

**Volume 1, Issue 2**

**Research Article**

**Date of Submission:** 07 May, 2025

**Date of Acceptance:** 01 September, 2025

**Date of Publication:** 10 September, 2025

## **New Modeling of Prime Number Series, IN-PAR**

**Ricardo Osés Rodríguez\***

Villa Clara Provincial Meteorological Center. Marta Abreu Street No. 57, Altos, corner of Juan Bruno Zayas, Santa Clara, Villa Clara, Cuba.

**\*Corresponding Author:**

Ricardo Osés Rodríguez, Villa Clara Provincial Meteorological Center. Marta Abreu Street No. 57, Altos, corner of Juan Bruno Zayas, Santa Clara, Villa Clara, Cuba

**Citation:** Rodriguez, R. O. (2025). New Modeling of Prime Number Series, IN-PAR. *Art Intelligence and Ele & Electronics Eng: AIEEE Open Access*, 1(2), 01-06.

### **Abstract**

#### **Objective**

The objective of our work is aimed at modeling prime number series using the ROR methodology and using the IN-PAR methodology as an improvement of the former.

#### **Methods**

The Objective Regressive Methodology, ROR, and the IN-PAR methodology are used. To carry out this work, a self-developed database consisting of 25 cases of prime numbers less than 100 was used. Subsequently, this series was modeled according to the ROR methodology and with the IN-PAR methodology using the first 25 cases, the errors of the predicted values with respect to the actual values were calculated and descriptive statistics of the corresponding errors were obtained.

#### **Results**

Perfect models are obtained for the prime number series using both methodologies. The IN-PAR methodology describes errors with zero mean, just like the ROR methodology, and a lower standard deviation than the ROR methodology. Both methodologies offer excellent results for prime numbers.

#### **Discussion**

Our work shows that the IN-PAR methodology obtains better results than ROR for the prime number series.

#### **Conclusions**

Perfect models are obtained for all series using both methodologies. The IN-PAR methodology offers better results for prime numbers than the ROR methodology. This alternative methodology to ROR is very interesting for artificial intelligence of computing machines. These methodologies could mean savings in machine time in the search for prime numbers, which are so important in cryptography.

**Keywords:** ROR Mathematical Modeling, IN-PAR Modeling, Prime Numbers, Cryptography

### **Introduction**

#### **The Problem of Weather Forecasting**

One area of application for time series is meteorological data, where different data sets with numerous meteorological variables have been developed. Since the beginning of the 20th century, the problem of weather forecasting has been addressed numerically, using atmospheric circulation models (systems of partial differential equations, or approximations

thereof) based on known initial conditions. Forecasting groups provide daily regional and local forecasts for population centers, and forecasts of meteorological phenomena of interest, primarily surface-borne phenomena (meteors such as precipitation, temperature, among others).

On the other hand, attempts have been made to predict local meteorological events by directly applying statistical techniques to the available historical observational records of these phenomena, for example, ARIMA models (Autoregression and Integrated Moving Averages). However, according to some authors, these have been operationally inefficient [1].

There is no established algorithm for forecasting meteorological variables (precipitation, temperature, cloudiness, wind, among others). Each group of forecasters follows their own sequence of steps and combines the information obtained to provide a forecast of these variables, based on the characteristics of the location and their individual and collective experience.

Observational data are increasingly available, providing valuable statistical information on local climatology. Automated applications for weather prediction have recently been developed [1-3]. The WIND-1 system, proposed in 2002, is aimed at predicting visibility and wind intensity at airport terminals in Nova Scotia, Canada; the authors implement a fuzzy k-NN that combines elements of case-based reasoning and fuzzy logic [2]. Present short-term local forecasting methods for the Santander area, Spain; they combine the outputs of numerical models with statistical information contained in local observations [1,3]. These systems are specific to the local areas for which they were developed due to the diversity of existing geographies and climatic characteristics.

In Cuba, the Cuba Forecast system was developed by the Cienfuegos Meteorological Center in 2003 [4]. It allows for forecasting meteorological variables for the country's different provinces. The basic synoptic scale information it uses is a grid developed by the European Centre for Medium-Range Forecasts. According to meteorological specialists, this is the only automated system in Cuba that can automatically forecast temperatures. Although this system certainly represents a step forward, it has not yet achieved the desired results. Other interesting work has been carried out at the Marta Abreu de las Villas Central University where an evaluation of decision-making systems applied to seasonal weather forecasting is being carried out [5,6]. In the Provincial Meteorological Center of Villa Clara, ARIMA models have been implemented on the monthly [7,4] and decadal scales for maximum and minimum temperatures as well as precipitation with outputs through the Provincial climatological bulletin with good results, it is worth noting that time forecasts have been made for temperatures mainly for one year and up to 20 years in the future, and also for the wind [7a,7b]. Modeling of some economically important variables such as bovine subclinical mastitis has also been carried out where the impact of some climatic variables on this disease is discussed, in addition, the application of dummy variables to the forecast of leptospirosis in humans has been ventured with excellent results by achieving for the first time to obtain forecasts one month in advance in the province [7c,7d,7e].

The ROR methodology consists of several steps and allows not only to mathematically model mosquito larval densities, as well as the population dynamics of mollusks, but goes further (possibility of modeling infectious entities of different etiologies, such as HIV / AIDS, Cholera, Influenza, Acute Respiratory Infections (ARI), Acute Bronchial Asthma Attacks (ABAA), Fasciolosis, Angiostrongylosis and even in the estimation of the length and area of the universe, monthly forecast of precipitation and extreme temperatures, forecast of meteorological disturbances / hurricanes, prediction of the latitude and longitude of earthquakes, search for information in white noises, modeling the equivalent effective temperature (EET) and atmospheric pressure (AP) up to the own electrical consumption of a municipality, province or nation) [8,10-15].

In this methodology, the dichotomous variables DS, DI, and NoC must first be created, where NoC is the number of base cases (its coefficient in the model represents the trend of the series).  $DS = 1$  if NoC is odd;  $DI = 0$  if NoC is even, and vice versa. DS represents a sawtooth function and DI this same function, but inverted, such that the variable to be modeled is trapped between these parameters and a large amount of variance can be explained. Subsequently, the regression analysis module of the SPSS statistical package version 19.0 (IBM, 2010) is executed, specifically the ENTER method, where the predicted variable and the ERROR are obtained. The autocorrelograms of the ERROR variable are then obtained, paying attention to the maximum significant partial autocorrelations (PACF), and the new variables are then calculated, taking into account the significant lag of the PACF. Finally, these variables are included in the new regression, regressed in a process of successive approximations until obtaining white noise in the regression errors. For atmospheric pressure, one-year lead lags were used, as other authors have used for climate indices [8-10].

The objective of our work is to model prime number series using the ROR methodology, using the IN-PAR methodology as an improvement on the previous one [16-19].

## Materials and Methods

For this study, we used a self-developed database consisting of 25 cases of prime numbers less than 100. The prime number series was then modeled using the ROR and IN-PAR methods, the errors of the predicted values relative to the actual values were calculated, and descriptive statistics for the corresponding errors were obtained.

## Results and Discussion.

The characteristics of the models obtained can be seen in Table 1. The correlation index R-squared is 1, the models are perfect, the errors are zero, and Fisher's F was estimated according to [20]. Since the errors are zero and division by zero occurs, it was operated according to the authors' definition of this type of uncertainty. As can be seen in the IN-PAR model, Fisher's F is much higher than that determined by ROR, which suggests that this model is more probable, as we will see later.

Series to modelingar	R squared or Explained Variance	Error of the model	F of Fisher
Primes ROR	1	0	3035.994*i
Primes IN-PAR	1	0	10842.761*i

**Table 1: Main Characteristics of the ROR Models Using Two Data Points**

When calculating the errors for each series by both methodologies, the descriptive statistics of the error were then calculated and it is observed that this IN-PAR methodology presents better results for prime numbers than the ROR Table 2, since the standard deviation is lower and the mean of the errors is the same then IN-

PAR presents lower dispersion values with respect to the mean values of the errors, the ROR methodology offers better results with smaller errors in the case of minimum and maximum values and while IN-PAR presents a lower standard deviation.

	N	Mínimum	Máximum	Means	Estándard Deviation
Even	25	2,00	50,00	26,0000	14,71960
Odd	25	3,00	51,00	27,0000	14,71960
PrimeNumbers	25	2,00	97,00	42,4000	29,47598
Residual by ROR	14	-3,11193	2,14260	,0000000	1,68697981
Residual by IN-EVEN	14	-2,46154	3,65714	,0000000	1,62981519
Valid N (by list)	14				

**Table 2: Descriptive Statistics**

The IN-PAR model for the Prime numbers Table 3, depends only on the parameters of the corresponding Odd number and this number returned in 11 cases (La11INPar), here appears the number 11 which is related to the results in other works, 11 seems to be a magic number because it appears in many natural phenomena [21,22].

Modelo		Coeficientes no estandarizados		Coeficientes	t	Sig.
		B	Error estándar	Beta		
1	Impar	1,297	,046	,754	28,310	,000
	<b>La11INPar</b>	,939	,099	,252	9,453	,000
a. Dependent variable: PrimeNUMBERS						
b. Linear regression through the origin						

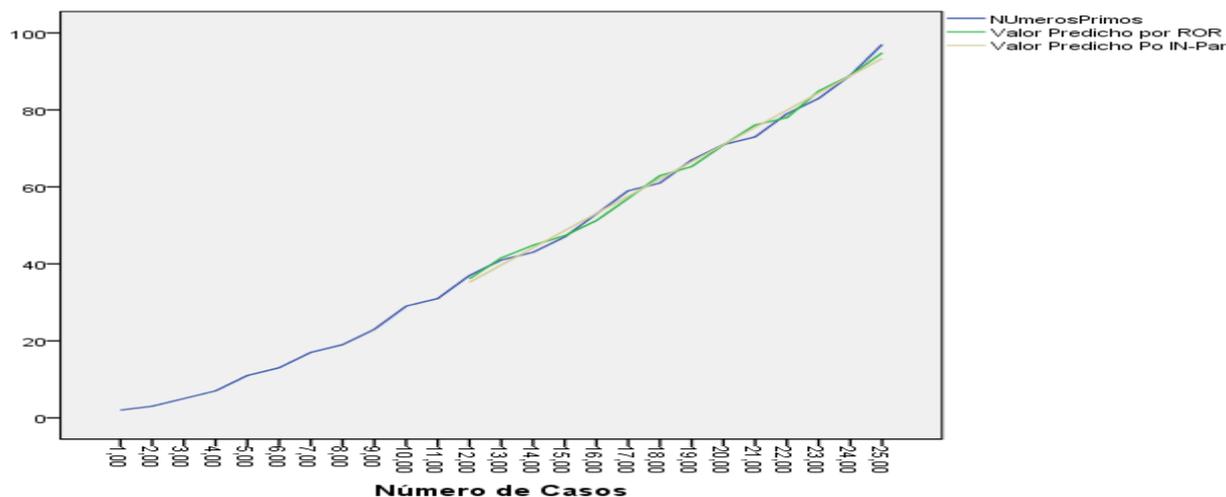
**Table 3: Coefficients<sup>a, b</sup>**

Here we will explain in more detail what the IN-PAR methodology consists of. It has the same steps as the ROR methodology, except that instead of using the sawtooth (SD) and inverted sawtooth (ID) variables, the series of Even Numbers and the series of Odd Numbers are used [23]. In our case, the variable chosen by the model was Odd. It can be seen that only two variables are used, while the ROR methodology uses 5 variables to obtain the same explained variance (Table 4).

Modelo		Coeficientes no estandarizados		Coeficientes	t	Sig.
		B	Error estándar	Beta		
1	DS	10,957	7,726	,116	1,418	,190
	<b>DI</b>	10,648	7,537	,113	1,413	,191
	<b>La1Primes</b>	,844	,348	,785	2,429	,038
	<b>La4Primes</b>	-,071	,392	-,053	-,183	,859
	<b>La11Primes</b>	,325	,318	,118	1,023	,333
a. Dependent variable: Prime Numbers						
b. Linear regression through the origin						

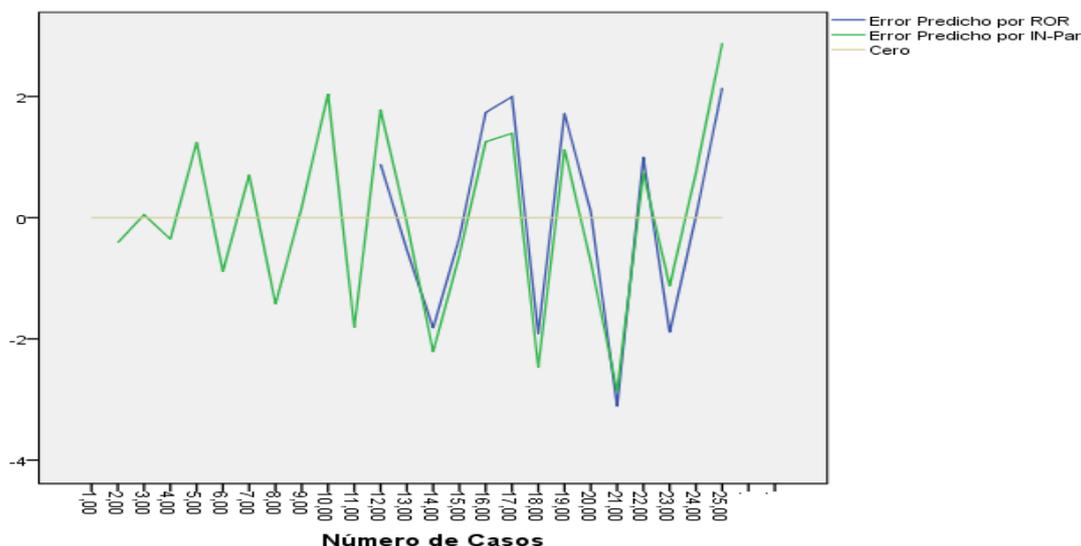
**Table 4: Coefficients<sup>a, b</sup>**

Below is a plot of the results obtained for the case of prime numbers (Figure 1). The good agreement between actual values and those modeled by both methodologies can be observed.



**Figure 1: Plot of Prime Numbers According to ROR and IN-PAR**

Figure 2 also shows the results between the ROR model and the IN-PAR model for the prime number errors, with the IN-PAR methodology showing better results with smaller errors.



**Figure 2: Plotting of Prime Number Errors According to ROR and IN-PAR**

This IN-PAR methodology is very interesting and important for artificial intelligence in computing machines because it can be used as an algorithm for acquiring knowledge, considering that only two variables were used for modeling. It is also an easy way to obtain prime numbers by assigning the corresponding odd number to the returned odd number with 11 cases, allowing us to go forward 11 steps. This could mean a saving in machine time in the search for prime numbers, so important in cryptography.

## Conclusions

- Perfect models for the prime number series are obtained using both methodologies.
- The ROR and IN-PAR methodologies describe prime numbers without errors.
- The IN-PAR methodology offers better results than ROR for prime numbers.
- This IN-PAR methodology is very interesting for artificial intelligence in computing machines.
- These methodologies could save machine time in the search for prime numbers, which are so important in cryptography.

## Reference

1. COFIÑO GONZALEZ, A. S. (2004). *Técnicas estadísticas y neuronales de agrupamiento adaptativo para la predicción probabilística de fenómenos meteorológicos locales: aplicación en el corto plazo y en la predicción estacional* (Doctoral dissertation, Universidad de Cantabria).
2. Riordan, D., & Hansen, B. K. (2002). A fuzzy case-based system for weather prediction. *Engineering Intelligent Systems for Electrical Engineering and Communications*, 10(3), 139-146.

3. García, C. M. S. (2006). *Técnicas estadísticas para la proyección local de la predicción meteorológica estacional: métodos, validación y estudios de sensibilidad* (Doctoral dissertation, Universidad de Cantabria).
4. Díaz Y, Fernández A, inventors; Cuba Forecast para el pronóstico de variables meteorológicas. Cuba. 2003.
5. Caballero, Y., Bello, R., Álvarez, D., & Pizano, Y. (2006, August). Improving the k-NN method: Rough Set in edit training set. In *IFIP World Computer Congress, TC 12* (pp. 21-30). Boston, MA: Springer US.
6. Caballero, Y., Arco, L., Bello, R., & Gómez, J. M. (2007). New measures for evaluating decision systems using rough set theory: The application in seasonal weather forecasting. In *Information Technologies in Environmental Engineering: ITEE 2007-Third International ICSC Symposium* (pp. 161-173). Springer Berlin Heidelberg.
7. Osés, R. (2004). Series meteorológicas de Villa Clara y otras provincias; Tesis para optar por la categoría de Máster en Matemática Aplicada, UCLV, 2004.
  - a. Impacto Climático hasta el 2020 en la temperatura de la Provincia de Villa Clara. Cuba (a) publicado en VI Conferencia Científica Internacional de Ingeniería Mecánica. 2 al 4 de noviembre. Villa Clara Cuba. Editorial Feijóo ISBN978-959-250-602-2 Autor: MSc. Ricardo Osés, Dr. Guillermo Saura González, MSc. Alfredo Pedraza Martínez.
  - b. Impacto Climático hasta el 2059 del viento en la Provincia de Villa Clara. Cuba (b) publicado en VI Conferencia Científica Internacional de Ingeniería Mecánica. 2 al 4 de noviembre. Villa Clara Cuba. Editorial Feijóo ISBN978-959-250-602-2 Autor: MSc. Ricardo Osés, Dr. Guillermo Saura González, MSc. Alfredo Pedraza Martínez, Lic. Meylin Otero Martin.
  - c. Insua, D. A., Rodríguez, R. O., González, G. S., & Martínez, A. P. (2010). Impacto de la humedad relativa mínima en la prevalencia de mastitis subclínica bovina utilizando regresión lineal. *REDVET. Revista Electrónica de Veterinaria*, 11(3B), 1-9.
  - d. Rodríguez, R. O., Insua, D. A., Rodríguez, O. C., González, G. S., & Martínez, A. P. (2010). Modelación del impacto de algunos factores climáticos en la prevalencia de mastitis subclínica bovina. *REDVET. Revista Electrónica de Veterinaria*, 11(3B), 1-8.
  - e. Rodríguez, R. O., Sánchez, J. J. B., cerero Rodríguez, O., González, G. S., & Martínez, A. P. (2010). Evaluación del comportamiento de la leptospirosis humana mediante un modelo matemático atendiendo a variables climáticas como predictoras. *REDVET. Revista electrónica de Veterinaria*, 11(3B), 1-11.
8. Osés, R.R.; Aldaz, C.J.W.; Fimia, D.R.; Segura, O.J.J.; Aldaz, C.N.G.; Segura, J.J. et al. The ROR's methodology an it's possibility to find information in a white noise. *Int J Curr Res*. 2017; 9(03): 47378-82.
9. Osés, R.R.; Fimia, D.R.; Aldaz, C.J.W.; Iannacone, O.J.; Zaita, F.Y.; Osés, L.C. et al. Modelación matemática del cólera por medio de la Regresión Objetiva Regresiva y su relación con las variables climáticas. Caibarién, Villa Clara, Cuba. *The Biologist (Lima)*. 2017;15 (Suplemento Especial 1):128.
10. Sánchez, Á.M.L.; Osés, R.R.; Fimia, D.R.; Gascón, R.B.C.; Iannacone, J.; Zaita, F.Y. et al. La Regresión Objetiva Regresiva más allá de un ruido blanco para los virus que circulan en la provincia Villa Clara, Cuba. *The Biologist (Lima)*. 2017; 15 (Suplemento Especial 1):127.
11. Osés, R.R.; Fimia, D.R.; Otero, M.M.; Osés, L.C.; Iannacone, J.; Burgos, A.I.; Ruiz C.N.; Armiñana, G.R.; Socarrás P.J. Incidencia del ritmo anual en algunas variables climáticas en poblaciones larvales de culícidos: pronóstico para la temporada ciclónica 2018 en Villa Clara, Cuba. *The Biologist (Lima)*. 2018; 16, jul-dic, Suplemento Especial 2.
12. Osés, R.R.; Carmenate, R.A.; Pedraza, M.A.F.; Fimia-Duarte, R. Prediction of latitude and longitude of earthquakes at global level using the Regressive Objective Regression method. *Advances in Theoretical & Computational Physics (Adv Theo Comp Phy)*. 2018; 1(3):1-5. DOI: doi.org/10.33140/ATCP.
13. Osés, R. R., Fimia, D. R., & Otero, M. M. (2019). Modelación ROR aplicada a pronósticos. Editorial Académica Española (eae). Editorial de Omni Scriptum Publishing KS. *Brivibas gatve*, 197.
14. Osés, R.R.; Machado, F.H.; González, M.A.A.; Fimia, D.R. Estudio del consumo eléctrico provincial de Villa Clara y su pronóstico 2019-2023 Cuba. *Revista ECOSOLAR*. 2019; 65:32-43.
15. Hernández Contreras, N., Doadrio Villarejo, I., Sostoa Fernández, A., Fimia Duarte, R., & Odio Palacios, N. (2006). Determination of the ichthyofauna involved in the control of culicids in aquatic systems of the Guamá municipality, Santiago de Cuba. *Cuban Journal of Tropical Medicine*, 58 (1), 0-0.
16. Lázaro Mata Cuevas: Ricardo Osés Rodríguez; Paul Robert Vogt; David del Valle Laveaga, Rigoberto Fimia Duarte. Meteorological variables and their Incidence in Infarcted Patients using the Objective Regressive Regression Methodology in the Hospital of Sagua la Grande, Villa Clara, Cuba. *International Journal of Multidisciplinary Research and Growth Evaluation*.
17. Ricardo Osés Rodríguez and Rigoberto Fimia Duarte. Forecast of Earthquakes Greater than 6 on the Richter Scale in Japan Using ROR Modeling. *J Mat Sci Eng Technol*, 2025.
18. Osés RR, Osés LC, del Valle LD, and Fimia DR. Modelling the first 100 digits of the number Pi (p) using the objective regressive regression methodology.
19. Ricardo osés rodríguez; paul robert vogt; rigoberto fimia duarte.la metodología de la regresión objetiva regresiva. y sus múltiples potencialidades de aplicación en diferentes campos de la ciencia. editora dialéctica. metodología de la regresión objetiva regresiva.2025. isbn:978-65-270-5261-6. E-isbn:978-65-270-5260-9.
20. Osés R.; Fimia R. Lizbet M., 2015.Division by zero, of Cristosols to estimate universe longitude. Futurology and Regressive methodology finding information beyond awhite noise. Lambert Academic Publishing. OmniScriptum GmbH & Co.KG. ISBN: 978-3-659-71469-6.
21. Ricardo Osés Rodríguez; Meylin Otero Martín; Rigoberto Fimia Duarte; Claudia Osés Llanes; Iosbel Burgos Alemán; Nancy Ruiz Cabrera & Julia Socarrás Padrón. Modeling And Monthly Forecast Prior To 11 Years Of The Precipitations

And Extreme Temperatures For Cuba. V Simposio Internacional Sobre Vigilancia, Monitoreo Y Control De Vectores Implicados En La Transmisión De Enfermedades Zoonóticas. 12 al 16 De noviembre De 2018, Trinidad, Cuba. *The Biologist* (Lima), 2018, b, Vol. 16, Jul-Dic, Suplemento Especial 2.

22. MODELACIÓN Y PRONÓSTICO DE LA LEUCEMIA LINFOIDE AGUA EN NIÑOS. IMPACTO DE LAS VARIABLES CLIMÁTICAS EN VILLA CLARA, CUBA. Ricardo Osés Rodríguez, Noira Durán Morera, Iosbel Burgos Alemán, Claudia Osés LLanes. VI Taller Cambio Climático y Salud. Sagua la Grande. 27-28 de noviembre de 2020.
23. Duarte, R. F., Osá, R., & Martán, M. O. (2020). La entomofauna de culicidos y los copódos abordados desde las alternativas de control biológico hasta la modelación matemática en dos provincias centrales de Cuba. *Anales de la Academia de Ciencias de Cuba*, 10(3), 803.