

# A Novel Method of Rainfall Prediction using MLP-FFN and Hybrid Neural Network Algorithm



G. Thailambal, P. Shanmugalakshmi, R. Durga

**Abstract:** The present work proposes a cross breed neural system and multilayer perceptron feed forward system based model for precipitation forecast. The crossover models are multistep technique. At first, the information is bunched into a sensible number of groups, at that point for each bunch has prepared independently by Neural Network (NN). Also, as a preprocessing stages a component choice stage is incorporated. Feed forward choice calculation is utilized to locate the most reasonable arrangement of highlights for foreseeing precipitation. To set up the creativity of the proposed cross breed forecast model (Hybrid Neural Network or HNN) has been contrasted and two surely understood models in particular multilayer perceptron feed-forward system (MLP-FFN) utilizing diverse execution measurements. The reproduction results have uncovered that the proposed model is essentially superior to conventional strategies in anticipating precipitation.

**Keywords:** Rainfall prediction, multi-layer perceptron, neural network, hybrid model.

## I. INTRODUCTION

India has a new tropical monsoonal environment, since the majority of the country exists inside the tropics and the air is usually impacted by the rainstorm. Factors Influencing the Atmosphere of India.

Latitude: India lies between eight 0 N and 37 0 N extensions. Himalaya Mountains: The Himalayas expect a noteworthy activity in crediting a sub-tropical touch to the atmosphere of India. The elevated Himalaya Mountains structure an impediment which impacts the climate of India. This foresees the infection wind gusts of north Asia from blowing into India, thus protecting it from truly cool winters.

This traps the Storm winds, driving them to shed their moistness inside the sub-continent. Temperature decreases with size. Places in the mountains are cooler than spots on the plains. Distance from the sea: With a long coastline, colossal waterfront regions have an accordant air. Domains in within India are a long way from the choosing effect of the sea. Such zones have cut-off points of air. European Unsettling influences: The reduced weight structures that get started once again the eastern med locale in winter and move eastwards towards Of India overlooking Iran, Afghanistan

and Pakistan are accountable for the winter deluge in northern India. Conditions in the Zones Encompassing of India: Temp and weight conditions inside East Africa, USA, Key Asia and Tibet pick the nature in the tempests and the intermittent dry out spells. Regarding example, fantastic heat in Far East Africa may draw typically the rainstorm turns from typically the Indian Sea into of which district along these sets out, triggering a dry period. Conditions in the Sea: Generally the atmosphere conditions above the Indian Sea plus the China Ocean may end up being in charge of hurricanes which constantly impact the east coast of India. Fly Techniques: Air back and out there movements inside the higher tiers of the air identified as fly steams may choose the appearance regarding the tempests and vaation of the rainstorm.

## II. LITERATURE SURVEY

Agrawal, R., (2015) The paper delineates the utilization of Again Spread count and their two backups by using a multi-layered Feed Forward System (FFN) building on 1-year step by step recognition data from Delhi to anticipate precipitation. The makers described the observation data over Delhi as infrequent (i. e in light of rainstorm) and non-ordinary. Typically the makers realized the calculation in MATLAB and selected the three counts: Again Proliferation, Fell Back Propagate and Layer Repetitive Method with the Mean Sq . Mistake (MSE) as the estimation. With their dataset, their noteworthy disclosures were: 1) the rear Engendering Computation was a lot better than the following two; 2) Expanding the amount of neurons in the framework decreases the MSE, and from this time forward performs of all the three chosen estimations is better.[1]

Aggarwal, R., and Kumar, R et al., (2014) has dismembered the commonly become data burrowing estimations for deluge fall desire. The particular five by and large gotten data exploration matters explicitly Neural Program (NN), Arbitrary Backwoods, Collection and Relapse Tree (CRT), Strengthen Vector Machine (SVM) and k-nearest neighbor, used for deciding. They to get ANN and GA for anticipation envisioning are tried. Making use of data of temperature, pneumatic pressure, precipitation, relative wetness and wind speed, it is seen that the nerve organs nets played your very best in the get-together. The papers by then develops an effective based GEORGIA and variations the regularity and the best artist of the for the most part gotten data mining ANN models. This is seen that the result from Gee dependent GA outmaneuvered those from the ANN models [3].

Manuscript published on 30 August 2019.

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Ganti, R. et al., (2013) suggested a mix breed strategy (SVM-Fluffy) that joins the Support Vector Machine with Fluffy Explanation techniques. Utilizing the data for the region Makassar Indonesia for quite a while (2001-2010) with tip factors, for example, heat, wind speed, clamminess and precipitation, watch the proposed SVM-Fluffy strategy to the fatigue Neuro-Fluffy philosophy. The particular proposed cream system, SVM-Fluffy strategy not solely is seen to be certain yet in addition observed to seek after the sort of genuine data. The accuracy of the SVM Fuzzy strategy is seen to be better than the Neuro-Fluffy strategy [8].

Bui, D.T., Pradhan, B., Revhaug, et al., (2013) the purpose of this examination is to build up a count to anticipate electric weight gauging using Neuro-Fluffy Frameworks. These people have inspected various strategies like Relapse strategy, Comfortable basis approach, Neural Program approach, Neuro-cushy procedure, and so on. They prescribe a mix model of Neural Program and Fluffy (Neuro-Fluffy) for transient weight foreseeing. The particular mean screw up from the Neuro fuzzy model is seen to be - 0.0040 which is vastly improved than one 70274 that from the distinctive direct backslide model, thereby demonstrating the commonness of the Neuro-cushioned model versus the various directly backslide in foreseeing at present minute[5].

Guhathakurta, P. et al., (2013) have developed an alternative Support Vector Machine (ESVR) model and discovers an important showing setup using the non-direct backslide to be explicit Support Vector Machines. Taking a gander at the data parameters of atmosphere like temperature, water vapor, natural weight, dew point, blowing wind speed, wind bearing, precipitation with a MLP (Multi-Layer preceptor) portrayal. The consequence of this examination is the count plots a class name and do straight out plan and report the present atmosphere and predicate the future happening conditions of atmosphere [10].

Goyal et al., (2013) looks at the impact atmosphere on collect yield, in Orissa area, using Aridity File. They find that precipitation and temperature are the two noteworthy components that impact collect yields. This examination, using diverse backslide examination, has invalidated the system for direct usage of meteorological factors (either month to month or normal), to check atmosphere influence on collect yield. They advocate the wire of „aridity index“ variable in the backslide model to unravel the econometric examination and moreover found to improve results [9].

Chau, K. W., and Wu, C. L. et al., (2012) developed a quantifiable model to improve the operational guess exactness. The maker used 8-parameter and 10-parameter control backslide models from 2003 to 2006 for Long Range Estimating and new authentic troupe foreseeing structure are explained. The model conditions are made by using the immediate backslide and neural framework techniques. The consequence of this examination is that the inclination of the guess achieved through this process is observed to be usually better when stood away from the mastery of the check got from the models attempted by various makers already [6][11].

## A. Data Collection

It is inspired by the way that for exceedingly appropriated information it will be hard for a solitary NN.

Consequently, it will be valuable, if the information focuses are bunched into sensible numbers of gatherings and apply a different NN for each group. Hence, unique NNs will gain proficiency with the distinctive piece in the entire example. The theory is tried by contrasting this HNN model and two other surely understood NN based models. For preparing the NNs of HNN model, scaled conjugate inclination plummet calculation, has been utilized, which is benchmarked against back engendering calculation. In the present examination fluffy c-implies calculation is utilized on beginning information focuses to bunch them into an appropriate number of clusters. Thereafter information purposes of each group are utilized to prepare one NN along these lines empowering a specific neural system to gain proficiency with the example for a particular gathering of information purposes of the entire information. During testing stage, participation of the testing test is resolved and the comparing NN prepared for that group is utilized to foresee the precipitation esteem. The quantity of ANNs utilized for each bunch can be expanded further to upgrade the precision. Nonetheless, this addition may influence the time multifaceted nature. In this way, in the present examination, only one ANN is utilized for each bunch to keep the model basic.

## B. Proposed System Methodology

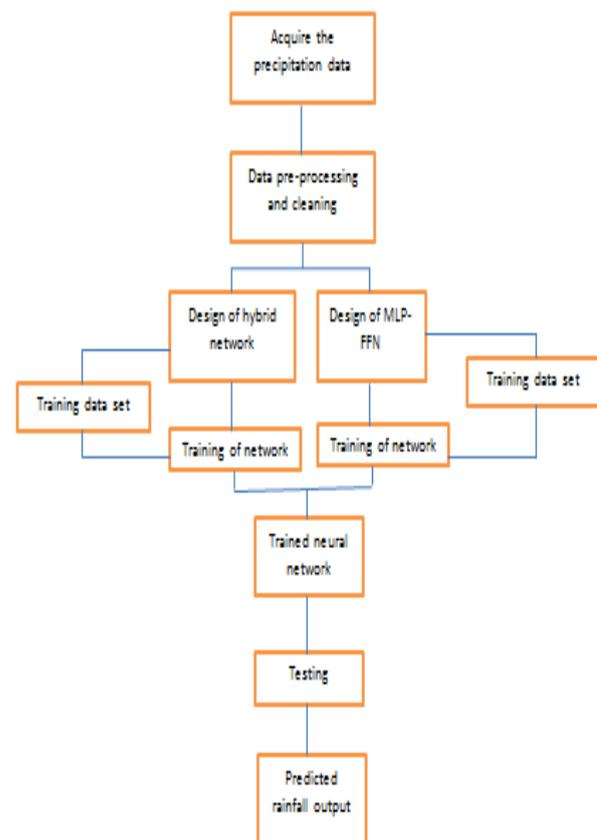


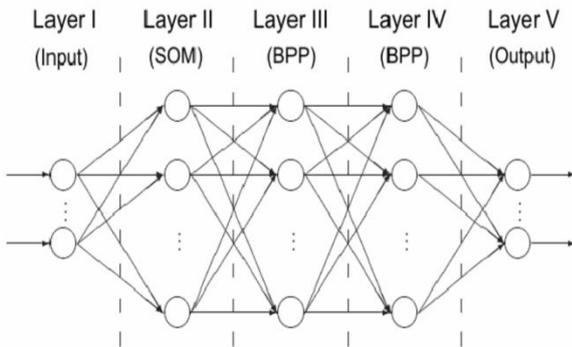
Fig 3.1 is a flowchart which explains the flow of proposed system

The present investigation proposes a half breed neural system (or HNN) model for precipitation forecast. The preparation period of the HNN strategy comprises of two unique stages. The primary stage groups the information focuses into an appropriate number of bunches. Next, for each bunch a different ANN model is utilized. Studies have uncovered that customary ANNs probably won't perform well whenever prepared utilizing inclination plummet based calculations. So we gone for Multilayer perceptron Feed forward network (MLP-FFN).

Hybrid Neural Network Model is available work proposes a Hybrid Neural Network (HNN) model which is bolstered by a multistep preparing stage. At first, the information focuses are gathered into an appropriate number of bunches. In the present examination, fluffy c-implies calculation has been utilized to group the information focuses into an appropriate number of bunches. The reasonable number of groups has been chosen by experimentation strategy. Next for each group a different NN is utilized and prepared to assemble the model

**C. Algorithm 1-HNN**

The present work proposes a Hybrid Neural Network (HNN) model which is upheld by a multistep preparing stage. At first, the information focuses are assembled into an appropriate number of bunches. In the present examination, fluffy c-implies calculation has been utilized to group the information focuses into a reasonable number of bunches.

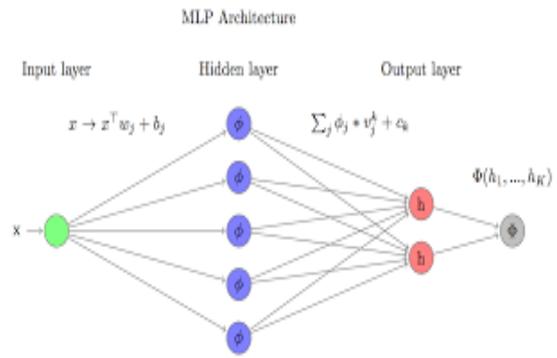


**Fig 3.2 Hybrid neural network**

The suitable number of bunches has been chosen by experimentation strategy. Next for each group a different NN is utilized and prepared to fabricate the model. It is roused by the way that for exceedingly conveyed information it could be hard for a solitary NN. Along these lines, it could be advantageous, if the information focuses are bunched into sensible number of gatherings and apply a different NN for each group.

**D. Algorithm 2-MLP**

A multilayer perceptron (MLP) is a class of feed forward counterfeit neural system. A MLP comprises of at any rate three layers of hubs: an info layer, a concealed layer and a yield layer. Aside from the info hubs, every hub is a neuron that uses a nonlinear enactment work. MLP uses a managed learning method got back to spread for preparing. Its different layers and non-straight actuation recognize MLP from a direct perceptron. It can recognize information that isn't straightly detachable.



**Fig 3.2 MLP-FFN**

On the off chance that a multilayer perceptron has a direct initiation work in all neurons, that is, a straight capacity that maps the weighted contributions to the yield of every neuron, at that point straight polynomial math demonstrates that any number of layers can be diminished to a two-layer input-yield model. In MLPs a few neurons utilize a nonlinear enactment work that was created to demonstrate the recurrence of activity possibilities, or terminating, of organic neurons.

**E. MATLAB**

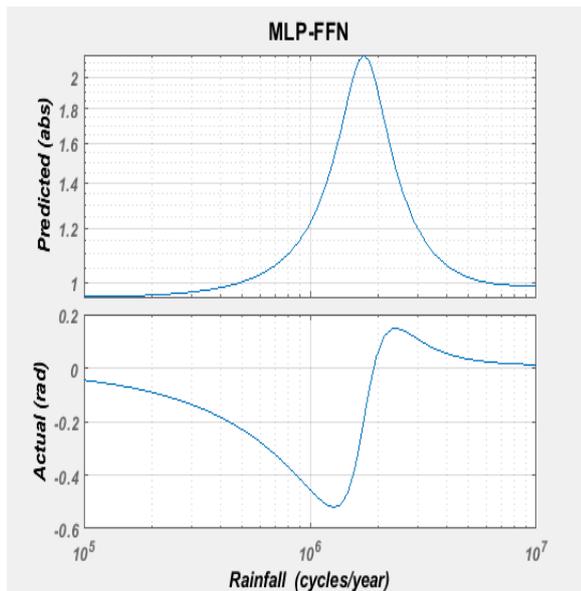
MATLAB is an item pack for tip top numerical estimation and portrayal. It outfits an instinctive space with numerous intrinsic capacities with respect to specific figuring, plans and movement. Best of all, it outfits basic extensibility with its own special irregular state programming language. The name MATLAB speaks to Matrix Laboratory. The fundamental structure square of MATLAB is the grid. The key information type is the exhibit. MATLABs worked in capacities give astounding instruments to direct polynomial math calculations, information investigation, signal handling, streamlining, numerical arrangements of ODES, quadrature and numerous different sorts of logical calculations. The greater part of these capacities utilizes the best in class calculations. There are various capacities for 2-D and 3-D course, MATLAB even gives an outer interface to run those projects from inside MATLAB. The client, be that as it may, isn't constrained to the inherent capacities; he can compose his own capacities in the MATLAB language. When composed, these capacities act simply like the implicit capacities. MATLAB's language is anything but difficult to learn and to utilize.

**III. RESULTS**

Notwithstanding, the danger of over fitting of the MLPNN was taken by early ceasing condition. As we utilized iterative technique for preparing a student, this ceasing condition fits better the information with every cycle There are two essential guidelines of halting condition (i.e., mean square mistake worth and mean square blunder change).

These standards help give direction about the quantity of cycles running before the introduction of over fitting of student, Prechelt. In Zaitun time arrangement programming, one can discover ceasing condition in neural system examination structure.

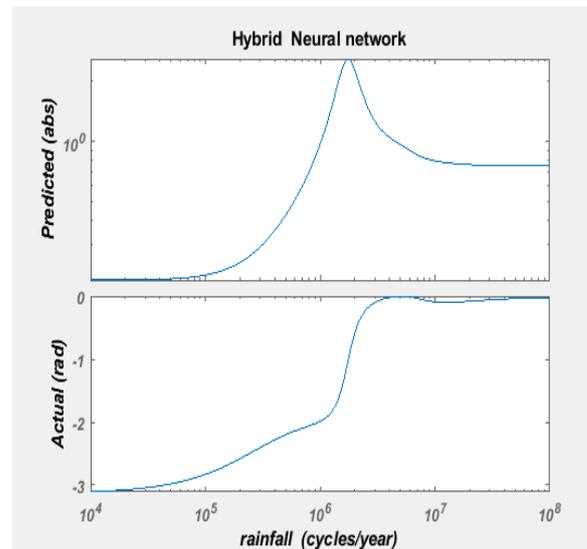
A few models are connected and tried with different mixes of layers (i.e., input layer, shrouded layer, and yield layer) and four enactment capacities (i.e., semi straight, sigmoid bipolar sigmoid, and the hyperbolic digression work). Following parameters of the ANN engineering regarding learning rate, force, inclination, the quantity of concealed neurons, and the actuation steady were considered. Experimentation strategy was received to pick the ideal estimation of each organized parameter of system model. The anticipated model has determined for information precision, Root mean square error(RMSE), Mean total error(MAE) and R-square blunder



**Fig 5.1 Plot between actual and predicted by MLP-FFN**

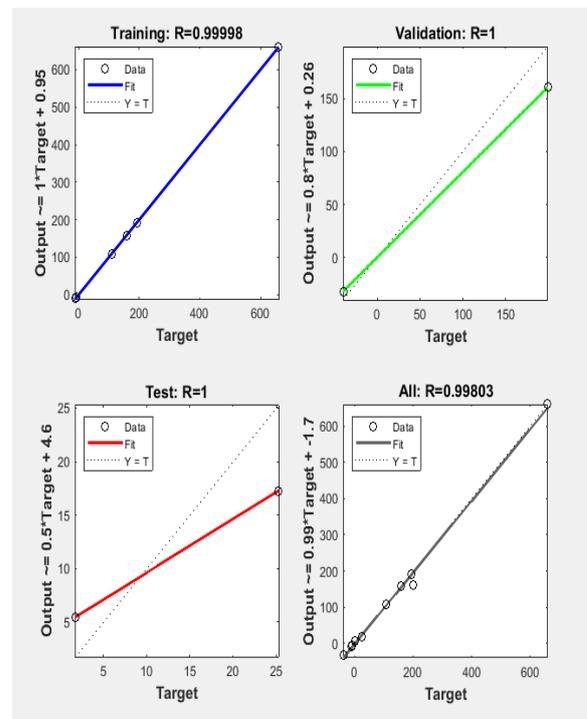
The above graph show the actual and prediction rate of rainfall dataset from 2010 to 2017 by MLP-FFN. By the graph through MLP-FFN system has indicating the rainfall rate in 2018 is lower than the previous year because the magnitude over the graph (i.e) the peak has fallen suddenly when comparing to the actual. This shows the rate of rainfall also less.

From Fig.5.2 show the actual and prediction rate of rainfall dataset from 2010 to 2017 by Hybrid neural network. The regression has lying through data at which has tested and trained. As like in MLP-FFN , the hybrid network also shown the rainfall has a same statistics on peak over the magnitude, but decrement prediction is not retaining lower than the MLP-FFN



**Fig 5.2: Plot between actual and predicted by Hybrid Neural Network.**

The regression plot has show below which has denoting the predicting dataset has passing over the true label.



**Fig 5.3 Plot Regression for Hybrid**

So the accuracy of the predicted data is more in this region. The validation is the execution period of the prediction dataset. The created ANN model comprises of 3 layers that are input, covered up, and yield of 30 neurons, 8 neurons, and 1 neuron, individually. For confirmation of estimate model, the residuals arrangement were tried and plotted to analyze whether the arrangement is uncorrelated or not. On the off chance that the residuals uncovered to be uncorrelated, the chose model is then connected to gauge dry season files. We found that sigmoid capacity is best for every dry season record for one-month scale data based on the criterion of mean square error.

Momentum of 0.5 and training epoch of 10000 were set. The input vector consists of previous 30 values of each index. After selection of the appropriate parameter of ANN, the forecasted model for each of the indices is then validated on 20% of data. Validation of forecasted model is done based on performance measures: MAE, the correlation coefficient ( $r$ ), and RMSE.

#### IV. CONCLUSION

This paper reports a definite study on precipitation expectations utilizing diverse neural system structures more than a quarter century. From the study it has been discovered that the majority of the analysts utilized back spread system for precipitation forecast and got critical outcomes. The study likewise gives an end that the determining strategies that utilization MLP and HNN are appropriate to foresee precipitation than other gauging procedures, for example, factual and numerical techniques. Anyway some impediment of those strategies has been found. The broad references in help of the various advancements of ANN research gave the paper ought to be of incredible assistance to ANN scientists to precisely anticipate precipitation later on.

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