

Weather Parameters
Forecasting as Variables for
Rainfall Prediction using
Adaptive Neuro Fuzzy Inference
System (ANFIS) and Support
Vector Regression (SVR)

by D C R Novitasari

Submission date: 27-Feb-2023 02:39PM (UTC+0700)

Submission ID: 2024133457

File name: Parameters_Forecasting_as_Variables_for_rainfall_prediction.pdf (998.8K)

Word count: 4644

Character count: 23856

PAPER · OPEN ACCESS

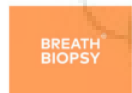
Weather Parameters Forecasting as Variables for Rainfall Prediction using Adaptive Neuro Fuzzy Inference System (ANFIS) and Support Vector Regression (SVR)

To cite this [article](#): D C R Novitasari *et al* 2020 *J. Phys.: Conf. Ser.* **1501** 012012

¹⁶ View the [article online](#) for updates and enhancements.

You may also like

- ¹³ [PREDICTION OF SOLAR FLARE SIZE](#)
- ⁵ [D TIME-TO-FLARE USING SUPPORT VECTOR MACHINE REGRESSION](#)
Laura E. Boucheron, Amani Al-Ghraibah and R. T. James McAteer
- ⁵ [Real-time prediction of respiratory motion using a cascade structure of an extended Kalman filter and support vector regression](#)
S-M Hong and W Bukhari
- [Periodic error detection and separation of magnetic levitation gyroscope signals based on continuous wavelet transform and singular spectrum analysis](#)
Yiwen Wang, Zhiqiang Yang, Zhen Shi et al.



Breath Biopsy® OMNI®

The most advanced, complete solution for global breath biomarker analysis

TRANSFORM YOUR RESEARCH WORKFLOW



Expert Study Design & Management



Robust Breath Collection



Reliable Sample Processing & Analysis



In-depth Data Analysis



Specialist Data Interpretation

Weather Parameters Forecasting as Variables for Rainfall Prediction using Adaptive Neuro Fuzzy Inference System (ANFIS) and Support Vector Regression (SVR)

D C R Novitasari¹, H Rohayani², Suwanto¹, Arnita³, Rico², R Junaidi⁴, Rr D N Setyowati⁵, R Pramulya⁶, F Setiawan⁷

¹ Department of Mathematics, UIN Sunan Ampel Surabaya, Surabaya, Indonesia

² Department of Information Technology, Adiwangsa Jambi University, Jambi, Indonesia

³ Department of Mathematics, Universitas Negeri Medan, Medan, Indonesia

⁴ Department of Architecture, UIN Sunan Ampel Surabaya, Surabaya, Indonesia

⁵ Department of Environmental Engineering, UIN Sunan Ampel Surabaya, Surabaya, Indonesia

⁶ Faculty of Agriculture, University Teuku Umar, Aceh, Indonesia

⁷ Forecaster and Analyst, Meteorological Climatological and Geophysics Agency, Surabaya, Indonesia

Abstract. The weather anomaly phenomenon that occurs can have some negative impact such as flooding, floods will paralyze the economic activities of the community, transportation activities, damage public infrastructure. In this research forecasting weather parameters as a variable for predicting the amount of rainfall using the ANFIS method and Support Vector Regression (SVR) with the aim to provide information on future weather conditions quickly and accurately. The people can prepare themselves and prepare the equipment needed to deal with it. Rainfall predicted based on synop data such as relative humidity, wind, and temperature. Each parameters must forecasted by using ANFIS and the result used for predict rainfall. Accurate prediction calculated using MSE and RMSE. Predictions of parameters that affect rainfall using the ANFIS method shown that for wind speed predictions having RMSE of 1.975004, temperature predictions have RMSE of 0.742332, and predictions of relative humidity have RMSE of 3.871590. Predicted rainfall based on the data results of the nearest method pre-processing using the Support Vector Regression (SVR) method produces an MSE error value of 0.0928.

21 Introduction

Indonesia is a tropical country that has two seasons, rain and dry [1]. Weather conditions are closely related to humans because all the series of activities carried out can be determined by the weather conditions that occur. This climate information is also very much needed in various fields such as agriculture, transportation, tourism, and others. Factors that influence the weather include, temperature, humidity, air pressure, wind speed, total cloud cover, and solar radiation.

Anomaly weather phenomena that occur has many negative impact one of which is floods, floods will cripple community economic activities, transportation activities, damage public infrastructure, and many other adverse effects. The importance of information about the weather is more precise information about rainfall so research have been predicted the occurrence of rain.

This research was conducted in the northern Surabaya region because the region is one of the centers of the city of Surabaya. The area has important public facilities such as port dock, hospital, school, center for religious tourism, and many offices and industrial sites. Given the vital importance of northern



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](https://creativecommons.org/licenses/by/3.0/). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

Published under licence by IOP Publishing Ltd

Surabaya for the city of Surabaya, information about the amount of rainfall is a necessity to deal with flooding that might occur due to the limited flow area capacity.

Determination of weather conditions has been carried out with a variety of methods and existing models, including: rainfall characteristics and clouds that produce high daily rainfall based on micro rain radar data [2], then the weather in the time series data is predicted using the Adaptive Neuro Fuzzy Inference System (ANFIS) [3], rainfall prediction can also be predicted using Modified Nearest Neighbour [4], rainfall prediction in northern Surabaya can also be applied with a fuzzy inference system, data mining can be used to predict the weather [5], and rain prediction in the dry season by using Support Vector Regression Modelling based on SOI and NINO 3.4 [6].

In the modern era, people are required to be able to know something that will happen and make plans for events that have been predicted. A good prediction is based on the behavior of symptoms or patterns that have been observed repeatedly and not a prediction based on speculation that doesn't have concrete reasons. There are various kinds of tools or methods that can be used to predict some of which are using a time series and then with an artificial intelligence-based method that is Support Vector Machine (SVM) [7]. The problem that can be overcome by using Support Vector Machine is a classification problem, in this problem the goal is to separate two or more classes with functions that are induced from the available examples [8]. Some examples of research cases that use Support Vector Classification method include: diabetic retinopathy detection system using Support Vector Machine [9], analysis of the influence of the Support Vector Machine (SVM) on the classification of data Microarray for cancer detection [10] and the implementation of the method Support Vector Machine method for Identification of cabbage plant leaf disease Support Vector can also be applied to the regression problem by using the concept of loss function which can be called the Support Vector Regression (SVR). Some types of loss functions in SVR are ϵ -insensitive quadratic, Huber and Laplace. In previous studies, SVR can be used for prediction cases, including forecasting crude palm oil using a Support Vector Regression Radial kernel basis [11], SVR analysts in predicting the exchange rate of the rupiah against the US dollar. (Amanda, Yasin, & Pratama, 2014), Support Vector Regression for Forecast the Demand and Supply of Pulpwood [12], and Support Vector Regression Modelling Rainfall Prediction in Dry Season Based on Southern Oscillation Index and NINO 3.4 [6].

Based on existing conditions, this research rainfall will be predicted using Adaptive Neuro Fuzzy Inference System (ANFIS) and Support Vector Regression (SVR) using relative humidity, wind, and temperature data obtained from Meteorological Maritime Station, Meteorological Climatological and Geophysics Agency Perak II Surabaya.

2. Basic Theory

2.1. Rain

A process of precipitation with a liquid form that requires the presence of a thick layer of the atmosphere in order to reach temperatures above the melting point of ice above the surface of the nearest earth is rain [13]. Rain occurs because of the process of condensation of water vapor in the atmosphere into droplets dense to fall, in addition to the process of cooling the air and also the addition of water vapor to the air can encourage the process of rain because it causes the air to become more saturated. The types of rain based on the process of occurrence are distinguished three types of rain, namely zenithal, orographic, frontal, and cyclonal rain [14].

The types of rain based on the process of occurrence are distinguished by three types of rain, namely zenithal rain, orographic rain, frontal rain, and cyclonal rain.

1. Zenithal Rain

Zenithal rain or convection rain occurs because air containing water vapor rises vertically. The rising air then experiences a decrease in temperature so the water vapor it contains turns into a falling point to earth into the rain.

2. Orographic rain

Orographic rain occurs because the mass of air containing water vapor is forced to climb the mountain slope so it is also called mountain rain.

3. Frontal rain

Frontal rain occurs in the meeting area between the mass of hot air and cold air masses. The mass of hot air will rise above the mass of air.

4. Cyclonal rain

Cyclone rain is rain that occurs because of the influence of cyclone winds. Rain that occurs due to cyclone is very dangerous because it can cause tornadoes and tropical cyclones "Hurricane" [14].

Rainfall is the amount of rainwater that falls on the ground surface with a certain period measured in units of height above the horizontal surface and doesn't occur by process evaporation, drainage or infiltration. The unit for measuring the rainfall is a millimeter (mm).

Rainfall in one region with another region will not always be the same. For example, in region one is experiencing the peak of the rainy season so the rainfall is increasing but in other regions is experiencing a decline, it is clear that rainfall in one region will not be the same as other regions but it doesn't rule out the possibility of the same rainfall [7]. According to BMKG rainfall is grouped into 4 groups, including:

1. Low rainfall (0-100 mm)
2. Medium rainfall (101-300 mm)
3. High rainfall (301-400)
4. Very high rainfall (> 400 mm).

Rainfall of an area can be influenced by several parameters, including; wind, relative humidity, and temperature.

2.2. Adaptive Neuro Fuzzy Inference System (ANFIS)

ANFIS (Adaptive Neuro-Fuzzy Inference System) is a hybrid algorithm which is a combination of Fuzzy Inference System (FIS) mechanisms that are configured in neural network architecture. ANFIS has two parameters, namely the premise parameter and the consequent parameter. In this algorithm, hybrid training is carried out with steps, such as steps forward and steps backward [15].

In order for a network with a radial baseline function to be equivalent to a fuzzy rule-based sugeno first-order model, limitations are needed:

- a. Both must have the same aggregation method (weighted average or weighted sum) to derive all outputs.
- b. The number of activation functions must be equal to the number of fuzzy rules (IF-THEN)
- c. If there are multiple inputs on the basis of the rules, then each activation function must be the same as the membership function of each input
- d. The activation function and fuzzy rules must have the same function for neurons and the rules on the output side.

In the Neuro-Fuzzy system there are five layers of processes in which the functions and equations of each layer are described as [16] [17],

Layer 1: Fuzzyfication Layer, at this layer a fuzzy set will be formed using the membership function. There are several membership functions that can be used including, Bell (bell), Gaussian, trap, triangle, etc. The output at layer 1 can be expressed as:

$$O_{1,i} = \mu A_i(x) = \frac{1}{1 + \left| \frac{x-c}{a} \right|^2} \quad (1)$$

Layer 2: Product layer, at this layer synthesized the transmission of information with layer 1 and the multiplication of all incoming and sending signals out. The output at this layer can be stated by:

$$O_{2,i} = \mu A_i(x) \cdot \mu B_i(y) = W_i \quad (2)$$

Layer 3: Normalization, the results of layer 2 are then normalized at layer 3. Output at layer three is stated in:

$$O_{3,i} = \frac{W_i}{W_1 + W_2} = \hat{W} \quad (3)$$

Layer 4: Defuzzyfication, output at layer 4 can be calculated using the formula:

$$O_{4,i} = \hat{W}_i \hat{Y}_i = \hat{W}_i (p_i x_1 + q_i x_2 + r_i) \quad (4)$$

with $\{p_i, q_i, r_i\}$ is a set of consequent parameters.

Layer 5: the total output layer, at this layer the results of layer 4 will be calculated with the following formula:

$$O_{5,i} = \sum \hat{W}_i \hat{Y}_i = \frac{\sum W_i \hat{Y}_i}{\sum \hat{W}_i} \quad (5)$$

10. Support Vector Regression (SVR)

Support vector machine (SVM) is a relatively new technique for making predictions, both in the case of classification and regression. The Support Vector Machine (SVM), developed by Boser, Guyon, and Vapnik, was first introduced in 1992 at the Annual Workshop on Computational Learning Theory. The basic concept of the SVM method is actually a combination or combination of computational theories that have existed in the previous year, such as the kernel introduced by Aronszajn in 1950, the Lagrange Multiplier discovered by Joseph Louis Lagrange in 1766, and so are the other supporting concepts [18]. Both scientists and practitioners have applied this technique to solve real problems in daily life. Its application includes the issue of gene expression analysis, financial prediction, weather to the medical field [19].

SVR is an application for the case of regression, the difference between SVM and SVR is the application of SVM is to find the best separator function (hyperplane) between an infinite number of functions to separate two objects. While SVR has an application to find a function as a hyperplane (dividing line) in the form of a regression function that matches all input data with an error ϵ and makes ϵ as thin as possible [20]. The regression function of the SVR method is

$$f(x) = \sum_{i=1}^l (\alpha - \alpha_i^*) \langle x, x_i \rangle + b \quad (6)$$

A function that shows the relationship between errors and whether the error is penalized is called a loss function. The loss function simplest is the ϵ -insensitive loss function which has the following formulation:

$$L_\epsilon(y) = \begin{cases} 0 & , |f(x) - y| \leq \epsilon \\ |f(x) - y| - \epsilon & , \text{for the others} \end{cases} \quad (7)$$

for others There are several kernel functions that are used to solve problems in linear and non-linear SVM that can be seen in the following equation.

a. Linear Kernel Function

$$k(x_i, x_j) = x_i \cdot x_j \quad (8)$$

b. Polynomial Kernel Function

$$k(x_i, x_j) = (1 + x_i \cdot x_j)^q, q=1, 2, 3, \dots, n \quad (9)$$

c. Radial Basis Kernel Function

$$k(x_i, x_j) = \exp \frac{-\|x_i - x_j\|^2}{2\sigma^q} \quad (10)$$

d. Sigmoid Kernel Function

$$k(x_i, x_j) = \tanh[k x_j^T x_i + \theta] \quad (11)$$

The SVR algorithm for the prediction process is as follows:

1. Prepare the necessary variables and parameters.
2. Determine the Kernel Function and loss function to be used.
3. Looking for alpha values and looking for bias values Calculate data based on values that have been obtained from the training process.

3. Research Methods

The type of this research is quantitative research. The flow of this research begins by conducting a literature study to study the problem to be studied, then collecting data which is then pre-processed by filling in the blanks. After filling in the blank data then predicting parameters that affect rainfall using the TS-ANFIS method, then predicting rainfall using the Support Vector Regression (SVR) method, after results are drawn conclusions based on the results obtained from this study. The flow in this study can be reviewed in Figure 1.

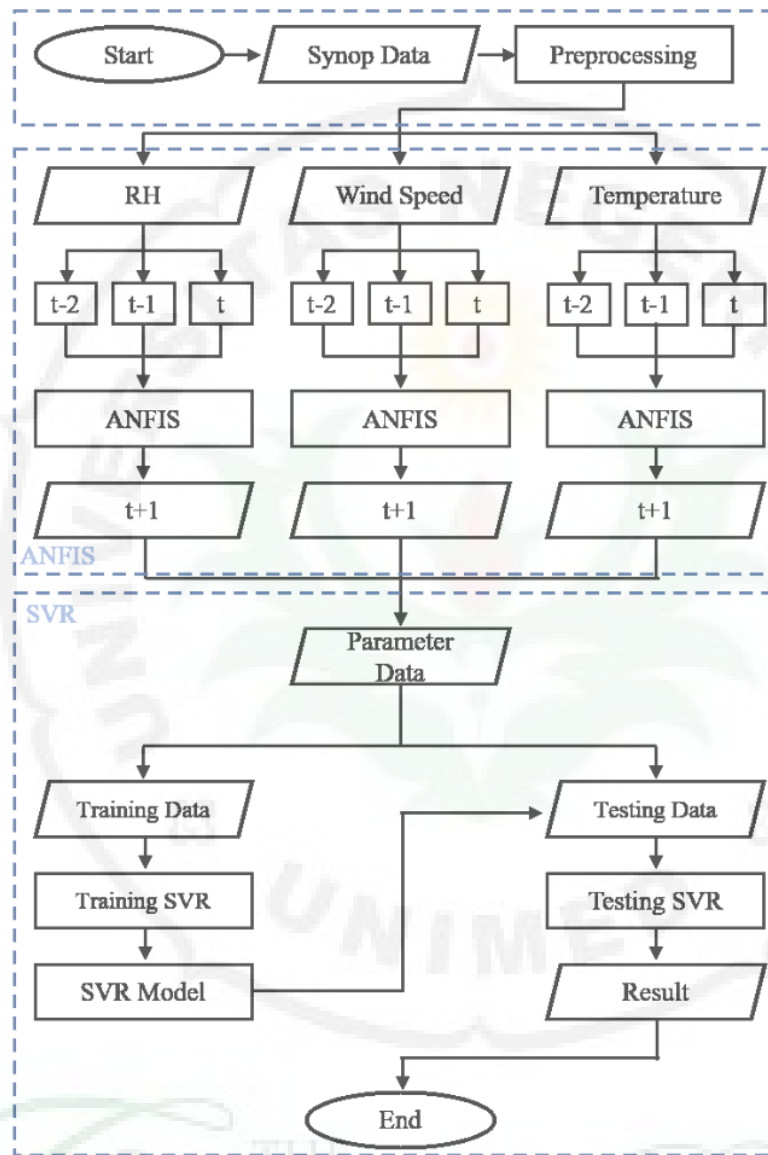


Figure 1. Flowchart rainfall prediction

17 Anfis and SVR in this research can be collaborated because rainfall predicted using SVR based on wind speed, relative humidity, and temperature (weather parameters), where the weather parameters (wind speed, relative humidity, and temperature) are predicted using ANFIS. In the process prediction of parameters after the process preprocessing the initial steps taken are the data constructed into time series data, and then forecast each parameters using Adaptive Neuro Fuzzy Inference System (ANFIS). Divide the result into training data and test data. After the prediction parameter data is obtained using TS_ANFIS, rainfall prediction is performed using the method Support Vector Regression (SVR) with the initial step of normalizing the data then grouping the data into training data and test data, then

initializing parameters to conduct training and testing data until the model is obtained optimal for predicting rainfall.

4. Results

Weather data that includes, wind speed, temperature, humidity, and rainfall obtained from the online data of the Meteorology Climatology and Geophysics Agency (BMKG) Maritim Perak II Surabaya station is processed by filling in blank data (preprocessing), then the prediction process of weather parameters that affects rainfall using TS-ANFIS is carried out. The results of predictions using TS-ANFIS are then used to predict rainfall using Support Vector Regression (SVR). The results of each of these processes are as follows:

4.1. Preprocessing

At this stage, the input is using weather data (temperature, humidity, wind speed) from January 2009 to December 2018. Weather data have missing values, some have value because there is no measurement (missing value) so it needs to be done preprocessing.

Existing data blanks will be filled based on the nearest value that is not lost (nearest method). The output obtained is data that will all be filled. Data prepared by this preparation include wind speed, temperature, humidity, and rainfall. Weather parameter data samples can be reviewed in Table 1.

Table 1. Data Samples

Temperature (°C)	Relative Humidity (%)	Wind Speed (knot)
29.2	83	4
29.3	75	3
30.2	77	5
9999	9999	9999
9999	9999	9999

In Table 1, there are parameter data that give code 9999, it's code means that the data on a day is not measurable or unobserved so that the data is filled in so that the results obtained the next process is more optimal. In table 2 the previous data (Table 1) containing code 9999 has been filled with new data calculated using the nearest method[21].

Table 2. Results Preprocessing

Temperature (°C)	Relative Humidity (%)	Wind Speed (knot)
29.2	83	4
29.3	75	3
30.2	77	5
27.3	86	4
27.3	86	4

4.2. Prediction using ANFIS

Weather parameter prediction with TS-ANFIS is based on data patterns that have occurred before. Weather parameter data is formed into time series format based on the previous time series, the input variables used are (t-2, t-1, and t) and then the output is t+1. Forecasting result of wind speed, temperature, humidity, and rainfall can be reviewed in Table 3, Table 4, and Table 5..

The initial step of ANFIS is the stage inference, after going through the stage inference, the ANFIS model has then carried out hybrid learning with forwarding direction learning using the LSE method

Recursive and backward learning using gradient descent. The results of predictions of relative humidity, temperature, and wind using ANFIS can be reviewed in Figure 2 – Figure 4.

Table 3. Result wind forecasting using ANFIS

t-2	t-1	t	t+1
12	10	9	6
10	9	6	8
9	6	8	9
6	8	9	10
8	9	10	14

Table 4. Result temperature forecasting using ANFIS

t-2	t-1	t	t+1
29.2	28.6	29.5	29.1
28.6	29.5	29.1	29.6
29.5	29.1	29.6	30.4
29.1	29.6	30.4	28.6
29.6	30.4	28.6	28.7

Table 5. Result RH forecasting using ANFIS

t-2	t-1	t	t+1
77	81	73	74
81	73	74	74
73	74	74	72
74	74	72	77
74	72	77	78

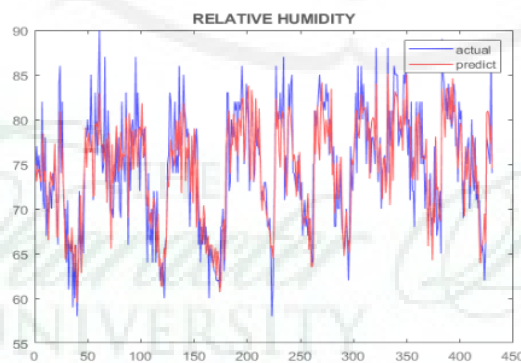


Figure 2. Relative humidity prediction

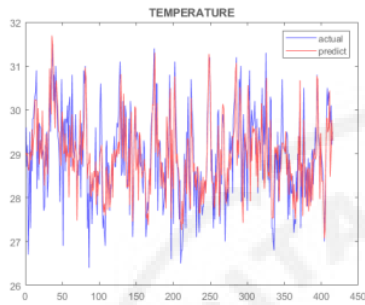


Figure 3. Temperature prediction

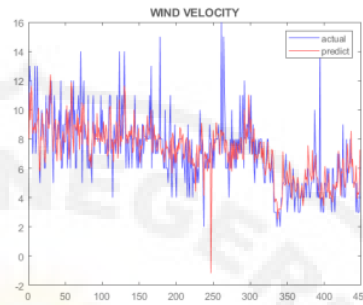


Figure 4. Wind prediction

Figure 2, 3, and 4 have two type lines, blue lines is a graph of the actual data and blue lines are the prediction result. Relative humidity was shown in figure 2, from there can be seen the red lines and blue lines have similar scheme it will be representing the error result. Figure 3 and figure 4 illustrate temperature and wind prediction using ANFIS. On figure 2 and 3 differences not too visible, in figure 4 there are some data that looks different. The wind prediction has an RMSE of 1.975004, temperature prediction has an RMSE of 0.742332, and relative humidity prediction has an RMSE of 3.871590.

4.3. Prediction using SVR

After obtaining the results of data in the previous process, the data process³³ using the Support Vector Regression (SVR) method. The method is used to predict rainfall based on wind speed, temperature, and relative humidity.

However, prior to the prediction process using the SVR algorithm, training and testing of weather temperature, relative humidity, wind speed, and rainfall data are first carried out. In the previous stage, training is conducted to look for models, then testing is conducted to test the models that are formed whether the model is optimal or not. To obtain model prediction in this research was taken 87.5% of the data, then the remaining 12.5% was used as test data.

Table 6. Rainfall Prediction Data Samples

X 1	X 2	X 3	Target
28.7	78	14	63
27.7	79	12	0
29.7	66	13	8.6
29.2	72	14	11
28.4	78	11	24.8
26.8	82	12	1.2

In the table 6 the variable x1 is the temperature parameter, x2 is air humidity, x3 is the wind speed variable, and the target is rainfall. The type of kernel used in this calculation is a linear kernel, the step taken is to prepare the necessary variables and parameters.

Training data sample:
 $x1 = [28,7 \ 27,7 \ 29,7 \ 29,2 \ 28,4 \ 26,8]$
 $x2 = [78,0 \ 79,0 \ 66,0 \ 72,0 \ 78,0 \ 82,0]$
 $x3 = [14,0 \ 12,0 \ 13,0 \ 14,0 \ 11,0 \ 12,0]$

Target data sample:
 $T = [63 \ 0 \ 8.6 \ 11 \ 24.8 \ 1.2]$

Kernel: kernel function type

C: constants (C = 1)

α, b : alpha and bias

calculate the K kernel matrix using equations (8)

$$K = x_k^T \cdot x$$

$$K = ((x_1^T \cdot x_1) + (x_2^T \cdot x_2) + (x_3^T \cdot x_3))$$

$$K = \begin{bmatrix} 7103,7 & 7125,0 & 6182,4 & 6650,0 & 7053,1 & 7333,2 \\ 7125,0 & 7152,3 & 6192,7 & 6664,8 & 7080,7 & 7364,4 \\ 6182,4 & 6192,7 & 5407,1 & 5801,2 & 6134,5 & 6364,0 \\ 6650,0 & 6664,8 & 5801,2 & 6232,6 & 6599,3 & 6854,6 \\ 7053,1 & 7080,7 & 6134,5 & 6599,3 & 7011,6 & 7289,1 \\ 7333,2 & 7364,4 & 6364,0 & 6854,6 & 7289,1 & 7586,2 \end{bmatrix}$$

Each element of the above matrix is the result of $x_i \cdot x_j$. The K kernel matrix above is then used in the next process to find alpha values and bias using Quadratic Programming with the help of software, found:
 $\alpha = [2.04373945497679, -0.421145981740259, 0.693980872226408]$
 Bias = 6.93778959270997

If either α_n or α_n^* is not zero, then the corresponding observation is called a support vector. After obtaining these values, the SVR model can be used as a predictor. The results of predictions using the SVR can be reviewed in Figure 5.

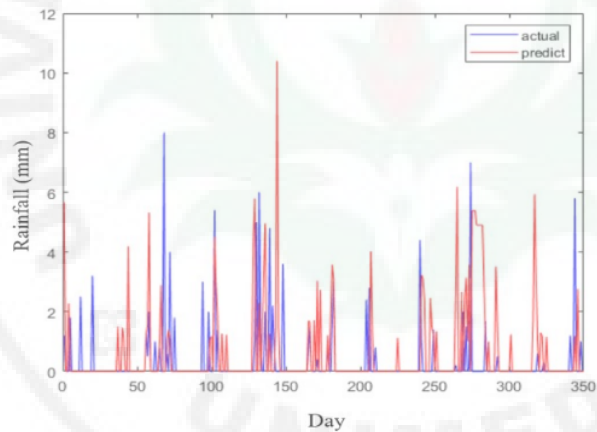


Figure 5. Prediction of Rainfall

Figure 5 has two type lines that is red and blue lines, the blue line is representing the rainfall actual data and the prediction of rainfall using Support Vector Regression (SVR) represented by the red lines. Prediction on the first day until fifty-day has a big difference, rainfall season reached the height on the 125 days until 150 days. From this figure can be known that there are differences between the red and blue lines, that differences on day 275 until day 300 is the biggest contributor error of prediction system because has a big difference. On actual data rain season occur with interval 20 days, the predicted rain season occurs with close interval. From that figure rainy season represented by a nonzero graph and the others is the dry season. The error MSE of the rainfall prediction model is 0.0928.

25
5. Conclusion

Based on the results of the implementation and trials using TS-ANFIS - SVR that has been predicted rainfall, it can be concluded that prediction of parameters that affect rainfall using TS-ANFIS method shows that for wind speed prediction has an RMSE of 1.975004, temperature prediction has an RMSE of 0.742332, and relative humidity prediction has an RMSE of 3.871590. Rainfall prediction based on data from pre-processing the method nearest using the method Support Vector Regression (SVR) produces a value error MSE of 0.0928.

6. References

- [1] N. D. rahayu, B. samito and N. Bashit, "Analisis Pengaruh Fenomena Indian Ocean Dipole (Iod) Terhadap Curah Hujan Di Pulau Jawa," *Jurnal Geodesi Undip*, pp. 57-67, 2018.
- [2] S. A. Syafira, M. D. Syaifullah and F. Renggono, "Karakteristik Hujan Dan Awan Penghasil Curah Hujan Harian Tinggi Berdasarkan Data Micro Rain Radar," *Jurnal Sains & Teknologi Modifikasi Cuaca*, pp. 27-35, 2016.
- [3] C. Dewi, D. P. Kartikasari and Y. T. Mursityo, "Prediksi Cuaca Pada Data Time Series Menggunakan Adaptive Neuro Fuzzy Inference System (Anfis)," *Jurnal Teknologi Informasi dan Ilmu Komunikasi (JTIK)*, pp. 18-24, 2014.
- [4] Muhammad and B. Lareno, "Modified Nearest Neighbor Untuk Prediksi Curah Hujan," in *Konferensi Nasional Sistem & Informatika 2015*, Bali, 2015.
- [5] S. Mujiasih, "Pemanfaatan Data Mining Untuk Perkiraan Cuaca," pp. 189-195, 2011.
- [6] G. Adhani, A. Buono and A. Faqih, "Support Vector Regression Modelling for Rainfall Prediction in Dry Season Based on Southern Oscillation Index and NINO 3.4," *ICACISIS*, pp. 315-320, 2013.
- [7] Fitriani, "Peramalan Curah Hujan Di Kota Makassar Menggunakan Model Arimax," UIN Alauddin, Makassar, 2014.
- [8] M. W. E. F., "Support Vector Machine," Universitas Kh. A. Wahab Hasbullah, Jombang, 2018.
- [9] W. Setiawan, "Sistem Deteksi Retinopati Diabetik Menggunakan Support Vector Machine," Universitas Diponegoro, Semarang, 2012.
- [10] R. Diani, U. N. Wisesty and A. Aditsania, "Analisis Pengaruh Kernel Support Vector Machine (SVM) pada Klasifikasi Data Microarray untuk Deteksi Kanker," *Indonesian Journal of Computing*, pp. 109-117, 2017.
- [11] R. E. Caraka, H. Yasin and A. w. Basyiruddin, "Peramalan Crude Palm Oil (CPO) Menggunakan Support Vector Regression Kernel Radial Basis," *Jurnal Matematika*, pp. 43-57, 2017.
- [12] V. Anandhi and R. M. Chezian, "Support Vector Regression to Forecast the Demand and Supply of Pulpwood," *International Journal of Future Computer and Communication*, pp. 266-269, 2013.
- [13] D. R. Navianti, I. G. N. R. Usadha and F. A. Widjajanti, "Penerapan Fuzzy Inference System pada Prediksi Curah Hujan di Surabaya Utara," *Jurnal Sains Dan Seni ITS*, pp. 23-28, 2012.
- [14] B. T. HK. and S. W. B. Harijono, *Meteorologi Indonesia Volume Ii Awan Dan Hujan Monsun*, Jakarta: Badan Meteorologi Klimatologi dan Geofisika, 2012.
- [15] S. Kinasih, "Prediksi Curah Hujan Menggunakan Adaptive Neuro Fuzzy Inference System (ANFIS)," 2018.
- [16] J.-S. R. Jang, "ANFIS: Adaptive-Network-Based Fuzzy Inference System," *IEEE*, pp. 665-685, 1993.
- [17] Novitasari, D. C. R., Suwanto, Bisri, M. H., & Asyhar, A. H., "Classification of EEG Signals using Fast Fourier Transform (FFT) and Adaptive Neuro Fuzzy Inference System," *MANTIKA*, 2019.
- [18] A. W. Kurniawati, "Implementasi Metode Support Vector Machine Untuk Identifikasi Penyakit Daun Tanaman Kubis (Studi Kasus: Temu Tani Malang)," *Politeknik Negeri Malang*, Malang, 2017.
- [19] B. Santosa, "Tutorial Support Vector Machines," ITS, Surabaya.
- [20] A. J. Smola and B. Scholkopf, "ATutorial on Support Vector Regression," *Statistics and Computing*, pp. 199-222, 2004.
- [21] Chi, Z., Hong-cai, F., Kai, J., & Ting, Y., "The Nearest Neighbor Algorithm of Filling Missing Data Based on Cluster Analysis," *ICCSEE*, 2013.

Weather Parameters Forecasting as Variables for Rainfall Prediction using Adaptive Neuro Fuzzy Inference System (ANFIS) and Support Vector Regression (SVR)

ORIGINALITY REPORT

19%

SIMILARITY INDEX

12%

INTERNET SOURCES

9%

PUBLICATIONS

8%

STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Emirates International School Student Paper	3%
2	jurnalsaintek.uinsby.ac.id Internet Source	3%
3	sciencepubco.com Internet Source	2%
4	Firda Nurul Auliah, Armin Lawi, Sri Astuti Thamrin., Edy Budiman. "Selection of Informative Genes to Classify Type 2 Diabetes Mellitus using Support Vector Machine", 2019 5th International Conference on Computing Engineering and Design (ICCED), 2019 Publication	1%
5	china.iopscience.iop.org Internet Source	1%
6	ijeecs.iaescore.com Internet Source	1%

downloads.hindawi.com

7

Internet Source

1 %

8

Dian Faruqi Azid, Budhi Irawan, Casi Setianingsih. "Translation russian cyrillic to latin alphabet using SVM (support vector machine)", 2017 IEEE Asia Pacific Conference on Wireless and Mobile (APWiMob), 2017

Publication

1 %

9

Georgi Nalbantov, Rob Bauer, Ida Sprinkhuizen-Kuyper. "Equity style timing using support vector regressions", Applied Financial Economics, 2006

Publication

<1 %

10

Submitted to School of Business and Management ITB

Student Paper

<1 %

11

int-math.com

Internet Source

<1 %

12

jurnal.fmipa.unmul.ac.id

Internet Source

<1 %

13

worldwidescience.org

Internet Source

<1 %

14

H.A. Moghaddam. "Feature Subset Selection for Face Detection Using Genetic Algorithms and Particle Swarm Optimization", 2006 IEEE

<1 %

International Conference on Networking Sensing and Control, 2006

Publication

15

machinelearningmastery.com

Internet Source

<1 %

16

Chengshuo Shen, Wei Zheng, Yong Hua Ding, Xinkun Ai et al. "IDP-PGFE: An Interpretable Disruption Predictor based on Physics-Guided Feature Extraction", Nuclear Fusion, 2023

Publication

<1 %

17

Abhishek Bihari, Murugesh P, Abhishek Kumar, Shailesh R, Naga Sathish B. "Evaporation Analysis of the Arabian Sea in 2013: A Study using Meteorological and Satellite Data", Research Square Platform LLC, 2023

Publication

<1 %

18

F. Ernst. "Interface dislocations forming during epitaxial growth of GeSi on (111) Si substrates at high temperatures", Materials Science and Engineering: A, 1997

Publication

<1 %

19

Submitted to Laureate Education Inc.

Student Paper

<1 %

20

www.ijfcc.org

Internet Source

<1 %

21

Internet Source

<1 %

22

sites.google.com

Internet Source

<1 %

23

Bing NIU. "Support vector machine for SAR/QSAR of phenethyl-amines", Acta Pharmacologica Sinica, 7/2007

Publication

<1 %

24

Inung Wijayanto, Achmad Rizal, Sugondo Hadiyoso. "Multilevel Wavelet Packet Entropy and Support Vector Machine for Epileptic EEG Classification", 2018 4th International Conference on Science and Technology (ICST), 2018

Publication

<1 %

25

ijiet.com

Internet Source

<1 %

26

Anang Tjahjono, Ardyono Priyadi, Mauridhi Hery Purnomo, Margo Pujiantara. "Overcurrent relay curve modeling using adaptive neuro fuzzy inference system", 2014 Makassar International Conference on Electrical Engineering and Informatics (MICEEI), 2014

Publication

<1 %

27

Sandika Maulana Putra, Aji Prasetya Wibawa, Triyanna Widiyaningtyas, Ilham Ari Elbaith

<1 %

Zaeni. "Performance of SVM in Classifying the Quartile of Computer Science Journals", 2019
5th International Conference on Science in Information Technology (ICSITech), 2019

Publication

28

cyberleninka.org

Internet Source

<1 %

29

shmpublisher.com

Internet Source

<1 %

30

uu.diva-portal.org

Internet Source

<1 %

31

www.ijeat.org

Internet Source

<1 %

32

Bernhard Schölkopf, Alex J. Smola, Robert C. Williamson, Peter L. Bartlett. "New Support Vector Algorithms", Neural Computation, 2000

Publication

<1 %

33

Deanna Van dijk, Jane Law. "The rate of grain release by pore - ice sublimation in cold - aeolian environments", Geografiska Annaler: Series A, Physical Geography, 2016

Publication

<1 %

34

Gita Adhani, Agus Buono, Akhmad Faqih. "Optimization of Support Vector Regression using Genetic Algorithm and Particle Swarm Optimization for Rainfall Prediction in Dry

<1 %

Season", TELKOMNIKA Indonesian Journal of
Electrical Engineering, 2014

Publication

35

S-M Hong, W Bukhari. "Real-time prediction of
respiratory motion using a cascade structure
of an extended Kalman filter and support
vector regression", Physics in Medicine and
Biology, 2014

Publication

<1 %

Exclude quotes

Off

Exclude matches

Off

Exclude bibliography

On

UNIVERSITAS SEKELoa MEDAN
UNIMED
THE
Character Building
UNIVERSITY