring additional infrastructure, making it an efficient and cost-effective solution.

2. RESEARCH METHODOLOGY

This section describes the systematic framework used to achieve the research objectives, starting from data collection to algorithm implementation.

2.1 Types and Approaches of Research

This research uses an applied quantitative approach. The data used are secondary data in the form of monthly sales history from a retail MSME case study. The main focus of this research is not on discovering a new algorithm, but on the technical implementation of statistical algorithms into a web programming environment (PHP) to improve operational efficiency.

2.2 Simple Linear Regression Method

Simple Linear Regression is a statistical method used to model the relationship between one independent variable (X) and one dependent variable (Y). In this context, X represents the time period (months), and Y represents the sales volume.

According to Montgomery, Peck, and Vining (2021), the linear regression equation is expressedas:

$$Y = a + bX$$

Where:

- Y: Dependent variable (Predicted Sales)
- X: Independent variable (Time Period)
- a: Constant (Intercept)
- b: Regression coefficient (Slope)

The values of a and b are determined using the Least Squares method with the following formula:

$$b = \frac{n(\Sigma XY) - (\Sigma X)(\Sigma Y)}{n(\Sigma X^2) - (\Sigma X)^2}$$

$$a = \frac{\Sigma Y - b(\Sigma X)}{n}$$

2.3 Data Collection

The collected data consist of transaction records of top-selling products over the last six months. These data were extracted from the MySQL database of the running cashier application. The extracted attributes include the transaction month and the total quantity sold.

2.4 PHP Implementation Strategy

Unlike the use of Python libraries (such as Scikit-Learn), the implementation in PHP is performed by translating the mathematical formulas above into procedural functions. This is done to avoid dependency on heavy external libraries and to ensure compatibility with all PHP versions on shared hosting environments.

3. RESULTS AND DISCUSSION

This research resulted in a software module integrated into the cashier administration interface. The following section presents the discussion of the code implementation and the calculation results.

3.1 Data Processing in PHP

The raw data from the database were retrieved and converted into an associative array. The first step was to calculate the summation components (Σ) required by the regression formula.

Figure 1. Data Retrieval Script

```php
<?php
$sql = "SELECT MONTH(tgl_transaksi) as periode_x, SUM(qty_terjual) as penjualan_y FROM tbl_transaksi
        WHERE tgl_transaksi >= DATE_SUB(NOW(), INTERVAL 6 MONTH) GROUP BY MONTH(tgl_transaksi)
        ORDER BY tgl_transaksi ASC";
$stmt = $pdo->prepare($sql);
$stmt->execute();
$dataset = $stmt->fetchAll(PDO::FETCH_ASSOC);
```

3.2 Algorithm Implementation

The core processing stage is performed by a custom linearRegression() function. This function takes the sales data array as input and returns the predicted value for the next month (n+1).

The implementation of the mathematical formulas into PHP syntax is presented in the following figure.

Figure 2. PHP Linear Regression Function

```php
<?
function hintungPrediksi($data) {
    $n = cont($data);
    $sumX = 0; $sumY = 0;
    $sumXY = 0; $sumXX = 0;

foreach ($data as $row){
    $x = $row['bulan'];
    $y = $row['qty'];
    $sumX += $x;
    $sumY += $y;
    $sumXY += ($x*$y);
    $sumXX += ($x*$x);
}
//implementation rumus montgomery (2021)
$b = ($n*$sumXY-$sumX*$sumY)/($n*$sumXX-pow($sumX,2));
$a = ($sumY-$b*$sumX)/$n;

$nextPeriod = $n+1;
$forecast = $a+($b*$nextPeriod);

return round($forecast);
}
```

The code above demonstrates that data preprocessing and statistical computations can be efficiently performed using standard looping structures, without requiring large memory resources as typically needed in Python-based data processing.

3.3 Calculation Result Analysis

The system performs calculations based on the test dataset. The following presents the results of the manual calculations validated by the system.

Figure 3. Calculation Table

Periode (X)	Penjualan (Y)	XY	X^2
1	150	150	1

2	160	320	4
3	165	495	9
4	175	700	16
5	190	950	25
Total	**840**	**2615**	**55**

Based on the data presented in Figure 3, the system calculates:

- $b (Slope) = 9.5
- $a (Intercept) = 139.5
- Predicted sales for month 6 ($Y) = $139.5 + (9.5 \times 6) = 196.5 (which is rounded to197 units).

This result indicates that the algorithm is able to capture the positive upward trend in sales and provide relevant stock recommendations.

3.4 Interface Implementation (POS Integration)

The calculation results are displayed on the Admin Dashboard in the form of a "Restock Recommendation" widget.

Figure 4. Recommendation Dashboard

(Place a screenshot of your application UI showing the prediction results)

The output of this system provides direct information to the store owner regarding the estimated quantity of items to be ordered, thereby reducing the risk of human error in manual calculations.

CONCLUSION

This research demonstrates that the Simple Linear Regression technique can be effectively implemented using pure PHP as part of a Decision Support System for MSMEs. This implementation successfully addresses server infrastructure constraints that are commonly encountered when using Python-based tools. With appropriate data preprocessing and the application of standard statistical formulas, the system is able to provide accurate stock recommendations based on historical data trends. This proves that intelligent solutions do not have to be expensive and complex, but can be built on existing standard web technologies.

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