

# Comparison of ANFIS and ARIMA Model for Weather Forecasting

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## Abstract

In this paper quickly illustrate the correlation investigation of Auto-Regressive Integrated Moving and Average (ARIMA) and Adaptive Network Based Fuzzy Inference System (ANFIS) models done by climate estimating. The climate determining is taken from University of Waterloo. The information is taken as Relative Humidity, Ambient Air Temperature, Barometric Pressure and Wind Direction utilized within this paper. The paper is carried out by analyzing the exhibitions are seen by demonstrating of ARIMA and ANIFIS model like with Sum of average of errors. Versatile Network Based Fuzzy Inference System (ANFIS) demonstrating is carried out by Mat lab programming and Auto-Regressive Integrated Moving and Average (ARIMA) displaying is produced by utilizing XLSTAT programming. ANFIS is carried out in Fuzzy Logic Toolbox in Mat Lab.

**Keywords:** ARIMA, ANFIS, Fuzzy Logic Tool, Weather Forecasting, XLSTAT Software

## 1. Introduction

Estimation of Weather estimate frameworks are the most unpredictable frameworks so that anticipating is carried out by workstations. Determining methods evaluation of future values by utilizing qualities watched. Climate anticipating is essentially utilized as a part of landing strips, seaports, atmosphere deceivability and so on. For instance in hangars we ought to think about climate for few hours and in seaports it is need state of climate least one week. Climate determining in atmosphere deceivability is fundamental for ranchers to sowing the seeds. By climate determining such a large number of preferences are available. Some of samples like to spare lives, decrease property harm, lessen yield harm, to tell the overall population what's in store. Climate estimating is carried out by utilizing such a large number of methods. Because of development or exchange of vitality brought about climate. Temperature contrast between two items reasons exchange of vitality. Exchange of vitality effects numerous climate Phenomena that happen by means of development of air in air. This sensation is called as convection.

Climate determining could be seen by such a variety of procedures by watching sky to exceptionally unpredictability mechanized scientific model. To think about climate expectation and anticipating will helps about future anyway it serves to draw general perspective of diagrams, isobars that permit to seen examples of climate. By utilizing advanced engineering like climate radars, satellite symbolism likewise gives data about climate anticipating.

Climate determining could be seen by such a variety of systems like Numerical Weather Prediction (NWP), Artificial Neural Networks (ANN), Neuro-Fuzzy Logic System, Fuzzy rationale and Clustering Analysis, Auto-Regressive Integrated Moving and Average (ARIMA). The information sets are gathered from college of Waterloo. In information set, there are four parameters and they are Relative Humidity, Ambient Air Temperature, Barometric Pressure and Wind Direction. For examination and climate anticipating in this paper we apply ANFIS and ARIMA demonstrating from information, thinking about the outcomes of ARIMA and ANFIS model<sup>1</sup>.

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In this paper for ARIMA demonstrating XLSTAT programming is utilized for climate forecasting. XLSTAT is concentrate prescient information that when sent into existing techniques makes them versatile to enhance results. So we can anticipate the qualities of four parameters conclusions before they happen. ANFIS editorial manager fuzzy rationale tool stash is utilized to create in ANFIS displaying. In ANFIS tool kit work first we ought to need to build fuzzy derivation framework (FIS)<sup>3</sup> and whose participation capacity parameters are balanced by utilizing back proliferation calculation or as a part of mixture with lease square routines. Furthermore at long last look at the outcomes got by ANFIS model and ARIMA model.

## 2. Literature Review

The support of climate determining has been connected first issue of numerical material science and after then approached by numerical routines. The creators discovered new strategies like Fuzzy C-Mean and Interval Type-2 Fuzzy Logic techniques<sup>2</sup>. Climate estimating might be seen by such a variety of procedures like Numerical Weather Prediction (NWP), Artificial Neural Networks (ANN), Neuro-Fuzzy Logic System, Fuzzy rationale and Clustering Analysis, Auto-Regressive Integrated Moving and Average (ARIMA), by utilizing these routines first discovered the obliged qualities and afterward contrast these qualities and their shortcoming and strengths. The creator utilized for precipitation forecast ANFIS model is better. For every day precipitation expectation creator connected multi parameter Adaptive Neuro Fuzzy Inference System (ANFIS) for information of Relative Humidity, Ambient Air Temperature, Barometric Pressure and Wind Direction.

Fuzzy rationale principle based methodology we can foresee radiation mist anticipating. At the point when the circumstances are sporadic then we utilize Numerical Weather Prediction (NWP), but this expectation strategy does not prepare tasteful outcomes. So for climate estimating fuzzy rationale based rough guess is recognized. So in this paper we look at numerical system and fuzzy rationale. For expectation in fuzzy rationale if-then leads are utilized. Forecast of time arrangement model gets by ANFIS. ANFIS model has mechanized ID calculation and outcomes could be effortlessly contrasted with neural system in less number of parameters and quicker adjust.

## 3. ARIMA Model

ANFIS implies Auto Regressive Integrated Moving Average. Box and Jenkins created ARIMA demonstrate so this model is additionally called as Box-Jenkins models. Basically ARIMA model is utilized for time arrangement estimation, parameter estimations and determining. In time arrangement estimation such a large number of techniques are available like Auto Regressive (AR), Moving Average (MA), and Auto Regressive Integrated Moving Average (ARIMA) etc. Above strategies might be relies on request of AR, MA, incorporated degree named as p, q, d. If q, d qualities are zeros then the given model is called as Auto Regressive (AR) model. In the event that p, d qualities are zeros then given model is called Moving Average (MA) model. If p, q qualities are available then that model is called Auto Regressive Moving Average (ARMA) model<sup>9</sup>.

Auto Regressive model for request of p is

$$X_t = a + \sum_{i=1}^p \phi_i X_{t-1} + \epsilon_t \quad (1)$$

In above comparison C is consistent and  $\epsilon_t$  is repetitive sound, is parameter of model

For AR (1) model

- When  $\Phi_1=0$  then  $x_t$  gets repetitive sound
- When  $\Phi_1=1, C=0$  then  $x_t$  is arbitrary walk
- When  $\Phi_1=1, C \neq 0$  then  $x_t$  is arbitrary stroll with float
- When  $\Phi_1 < 0$ , then  $x_t$  wavers between positive and negative qualities.

Moving Average model of request q is

$$X_t = \epsilon_t + \sum_{i=1}^q \phi_i \epsilon_{t-i} \quad (2)$$

Where  $\Phi_i$  is parameter of model,  $\epsilon_t$  is repetitive sound

At the point when over two comparisons consolidate then ARIMA

$$y_t = a_0 + \sum_{i=1}^p \phi_i y_{t-1} + \sum_{j=0}^q \phi_j \epsilon_{t-j} \quad (3)$$

By using XLSTAT observe the results for different orders of ARIMA (p, d, q). And among those results take

the minimum error result as output. For ARIMA (1, 2, 2) the errors are less when compared to other order. The output of ARIMA (1, 2, 2) is shown in Figures (1), (2)

### 4. ANFIS Model

Full name of ANFIS is Adaptive Network Based Fuzzy Inference System. Roger Jang connected ANFIS in 1993. for ANFIS model<sup>5-8</sup>; we utilize if then manage for building of fuzzy impedance framework. Anfis has five layers. The layers are making participation capacities, increase specialist, normalizing layers, versatile hub and yield layer separately. So as to prepare the neutron fuzzy model let us take two past specimens called as  $y(k-1)$  and  $y(k-2)$  of the offered sign to estimating of  $y(k)$ <sup>4</sup>. Two inputs having two enrolment capacities  $m1$  and  $m2$  in Gaussian manifestation of Takagi-sugeno-sort fuzzy framework. The guidelines are shaped by if –then principle premise and the principles are given below

- If  $y(k-1)$  is  $m1$  and  $y(k-2)$  is  $m1$  then  $u(k)$  is  $m1$
- If  $y(k-1)$  is  $m1$  and  $y(k-2)$  is  $m2$  then  $u(k)$  is  $m2$
- If  $y(k-1)$  is  $m2$  and  $y(k-2)$  is  $m1$  then  $u(k)$  is  $m3$
- If  $y(k-1)$  is  $m2$  and  $y(k-2)$  is  $m2$  then  $u(k)$  is  $m4$

The output of the ANFIS model is shown in Figure 4,

### 5. Result

In ARIMA model we get output of average of testing errors weather forecasting predictions is 0.858 and in ANFIS model average of testing errors is 10.356.

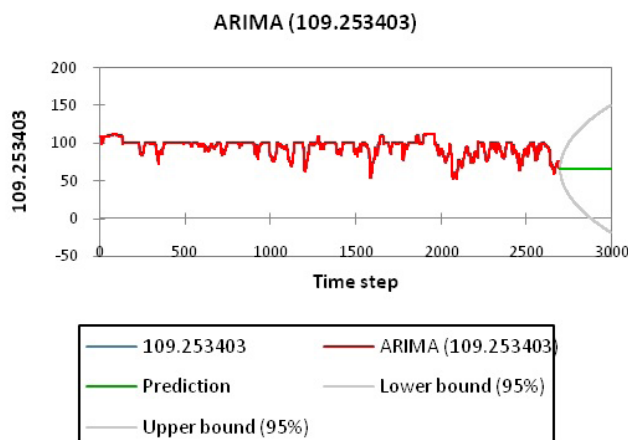


Figure 1. The data plot with predicted values.

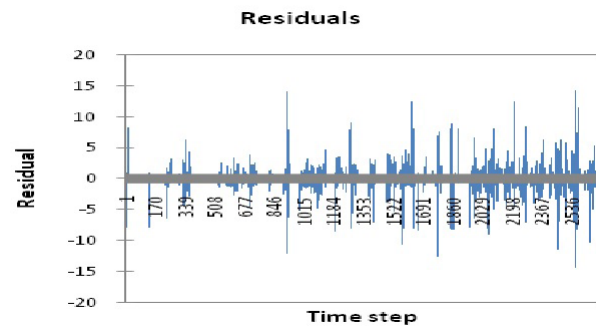


Figure 2. Residuals of system.

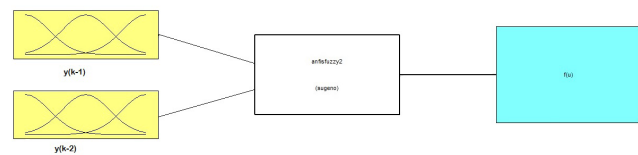


Figure 3. Takagi-sugeno-type fuzzy system.

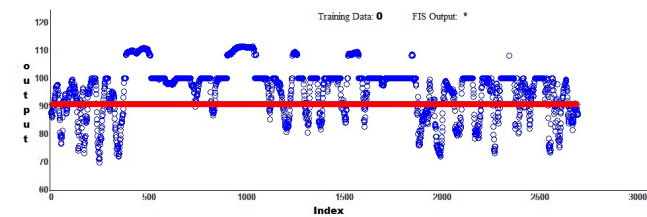


Figure 4. Output of ANFIS.

### 6. Conclusion

In this paper we discuss about ANFIS and ARIMA model for weather forecasting. ARIMA is most effective methods for weather forecasting when compared with ANFIS and ARIMA will take more time when compared with ANFIS.

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