PALM OIL PRODUCTION PREDICTION USING SUPPORT VECTOR REGRESSION ALGORITHM AND LONG SHORT-TERM MEMORY

TUGAS AKHIR

Diajukan Sebagai Salah Satu Syarat
untuk Memperoleh Gelar Sarjana Komputer pada
Program Studi Sistem Informasi

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UIN SUSKA RIAU

FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI SULTAN SYARIF KASIM RIAU
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di Pekanbaru, pada tanggal 03 Juli 2024

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Pekanbaru, 25 Juni 2024

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LEMBAR PERSEMBAHAN

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

Dengan menyebut nama Allah yang maha pengasih lagi maha penyayang

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Pekanbaru, 03 Juli 2024

Peneliti,

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International Conference on Circuit, Systems and Communication

NAASRM - National Association for Applied Scientific Research-MOROCCO

Date: June 05, 2024

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Dear Delvi Hastari,

Thank you for submitting your contribution ID-[260] for presentation at ICCSC2024 virtual conference "2024 International Conference on Circuit, Systems and Communication " to be held (virtual) June 28-29, 2024 in FSDM, SMBA University, Fez, Morocco.

Congratulations, your contribution meets acceptance requirements set forth by the Program Committee:

Event : 2024 International Conference on Circuit, Systems and Communication
Paper ID : 260
Paper title : Palm Oil Production Prediction using Support Vector Regression Algorithm and Long Short-Term Memory

Confirmation of your presentation on the final program is contingent upon receipt of the presenting author's registration and the payment of fees before 24 May 2024. Please indicate the ID of your paper in a payment order on the bank desk and after fill the registration form on this page : https://iccsc.info/reg.html

You must attend and present your work at the conference to be included in the final proceeding.

Thank you for your interest, and we look forward to working with you on a successful conference.

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From the
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Judul Disertasi/Thesis/Skripsi/Karya Ilmiah lainnya*:
Palm Oil Production Prediction using Support Vector Regression Algorithm and Long Short-Term Memory

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Pekanbaru, 5 Juli 2024
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*pilih salah satu sasuai jenis karya tulis

Palm Oil Production Prediction Using Support Vector Regression Algorithm and Long Short-Term Memory

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***Abstract*—Currently, palm oil plantations play an essential part of the agricultural sector, especially in the worldwide palm oil supply network. The global expansion of palm oil plantations has been swift, and Indonesia and Malaysia are expected to maintain their dominance in the export of vegetable oil. Palm oil produced by one company, which has 20 plantations spread across Riau, sometimes experiences fluctuations, both increases and decreases, in the previous period. This often occurs throughout the period, with a significant decline in production. This trend of fluctuations has raised concerns among parties facing uncertainty and risk in palm oil trading, and it affects the income of small farmers, which in turn impacts national revenue in the long term. An effective approach needs to be taken by predicting the production volume based on data from a specific period. Many techniques can be used for prediction, as has been done in previous research. However, this study applies a more consistent technique by using Support Vector Regression (SVR) and Long Short-Term Memory (LSTM) models. As per the research findings, the SVR model outperforms the LSTM model, as evidenced by the SVR's error value of 0.0%. This highlights the SVR model's superior performance compared to the LSTM model. Based on the SVR model's performance reaching 100%, this model can be used as a reference for predicting the production quantity of other types such as sunflower oil, olive oil, corn oil, or even rubber, tea, and similar products using time series data.**

Keywords*— *long short-term memory, palm oil, prediction, support vector regression

I. Introduction

Currently, palm oil plantations play an essential part of the agricultural sector, especially in the worldwide palm oil supply network. There has been a significant increase in the demand for oils and fats worldwide due to population and wealth growth, with global consumption rising from 166.76 million to 217.43 million tons between 2013 and 2022 [1]. Palm oil production has surged in response to this demand, with global production increasing from 59.3 million to 78.06 million tons over the same period [2]. here are more than three million small-scale palm oil plantations worldwide, producing approximately four million tons of palm oil annually. Palm oil stands out as the most productive oil-producing crop and is regarded as the most cost-effective vegetable oil when compared to other oil-producing crops [3]. The average palm oil yield surpasses that of other oil-producing crops by 3 to 8 times [4].

The global expansion of palm oil plantations has been swift, and Indonesia and Malaysia are expected to maintain their dominance in the export of vegetable oil. Corley [5] sawtooth minyak has the potential to meet the world's continuously increasing demand for sawtooth, estimated to reach 240 million tons by 2050. Considering the global consumption of vegetable oil is projected to continue increasing over the next decade [1], There remains significant untapped market potential for products derived from palm oil. Palm oil has become Indonesia's largest agricultural export. The export value of Indonesia's palm oil reached 29.63 billion USD in 2022 [6]. Palm oil serves not only as an essential source of national income but also plays a significant role in achieving the national biodiesel target (B-30) in 2020 [7]. In addition to being labor-intensive, oil palm cultivation provides a living for those who work on oil palm plantations. The amount of jobs, including those in the palm oil sector, will more than double [8]. Riau became the center of oil palm production in Indonesia with a production of 8.74 million tons. This amount is equivalent to 18.67% of national palm oil production of 46.82 million tons [9].

Palm oil produced by one company, which has 20 plantations spread across Riau, sometimes experiences fluctuations, both increases and decreases, in the previous period. This often occurs throughout the period, with a significant decline in production. This trend of fluctuations has raised concerns among parties facing uncertainty and risk in palm oil trading, and it affects the income of small farmers, which in turn impacts national revenue in the long term. Therefore, it is crucial to study the determinants of palm oil production to better anticipate production fluctuations over time and ensure stable production in the future, aiding in making wise decisions. An effective approach needs to be taken by predicting the production volume based on data from a specific period. This prediction can assist in forecasting monthly production based on previous data. Many techniques can be used for prediction, as has been done in previous research [10] [11]. However, this study applies a more consistent technique by using SVR and LSTM models.

Several prediction algorithms based on regression and classification have been utilized to forecast crop yields,

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including SVR and LSTM [12]. SVR, a component of the SVM methodology, seeks to estimate the function f(x) in accordance with the principle of structural risk minimization, as prescribed by statistical learning theory. SVR holds significant promise in mitigating overfitting due to its adherence to the concept of minimizing structural risk, which effectively manages the trade-off between prediction accuracy with a comprehensive regression function [13]. LSTM networks are effectively utilized for classifying and predicting sequential and time-series data. They consist of a forget gate, input gate, and output gate that manage the filtering of prior states. This structure is designed to capture earlier states that impact the current state, rather than just the most recent states[12].

Many studies have been conducted on SVR and LSTM for prediction. Research was conducted to evaluate the effectiveness of three data mining algorithms MLP, SVR and LR in predicting Crude Palm Oil (CPO) production based on the volume of Fresh Fruit Bunches (FFB). From testing using testing data, SVR produced higher accuracy and generated MSE error values of 955.002, MAPE 55.169, MAD 22.227, and PTA 0.694. To predict the amount of CPO production by applying SVR, a prototype was developed with a testing result of 80.225 [14]. The study employed an Artificial Neural Network (ANN) architecture comprising the input layer has 60 neurons, the hidden layer has 5 neurons, and the output layer has 1 neuron yielded the best accuracy with MAE and MSE of 0.5346 and 0.4707 using 5 hidden layers and the lowest accuracy using 2 hidden layers with MAE and MSE values of 1.5843 and 4.087 [15].

Another study compared the use of LSTM and Backpropagation for prediction improvement. With RMSE values of 0.8 for LSTM and 0.10 for Backpropagation, the outcomes of this research, which involved prediction, indicate that the LSTM approach is able to produce superior predictions compared to Backpropagation [16]. Another research utilized the LSTM-RNN method to predict forty-seven years of time series data, resulting in MAPE values of 2.7098% for training data and 2.9861% for testing data [17]. A study comparing the performance of SVR and ANN using an eight-year time series dataset found that the SVR model outperformed the ANN model with R^2 and MSE in the Radial Basis Function (RBF) kernel of 95% and 6%, respectively, while the ANN produced determination coefficient and MSE values of only 74% and 9% [10].

In another study, deep learning methods using the RNN-LSTM algorithm were applied to predict palm oil production. The data used consisted of the past 11 years, divided into 3, 5, 7, and 9 inputs. The best prediction results were achieved with 9 inputs, the validation model showed MSE, MAE, and MAPE values of 1.186, 0.732, and 0.030 respectively, while the evaluation model had values of 39.711, 4.210, and 0.154 [18]. Additionally, a study compared MLP and LSTM for predicting CPO prices. The LSTM test with Adam optimization and 6 hidden neurons showed that the predicted values did not differ from the actual values, with an MAPE of 2.11%. Therefore, LSTM has high forecasting accuracy because the MAPE is less than 10% [19].

An effective prediction model can be obtained by combining SVR and LSTM, as in previous studies. SVR and LSTM will also be used in this study to forecast palm oil production levels and assist in managing production scheduling in the future. The dataset used is the data from one company engaged in plantations in Riau, Indonesia, which includes information on the amount of palm oil produced each month from 2018 to 2023, used in this study.

II. Research Methodology

A. Research Flow

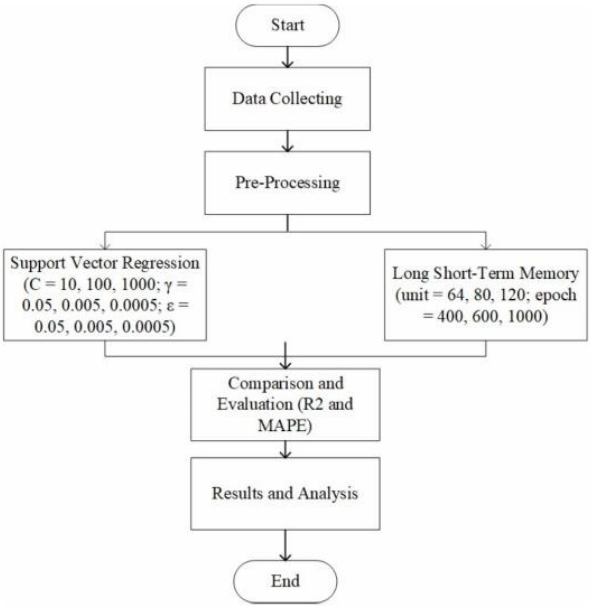

Fig. 1. Research Flow

The data used in this study is a time series dataset of palm oil production in 20 plantations belonging to one state-owned company focusing on palm oil and rubber located in Riau, Indonesia. Data was collected on a monthly basis from January 2018 to October 2023, totaling 70 rows of data per plantation. Subsequently, the obtained data was processed, normalized using min-max scaler, and divided into test data and training data. Two different processes were then applied to process the data. During the training stage, the SVR algorithm was utilized for model training, with the selection of hyperparameters such as C value, Gamma, and Epsilon. In contrast, for LSTM, hyperparameters including units, epochs, and activation functions were set to create the model. Subsequently, the model underwent testing by predicting the pre-arranged test data. The prediction results were then compared and evaluated using R^2 and MAPE to obtain the performance values of each model.

B. Support Vector Regression (SVR)

SVM, known for its powerful classification capabilities, has become increasingly popular. Although SVM was originally intended for classification, SVR was developed specifically for addressing regression problems [20]. The fundamental concept of SVR involves performing linear regression in a feature space with high dimensions, achieved by mapping the input data using a nonlinear function [21]. The objective of SVR is to approximate a continuous function $f(x)$ with a tolerance margin of ε for all output values [22]. The regression function is shown in the equation [23].

$$f(x) = w^t \varphi(x) + b \quad (1)$$

w is the weighting vector, $\varphi(x)$ is the function that transforms x to the feature space, b is the bias coefficient, and $f(x)$ is the regression function.

C. Long Short-Term Memory (LSTM)

LSTM is an adaptation of the Recurrent Neural Network (RNN) technique, or more precisely, it is the result of the evolution of the RNN method. LSTM overcomes the issue of the vanishing gradient, which is a common problem in RNNs when dealing with long sequences of time series data. As a result, learning occurs in these layers very slowly or not at all [24]. LSTM has the ability to generate an information graph in a long time span and resolve unexpected dependency issues [25]. There are several gates in the gate unit in the LSTM design, including the forget gate, input gate, and output gate [26]. Equations (2)-(7) represent the formulas below. [27].

$$f_t = \sigma(W_f \cdot [h_{t-1}, x_t] + b_f) \quad (2)$$

$$i_t = \sigma(W_i \cdot [h_{t-1}, x_t] + b_i) \quad (3)$$

$$\tilde{c_t} = tanh(W_c \cdot [h_{t-1}, x_t]) \quad (4)$$

$$c_t = f_t * c_{t-1} + i_t * \tilde{c_t} \quad (5)$$

$$o_t = \sigma(W_o \cdot [h_{t-1}, x_t] + b_o) \quad (6)$$

$$h_t = o_t tanh(c_t) \quad (7)$$

In formulas (2), (3) and (6), the notations in these equations, which are the forget gate, input gate, and output gate, are denoted by f_t, i_t and o_t respectively. The notation x_t represents the input data, and h_{t-1}, x_t represents the hidden vector step. W is the weight vector, and b is the bias. In formula (4) the notation $\tilde{c_t}$ indicates that it is the candidate value of the cell state, while in formula (5) the notation c_t represents the value of the cell state.

D. Evaluation Metric

The evaluation metrics can be utilized to gauge a model's performance. Evaluation metrics play an important role because of their ability to differentiate between different learning model outcomes [28]. Several performance metrics are used to assess the performance of regression models, such as the Coefficient of Determination and Mean Absolute Percentage Error.

- Coefficient of Determination (R^2), elucidates the degree of association between the predicted and observed values. The coefficient of determination evaluates the precision of a regression model's fit, indicating the extent to which the model outperforms a baseline model [29]. The coefficient of determination represents the amount of variance in the observed values explained by the linear regression model. Models with an R^2 greater than 55% are deemed satisfactory, those below 30% are considered questionable, and those exceeding 75% are regarded as excellent [30]. The equation's formula is utilized to compute the coefficient of determination's performance for the SVR and LSTM algorithms [31].

$$R^2 = 1\frac{(y_i - \hat{y}_i)^2}{(y_i - \bar{y}_i)^2} \quad (8)$$

y is a vector of actual values and $\hat{y}$ is a vector of predicted values.

- Mean Absolute Percentage Error (MAPE), calculates the average percentage difference, indicating the extent of deviation between the predictions made by the model and the actual values [28]. MAPE is a frequently employed metric in statistics to assess the precision of a forecasting approach. A MAPE value closer to zero signifies a more accurate prediction [32]. The formula for calculating the MAPE value is shown in the equation below [21].

$$MAPE = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{y_i - \hat{y}_i}{\hat{y}_i}\right| \times 100 \quad (9)$$

n is the number of data, y is a vector of actual values, and $\hat{y}$ is a vector of predicted values.

III. Result and Discussion

A. Support Vector Regression (SVR)

In the SVR model, the value of C is set to 10, 100, 1000 the value of gamma is set to 0.05, 0.005, 0.0005 and epsilon is set to 0.05, 0.005, 0.0005. These hyperparameters are paired with each testing data splits: 90:10, 80:20, and 70:30. The experiment's findings are detailed in Table 1.

TABLE I. Support Vector Regression Test results

Plantation	Parameter	90:10			...	70:30
	C	*10*	*100*	*1000*	...	*1000*
	Gamma	*0.05*	*0.005*	*0.0005*	...	*0.0005*
	Epsilon	*0.05*	*0.005*	*0.0005*	...	*0.0005*
SRO	R^2	98.6	100.0	100.0	...	100.0
	MAPE	6.1	0.6	0.1	...	0.2
STA	R^2	98.7	100.0	100.0	...	100.0
	MAPE	1.7	0.2	0.0	...	0.2
SIN	R^2	97.9	100.0	100.0	...	100.0
	MAPE	3.1	0.3	0.0	...	0.0
SSI	R^2	83.2	99.8	100.0	...	100.0
	MAPE	20.4	2.0	0.2	...	0.3
SBE	R^2	98.3	100.0	100.0	...	100.0
	MAPE	3.6	0.4	0.0	...	0.0
TER	R^2	97.6	100.0	100.0	...	100.0
	MAPE	5.0	0.6	0.1	...	0.0
TAN	R^2	99.0	100.0	100.0	...	100.0
	MAPE	8.4	0.8	0.1	...	0.1
SKE	R^2	99.2	100.0	100.0	...	100.0
	MAPE	1.3	0.1	0.0	...	0.1
SLI	R^2	99.0	100.0	100.0	...	100.0
	MAPE	7.4	0.7	0.1	...	0.1
SBL	R^2	95.3	100.0	100.0	...	100.0
	MAPE	5.3	0.4	0.0	...	0.1
TAM	R^2	96.3	100.0	100.0	...	100.0
	MAPE	3.8	0.4	0.0	...	0.0
SGO	R^2	73.2	99.7	100.0	...	100.0
	MAPE	6.2	0.6	0.1	...	0.1
SGH	R^2	85.0	99.8	100.0	...	100.0
	MAPE	6.4	0.6	0.1	...	0.1
SPA	R^2	73.1	99.7	100.0	...	100.0
	MAPE	6.6	0.7	0.1	...	0.1
TME	R^2	97.2	100.0	100.0	...	100.0
	MAPE	7.7	0.8	0.1	...	0.1
TPU	R^2	60.0	99.6	100.0	...	100.0
	MAPE	7.7	0.8	0.1	...	0.1
AMO-1	R^2	98.7	100.0	100.0	...	100.0
	MAPE	3.0	0.4	0.0	...	0.1
AMO-2	R^2	91.1	99.9	100.0	...	100.0
	MAPE	9.4	0.9	0.1	...	0.2
LDA	R^2	98.8	100.0	100.0	...	100.0
	MAPE	5.8	0.6	0.1	...	0.1
SBT	R^2	82.9	99.8	100.0	...	100.0
	MAPE	5.4	0.5	0.0	...	0.1

From the test results, optimal parameters and data ratios were obtained to predict the production quantity in the twenty plantations. Fig. 2 shows the prediction results graph of the Sei Kencana (SKE) plantation, where the attributes have optimal parameter and ratio testing. The testing shown in the figure uses a data ratio of 90:10, parameter C set to 1000, gamma set to 0.0005, and epsilon set to 0.0005. This experiment resulted an R^2 value of 100.0% with an error value of 0.0%.

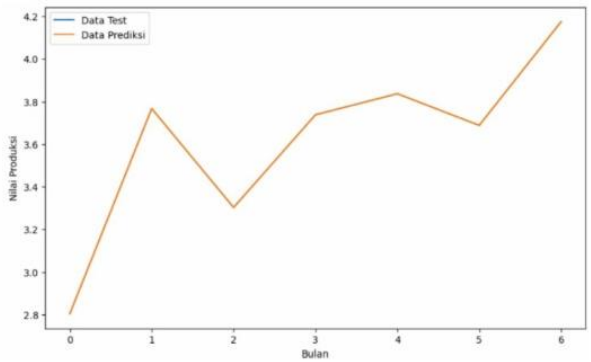

Fig. 2. Prediction result chart of Sei Kencana Plantation

B. *Long Short-Term Memory*

This research applies hyperparameter units to 64, 80, 120. hen the epoch iteration is set to 400, 600, 1000. The activation function used is relu. These hyperparameters are paired with each scenario of data distribution ratio 90:10, 80:20, and 70:30. The experiment's findings are detailed in Table 2.

TABLE II. LONG SHORT-TERM MEMORY TEST RESULTS

Plantation	Parameter	90:10			…	70:30
	Unit	*64*	*80*	*120*	…	*120*
	Epoch	*400*	*600*	*1000*	…	*1000*
SRO	R^2	99.6	99.7	99.8	…	99.8
	MAPE	1.2	2.1	64.8	…	157.9
STA	R^2	97.8	99.6	99.7	…	99.4
	MAPE	2.0	1.0	19.8	…	169.4
SIN	R^2	97.5	99.8	99.9	…	99.7
	MAPE	4.0	1.0	35.7	…	66.8
SSI	R^2	94.8	99.7	98.9	…	95.1
	MAPE	11.3	2.4	56.0	…	57.4
SBE	R^2	99.8	99.7	99.8	…	99.4
	MAPE	1.7	1.6	46.8	…	70.0
TER	R^2	99.6	98.8	99.9	…	99.3
	MAPE	2.0	2.6	51.0	…	44.3
TAN	R^2	99.4	99.9	99.4	…	99.9
	MAPE	3.0	1.9	91.1	…	95.0
SKE	R^2	90.8	97.1	97.9	…	99.9
	MAPE	4.6	2.7	17.7	…	47.8
SLI	R^2	99.9	99.9	99.4	…	99.5
	MAPE	0.9	2.5	88.5	…	98.6
SBL	R^2	97.3	93.1	93.9	…	96.7
	MAPE	0.8	1.4	15.4	…	46.7
TAM	R^2	97.3	99.9	99.4	…	99.7
	MAPE	3.3	0.4	26.5	…	36.4
SGO	R^2	99.6	98.7	84.2	…	97.1
	MAPE	0.8	1.3	13.8	…	18.5
SGH	R^2	99.7	99.8	93.3	…	98.9
	MAPE	1.2	0.7	20.3	…	20.3
SPA	R^2	99.9	98.1	97.5	…	95.7
	MAPE	0.2	1.7	15.0	…	18.5
TME	R^2	99.7	99.9	99.6	…	99.4
	MAPE	1.6	1.0	76.1	…	61.3
TPU	R^2	99.2	96.8	-32.4	…	85.0
AMO-1	R^2	93.9	98.1	97.9	…	72.6
	MAPE	4.3	2.1	36.5	…	57.6
AMO-2	R^2	86.3	92.0	91.6	…	69.0
	MAPE	4.9	0.7	22.3	…	46.4
LDA	R^2	99.9	99.5	99.8	…	99.9
	MAPE	2.0	2.9	81.5	…	88.1
SBT	R^2	99.5	99.9	98.3	…	93.7
	MAPE	1.0	0.3	15.7	…	21.2

Based on the experiments, optimal hyperparameters and data ratios were obtained from the LSTM model in predicting the quantity of palm oil production. Fig. 3 shows the prediction results graph of the Sungai Pagar (SPA) plantation using a data ratio of 90:10 with hyperparameters unit 64, epoch 400, and relu activation function.

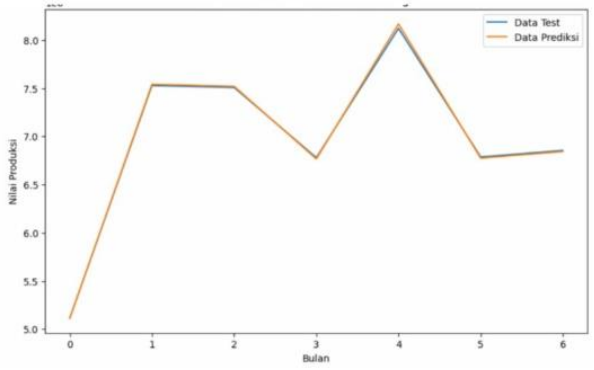

Fig. 3. Prediction result chart of Sei Pagar Plantation

Fig. 3 yields an R^2 value of 99.9% with an error value of 0.2%. It can be seen that the activation function works very well for each prediction attribute. This can occur because the activation function used, namely relu, can overcome the vanishing gradient, which hinders the model's ability to learn and update information correctly.

C. *Comparison of Machine Learning Performance in Terms of Performance Metric Evaluation*

Table 3 presents the models for machine learning and deep learning utilized for predicting crop yield, along with their corresponding parameters.

TABLE III. DIFFERENT PREDICTION ALGORITHM FOR CROP YIELD PREDICTION

Research	Data	Model	Performance Evaluation Metrics
[33]	Wheat Yield prediction (spatial and temporal)	DNN	R^2 0.77, MAPE 15.38, RMSE 721 kg/ha
[34]	Maize Yield Prediction (Spatial and Temporal Data)	Random Forest	R^2 075
		XGBoost	R^2 0.77
		LSTM	R^2 0.68
[35]	Soybean Yield Prediction (Spatial and Temporal Data)	CNN-LSTM	R^2 0.78, RMSE 329.53

Research	Data	Model	Performance Evaluation Metrics
[36]	Soybean Yield Prediction	DNN	R^2 0.720
		SVR	R^2 0.669
		RF	R^2 0.662
[17]	Palm oil production (temporal data)	LSTM	MAPE 2.7098%
[37]	palm oil yield (temporal data)	Genetic Algorithm	R^2 0.948, MSE 0.022
[38]	NDVI and LAI data corn yield	Regression Analysis	R^2 0.92-0.94
[39]	Wheat yield prediction (spatial and temporal data)	SVM	R^2 0.77
		GPR	R^2 0.79
		RF	R^2 0.81
[40]	Wheat yield prediction (spatial and temporal data)	SVM	R^2 0.75
[41]	Rice yield prediction (spatial and temporal data)	BPNN	RMSE 800 kg/ha, R^2 0.24
		RF	RMSE 744 kg/ha, R^2 0.31
		SVM	RMSE 737 kg/ha, R^2 0.33

IV. Conclusion

The prediction of oil palm production quantities using SVR and LSTM models has been conducted on time series data for 20 plantations. he optimal parameters and data ratios were determined for each prediction attribute, resulting in the best performance for each model. For the SVR model, the optimal data ratios and parameters were 90:10, 80:20, and 70:30, with C, gamma and epsilon (100, 0.005 and 0.0005), (1000, 0.005 and 0.0005) yielding an R^2 value of 100% and MAPE of 0.0%. Meanwhile, the LSTM model, utilizing a data ratio of 90:10, unit = 64, and epoch = 400, achieved an R^2 value of 99.99% and MAPE of 0.2%. As per the research findings, the SVR model outperforms the LSTM model, as evidenced by the SVR's error value of 0.0%. This highlights the SVR model's superior performance compared to the LSTM model.

The superiority of SVR arises because in situations with limited data, SVR can establish better non-linear relationships compared to LSTM. Previous studies in this research utilized different datasets. Time series data from 2019-2023 were obtained from one state-owned company focusing on palm oil and rubber located in Riau, Indonesia, which currently consists of a total of 20 plantations. This study also compared algorithms with higher computational complexity, such as LSTM. Like other studies, this research also has limitations. The dataset used is relatively small, covering only a 5-year period. Based on the SVR model's performance reaching 100%, this model can be used as a reference for predicting the production quantity of other types such as sunflower oil, olive oil, corn oil, or even rubber, tea, and similar products using time series data.

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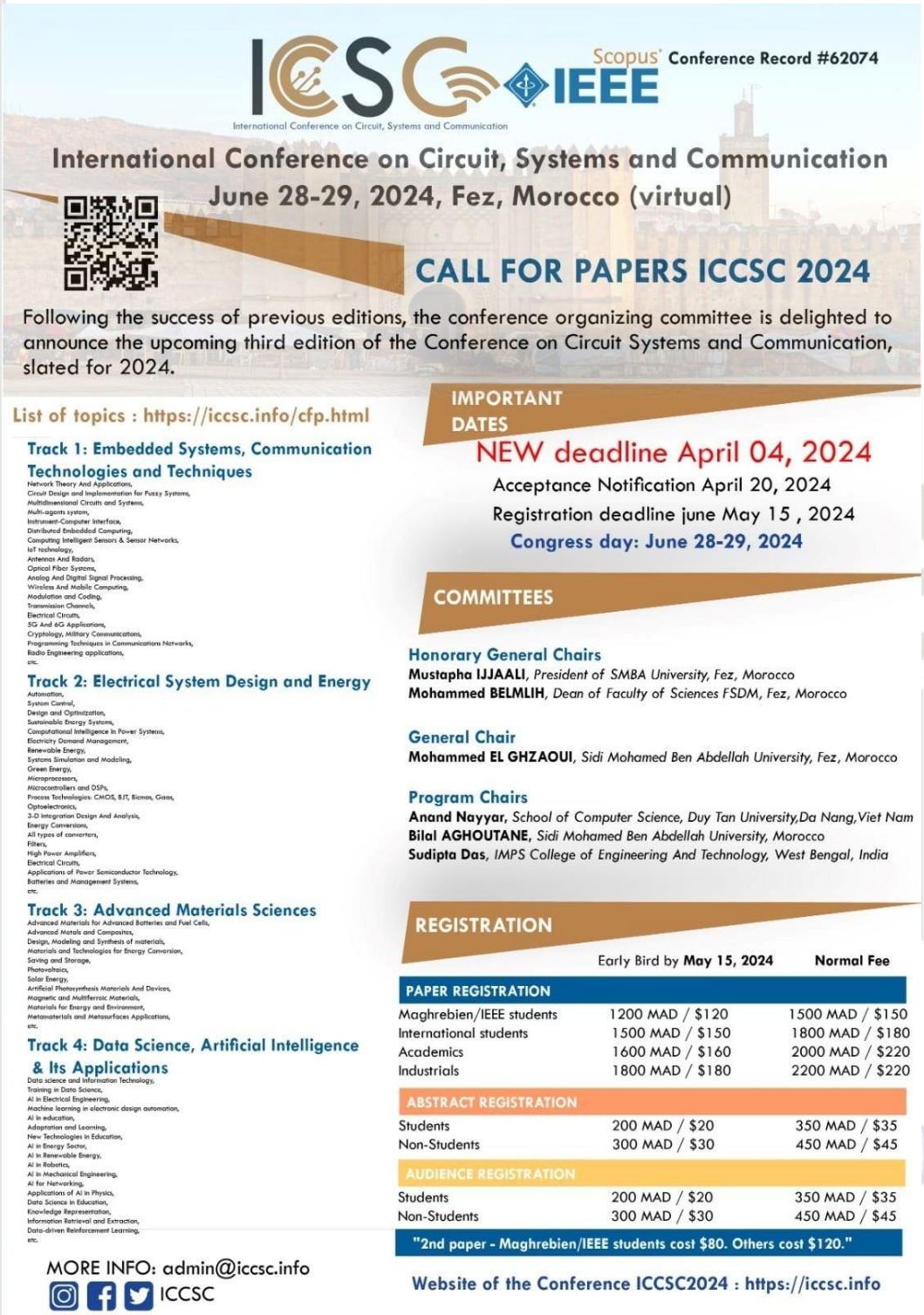

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Microsoft CMT <email@msr-cmt.org> 28 April 2024 pukul 05.11
Balas Ke: Bilal Aghoutane <bilal.aghoutane@uit.ac.ma>
Kepada: Delvi Hastari <12050320385@students.uin-suska.ac.id>
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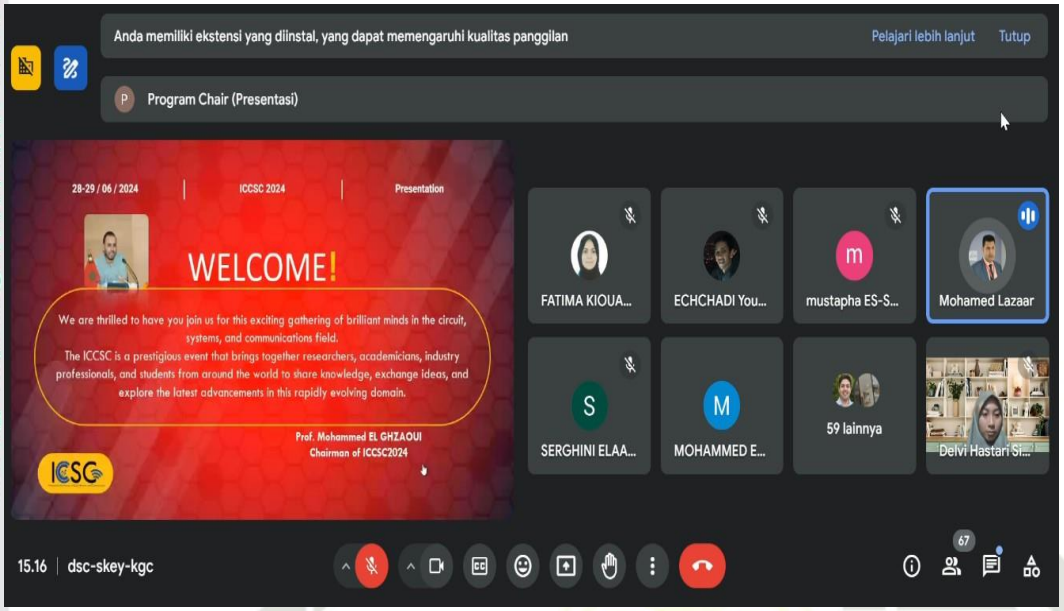
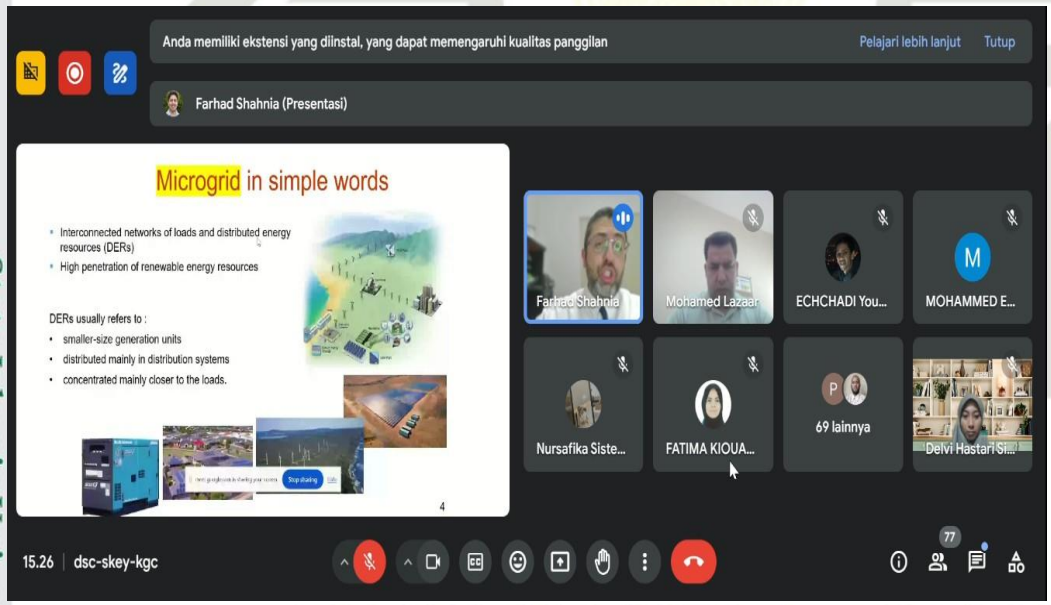
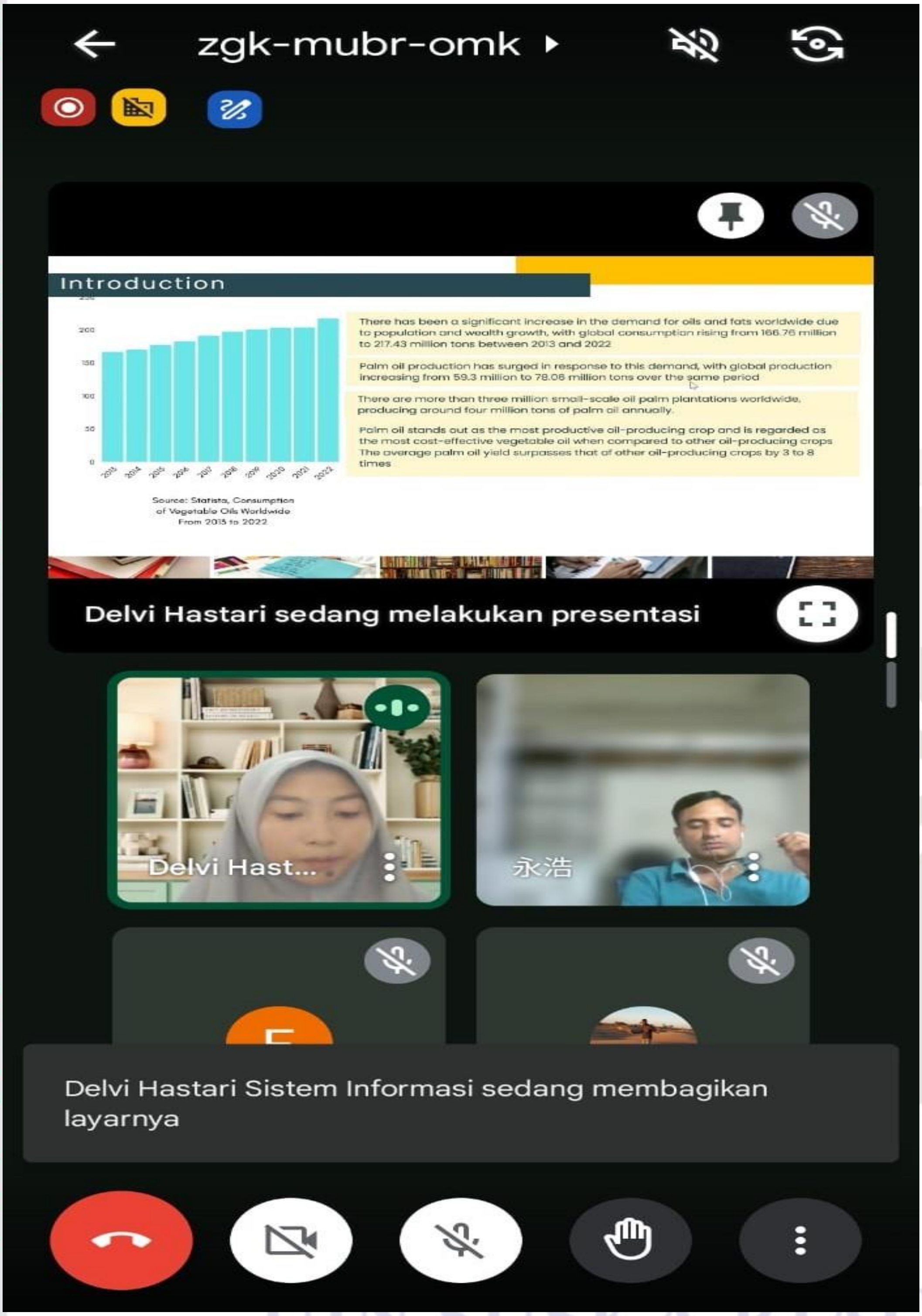






LAMPIRAN D

REVIEW DAN REVISI

D.1 Review dari Reviewer

View Reviews

Paper ID
260

Paper Title
Palm Oil Production Prediction Using Support Vector Regression Algorithm And Long Short-Term Memory

Reviewer #1

Questions

1. Comments to authors
1. A comparative table should be included (performance analysis of other research works using similar parameters)
2. References must be in the same format.
3. The advantages and limitations must be mentioned.
4. Is this method applicable to other type of oil production? Have you studied about this?

Reviewer #2

Questions

1. Comments to authors
- The authors apply a theoretical investigation to study the Palm Oil Production Prediction Using Support Vector Regression Algorithm And Long Short-Term Memory
1.The author should give more of the motivation why they choose the E Palm Oil Production Prediction in introduction.
2. The authors should give the role do oil palm plantations play in the agricultural industry nowadays based on this study.
3. According to the tests, which model is superior: SVR or LSTM
4. The authors shpould give the error value associated with the Support Vector Regression model

In general, the manuscript has a correct methodological structure. But for my opinion the authors should making a major revision on this manuscript. I hope that authors reconsider these all points, and they clarify some issues.

D.2 Catatan dari Reviewer

View Chair Note

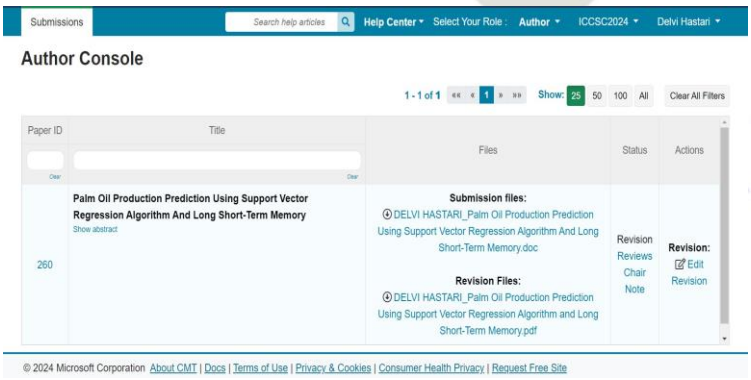
Paper ID
260

Paper Title
Palm Oil Production Prediction Using Support Vector Regression Algorithm And Long Short-Term Memory

QUESTIONS

1. Informations & report plagiarism :
The similarity index of your paper is 18% which is high. You should to reduce it below 15%.
Here is the link to the similarity report of your paper.
https://drive.google.com/file/d/1zqry69AsvebZTemknMJ4BNDddw1K6B6X/view?usp=sharing

D.3 Bukti Revisi



LAMPIRAN E

REGISTRASI

E.1 Form Registrasi

E.2 Bukti Pembayaran

INVOICE

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Date: May 31, 2024
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LAMPIRAN F

CAMERA READY

Camera Ready Summary

Conference Name

2024 International Conference on Circuit, Systems and Communication

Paper ID

260

Paper Title

Palm Oil Production Prediction Using Support Vector Regression Algorithm And Long Short-Term Memory

Abstract

Currently, palm oil plantations play an essential part of the agricultural sector, especially in the worldwide palm oil supply network. The global expansion of palm oil plantations has been swift, and Indonesia and Malaysia are expected to maintain their dominance in the export of vegetable oil. Palm oil produced by one company, which has 20 plantations spread across Riau, sometimes experiences fluctuations, both increases and decreases, in the previous period. This often occurs throughout the period, with a significant decline in production. This trend of fluctuations has raised concerns among parties facing uncertainty and risk in palm oil trading, and it affects the income of small farmers, which in turn impacts national revenue in the long term. An effective approach needs to be taken by predicting the production volume based on data from a specific period. Many techniques can be used for prediction, as has been done in previous research. However, this study applies a more consistent technique by using Support Vector Regression (SVR) and Long Short-Term Memory (LSTM) models. As per the research findings, the SVR model outperforms the LSTM model, as evidenced by the SVR's error value of 0.001%. This highlights the SVR model's superior performance compared to the LSTM model. Based on the SVR model's performance reaching 100%, this model can be used as a reference for predicting the production quantity of other types such as sunflower oil, olive oil, corn oil, or even rubber, tea, and similar products using time series data.

Authors

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Camera Ready Files

DELVI HASTARI_Palm Oil Production Prediction Using Support Vector Regression Algorithm and Long Short-Term Memory_Camera Ready.pdf (637.9 Kb, 5/30/2024, 10:22:14 PM)

DAFTAR RIWAYAT HIDUP

Delvi Hastari atau akrab dipanggil Delvi, lahir di Medan pada tanggal 19 Juli 2002. Anak dari pasangan Bapak Sutami dan Ibu Rina Erwita merupakan putri sulung dari dua bersaudara. Pada tahun 2007 peneliti memulai pendidikan dengan masuk TK Cendana Kec.Teluk Belengkong, Indragiri Hilir dan lulus di TK Suntai pada tahun 2008. Pada tahun yang sama peneliti melanjutkan pendidikan di SDS 045 Suntai, PT. THIP Wil 1 Suntai Estate Kecamatan Mandah, Indragiri Hilir kemudian menamatkan sekolah dasar pada tahun 2014 di SD Negeri 029 Padang Mutung. Pada tahun 2014 peneliti melanjutkan pendidikan di SMP Negeri 1 Kampar dan lulus pada tahun 2017, ditahun yang sama peneliti melanjutkan pendidikan di SMA Negeri 1 Kampar Timur dengan jurusan Ilmu Pengetahuan Alam (IPA). Setelah menyelesaikan pendidikan sekolah pada tahun 2020, ditahun yang sama pula peneliti melanjutkan pendidikan ke Perguruan Tinggi dan diterima menjadi mahasiswa Program Studi Sistem Informasi Fakultas Sains dan Teknologi Universitas Islam Negeri Sultan Syarif Kasim Riau melalui jalur SNMPTN. Selama masa perkuliahan, peneliti bergabung dalam Organisasi *Puzzle Research Data Technology* (*PREDATECH*) UIN Sultan Syarif Kasim Riau. Pada penelitian tugas akir ini, peneliti mengambil topik *Data Mining* dengan judul "*Palm Oil Production Prediction using Support Vector Regression Algorithm and Long Short-Term Memory*" sehingga terselesaikan pula kuliah Strata-1 (S1) peneliti pada tahun 2024. Untuk menjalin komunikasi yang baik dengan peneliti baik dari dalam kampus maupun luar kampus dapat menghubungi kontak melalui e-mail delvihastari19@gmail.com.

SURAT PERNYATAAN

Saya yang bertanda tangan dibawah ini:

Nama	:	Delvi Hastari
NIM	:	12050320385
Program Studi	:	Sistem Informasi
Judul Tugas Akhir	:	Palm Oil Production Prediction using Support Vector Regression Algorithm and Long Short-Term Memory

Menyatakan bahwa akan melengkapi seluruh kelengkapan administrasi Tugas Akhir Program Studi Sistem Informasi Fakultas Sains dan Teknologi Universitas Islam Negeri Sultan Syarif Kasim Riau berupa **bukti pelaksanaan *conference* secara lengkap**. Demikian yang dapat Saya sampaikan dengan sungguh – sungguh. Kami ucapkan Terima Kasih.

Pekanbaru, 3 Juli 2024

Hormat Kami,

Delvi Hastari

NIM. 12050320385