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Performance Evaluation Of Call Setup Success Rate (cssr) In A Global System For Mobile Communications (gsm) Network.

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Abstract:

Call set up success rate in a GSM network is one of the very key performance indicators (KPI) used by all GSM operator and service provider. CSSR is the fraction of the attempts to make a call that result in a connection to the dialed number. The Main purpose of this paper is to examine the performance of call setup success rate in a GSM network. The Problem here is that usually all call attempt are expected to be successful never the less calls still fail due to various reasons not all call attempts end with a connection to the dialed number. The method employed a data mining technique for the design and analysis by RMSE and Pearson correlation to the dialed number. The **Method** employed a data mining technique for the design and Analysis of the data. It was aided by RMSE and Pearson correlation coefficient to the dialed number, a four weeks' data of CSSR was partitioned into input and output training and checking paired data set, the data was trained with the use of ANFIS model in a Mat lab 2018a environment. Main **Finding**s shows that ANFIS has an effective hybrid training or learning between the real and implemented. The performance of the ANFIS model was evaluated using standard error measurements. The **implications** of the study are that the proposed error modeling can be used in order to assure standard in measurement of CSSR. ANFIS guarantee proper planning, network correlation coefficient, a four weeks' data of CSSR was partitioned into input and output training and check ing paired data set, the data was trained with the use of ANFIS model in a Mat lab 2018a environment. Main **Finding**s shows that **Adaptive Neuro-Fuzzy Inference System (**ANFIS) has an effective hybrid training or learning between the real and implemented. The performance of the ANFIS model was evaluated using standard error measurements. The **implications** of the study are that the proposed error modeling can be used in order to assure standard in measurement of CSSR. ANFIS guarantee proper planning, network management, forecasting or prediction for optimal network performance.

KEYWORDS: GSM Network, Call Setup Success Rate, Error Rate and KPI.

I. INTRODUCTION:

Global System for Mobile Communications is a Standard developed by the European telecommunications institute to describe the protocol for second generation digital networks used by mobile devices. It is a digital wireless network designed by standardization from European telecommunications operators and manufacturers. The GSM standard provides a common set of compatible services and capabilities to all mobile users across Europe and several million customers worldwide [7]. Wireless mobile communication system has grown from the

first generation (1G) of analogue system, through the second generation (2G) of digital system to the ever maturing third generation (3G) high speed multiple service system and has transformed the ease of communication the world over. However, the widespread use of mobile communications has heightened consumer demand for better quality service. Thus, network operators all over the world, face the challenges of improving the quality of service while increasing capacity and rolling out new services as they provide wider coverage at the same time had led to 4G (fourth generation) as the fourth generation of mobile telecommunications technology, succeeding 3G and preceding 5G (fifth generation) and 6G (sixth generation). A 4G system support applications like amended mobile web access, Internet Protocol (IP) telephony, gaming services, high-definition mobile TV, video conferencing, three dimensional (3D) television, and cloud computing in addition to the usual voice and other services of 3G [8]. **Adaptive Neuro-Fuzzy Inference System (ANFIS**). This is an intelligent Neuro-Fuzzy technique used for the modelling and control of ill- defined and uncertain systems ANFIS used input/output pairs of the system under consideration.

ANFIS combines the benefits of the two machine learning techniques (Fuzzy Logic and Neural Network) into a single technique. An ANFIS works by applying Neural Network learning methods to tune the parameters of a Fuzzy Inference System (FIS) [9].

II. RESEARCH BACKROUND

Basic Structure of a GSM Network

The Basic Transceiver Station (BTS) consists of the equipment for transmitting and receiving radio signal; transceiver, antennas, equipment for encrypting and decrypting communication with the Base Station Controller (BSC). Typically, a BTS will have several Transceivers (TRXs) which allows it to serve several different frequencies and different sector cell [2,10]

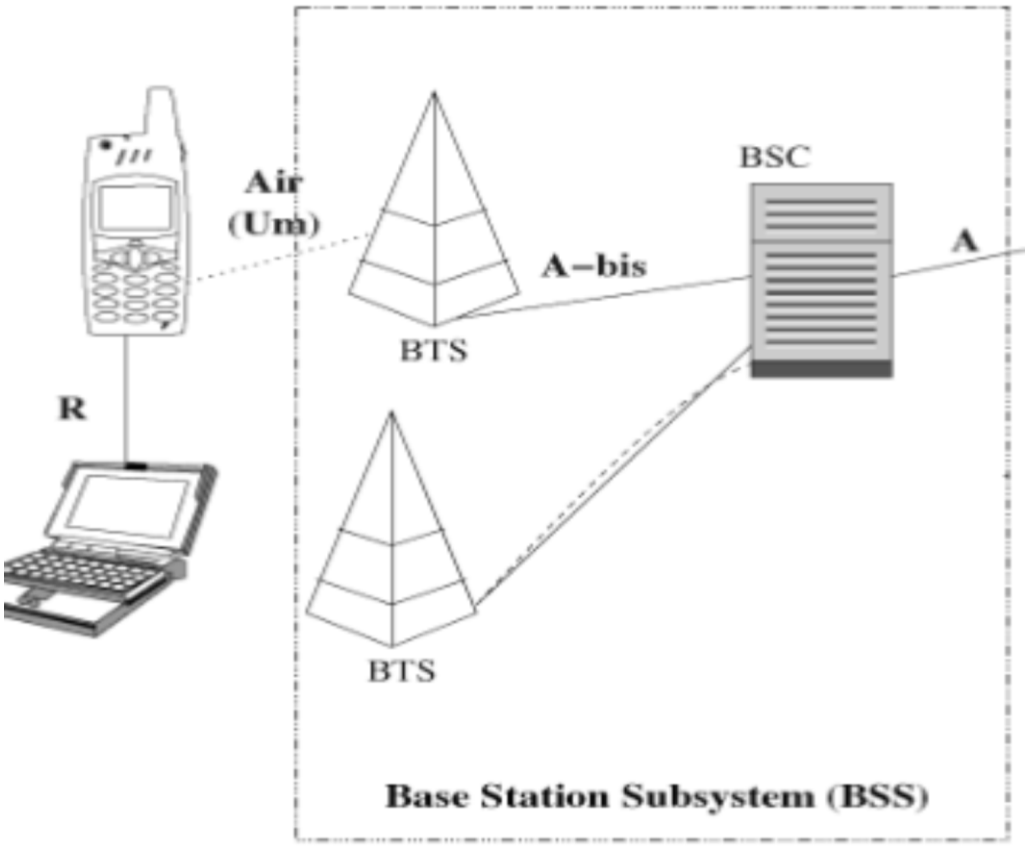


Fig 2.0

Call Setup

Different procedures are necessary depending on the initiating and terminating party in a call setup procedure. Mobile to Mobile call (MMC) is a call setup between two mobile subscribers. Successful call set up involves two procedures. First procedure is Immediate Assignment procedure which is used to create a signaling connection between a Mobile station (MS) and the network. It can be initiated only by the MS sending a CHANNEL REQUEST message on the Random Access channel (RACH) to the BTS that it requires a signaling channel (SDCCH). This message contains the information field „establishment cause and random reference ". The „establishment cause "gives the reason why the MS is requesting a SDCCH [3].

Possible reasons are:

- Handover call
- handshake
- VoIP Call
- Voice call
- Data call
- location update

Then signalization between the MS and network in order to activate the signaling channel, recognize the service being requested by the MS, etc. The successful seizure of SDCCH is acknowledged by sending the Establish Intention message from MS to BTS and then to BSC. Further coordination procedure (authentication, ciphering etc.) are now performed on the SDCCH [3, 7,].
Second procedure is Assignment procedure which normally use the speech channel. The MSC is initiate the call procedure. The MSC sends an ASSIGNMENT REQUEST message to the BSC requesting the assignment of a radio resource (RR). It then established a signaling between the BTS and BSC in order to allocate and activate a suitable Traffic channel (TCH). If the TCH is successfully seizure by the MS, the BSC sends the ASSIGNMENT COMPLETE message [3, 7, 10].

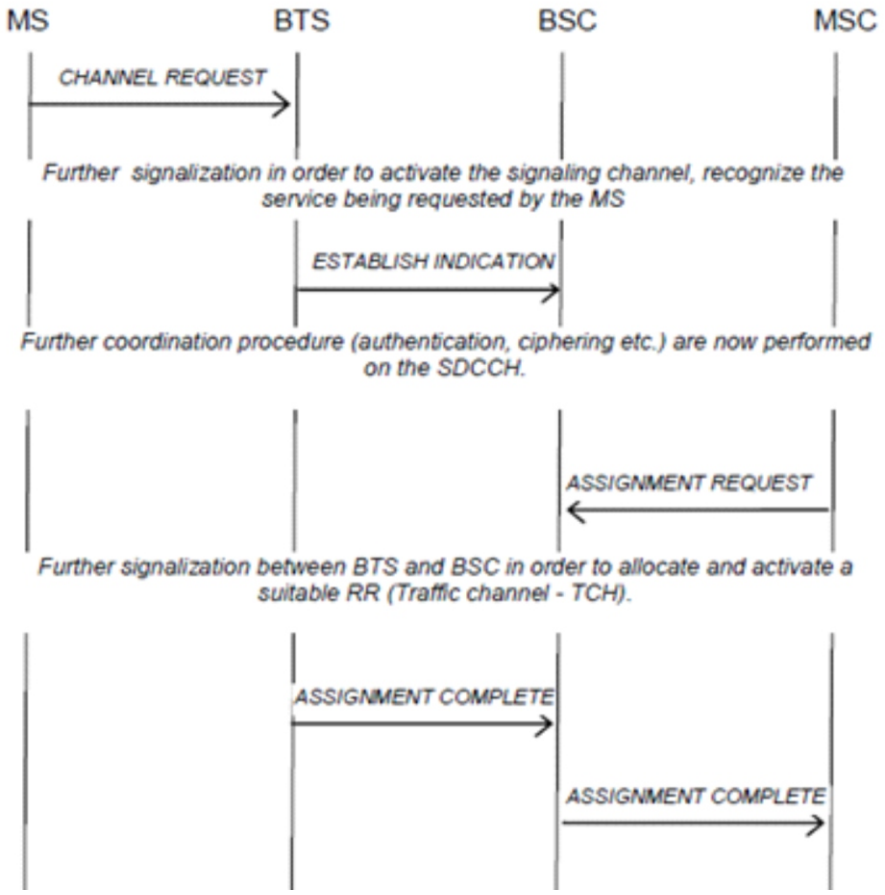


Fig 2.1 Typically between a GSM and a GSM for the above procedures.

Call Setup Success Rate (CSSR) This is the performance indicator which measures the ease with which calls are established or setup. The higher the value, the easier it is to set up a call. High call setup success rate is achieved when standalone dedicated control channel (SDCCH) seizures and traffic channel (TCH) allocation are easily achieved to set up a call. It is calculated as number of the unblocked call attempts divided by the total number of call attempts. This study shall be modeling and simulating an Adaptive Neuro-Fuzzy Inference System (ANFIS) for CSSR to evaluate the performance of CSSR in a GSM network [6,8].

Some Key Parameters Affecting CSSR: Some of the parameters affecting call setup success rate include;

i) Accessibility. Accessibility is the percentage of time a user is not rejected due to unavailability of system resources when attempting to place a call. Accessibility problems can be due to inadequate traffic call resources such as Transceivers or cabinets, seasonal sporadic surges in traffic, improper RF feature parameter settings or problems in the neighboring cell, the higher the accessibility the higher the CSSR [2,6].

ii) Traffic Channels Availability Rate (PTTCH). PTTCH is the availability of a traffic channel for the transportation of speech and data information. It is one of the performance indicator for an operation in a GSM network. CSSR is a function of TCH assigned hence the higher the PTTCH the higher the CSSR.

iii) Control Channels Drop Call Rate (PCDROP). A dropped call occurs when one or more control channels is released for other reasons than handover or normal call release. Hence, this key performance indicator shows the70 percentage of dropped control channels connections (dropped calls) out of total number of released Control channels. PCDROP assesses the percentage of calls that were terminated prematurely due to network problems. The target set by this KPI Indicator is <3%. PCDROP cannot be completely eliminated as some BTS, especially those in rural areas and districts bordering other countries will have no adjacent BTS to perform call handover thus resulting in calls being dropped [4,6].

iv) Handover Success Rate (HSR). The handover success rate shows the percentage of successful handovers of all handover attempts. A handover attempt is when a handover command is sent to the mobile HLR [6,8].

III. METHODOLOGY

The study presents an insight into network performance evaluation of a CSSR of a top GSM network in Nigeria by conducting some measurements on one of the very key performance indicator (KPIs) used by all GSM operators and Pearson correlation coefficient was used to analyzed the error arising from the use of Adaptive Neuro Fuzzy Inference System(ANFIS) in a Mat lab 2018a [5] environment.

(a)

Data Collection

A CSSR data set of four weeks was obtained from a top GSM network in Nigeria from the period August 2019 to October 2019.

IV. RESULTS AND DISCUSSION

This study simulates live data set of CSSR of a top GSM network as against other studies in this field which may use drive test or secondary data. The result obtained are herein below fig4.0 to fig 4.5 and the flow chart of the method ANFIS in fig4. 6

Fig 4.0 ANFIS Design

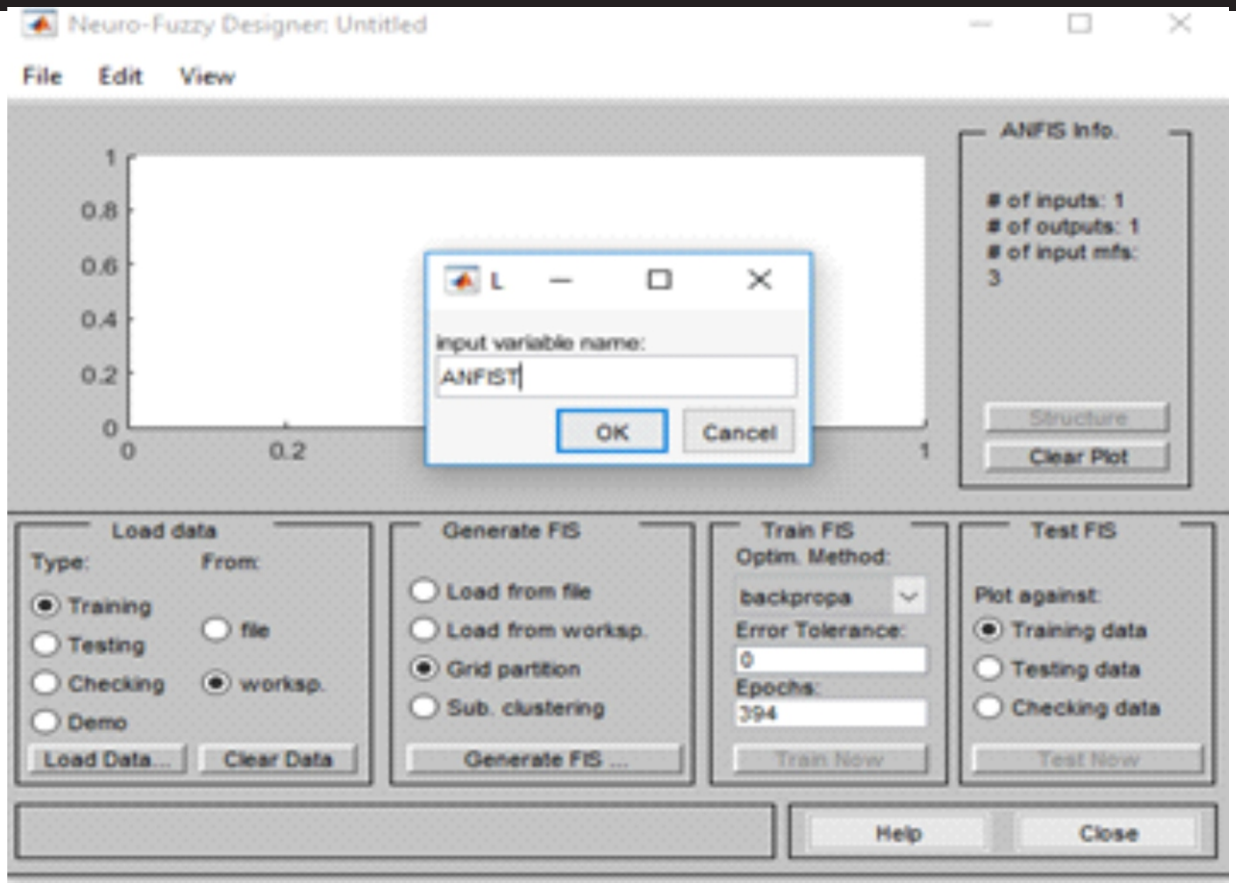


Fig 4. 1 Fuzzy inference system (FIS) Editor

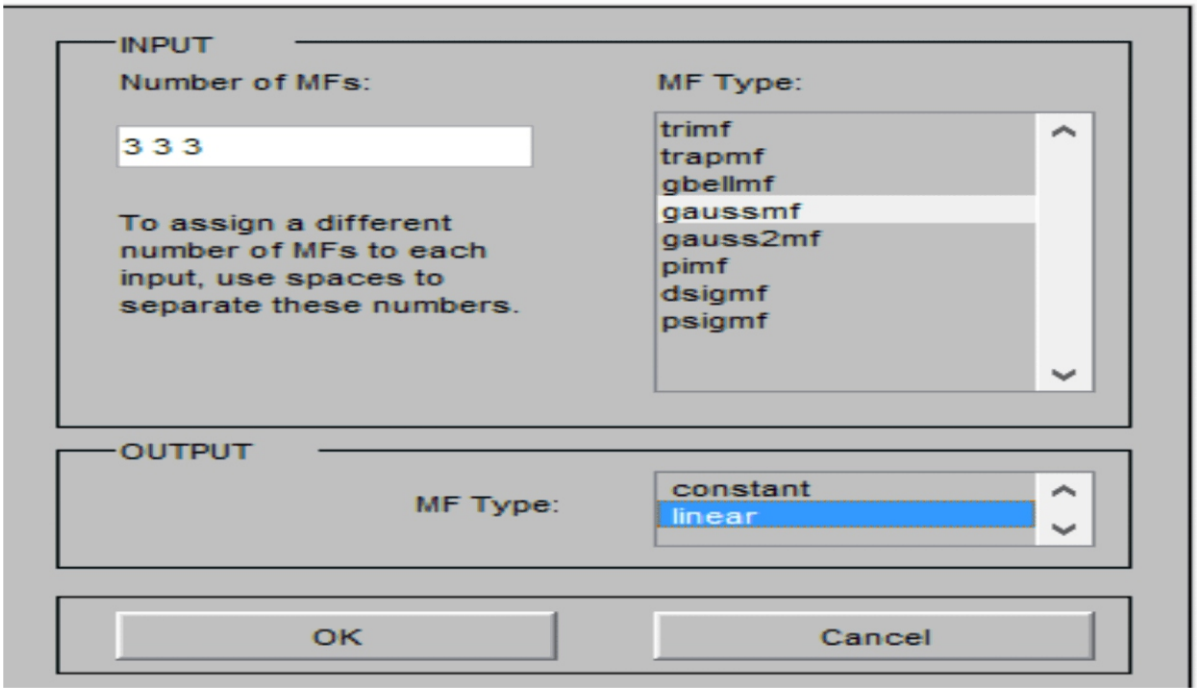


Fig 4.2 Membership Function Editor

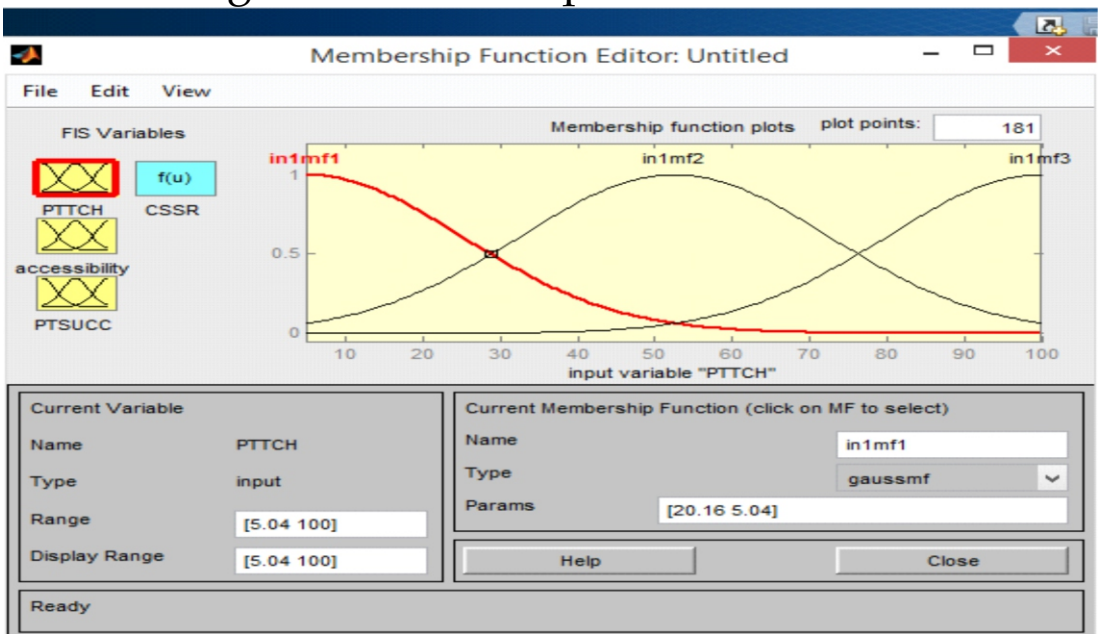


Fig4. 3 Rule Editor

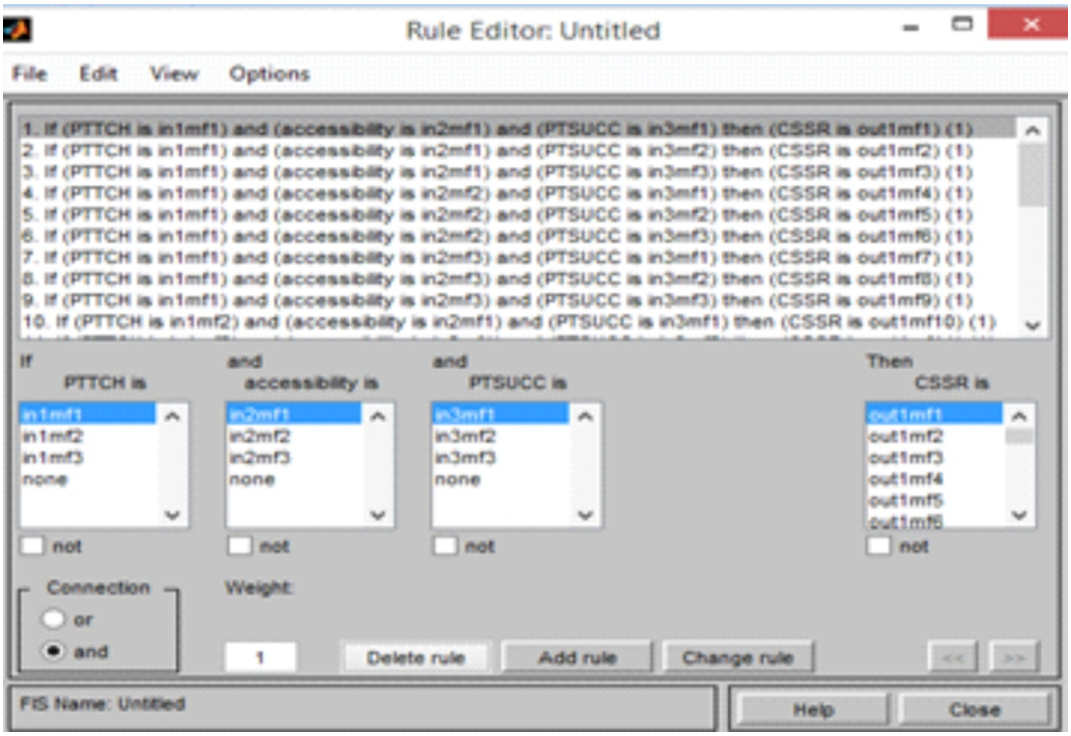


Fig4. 4 Rule Viewer

Fig4. 5 Surface Viewer

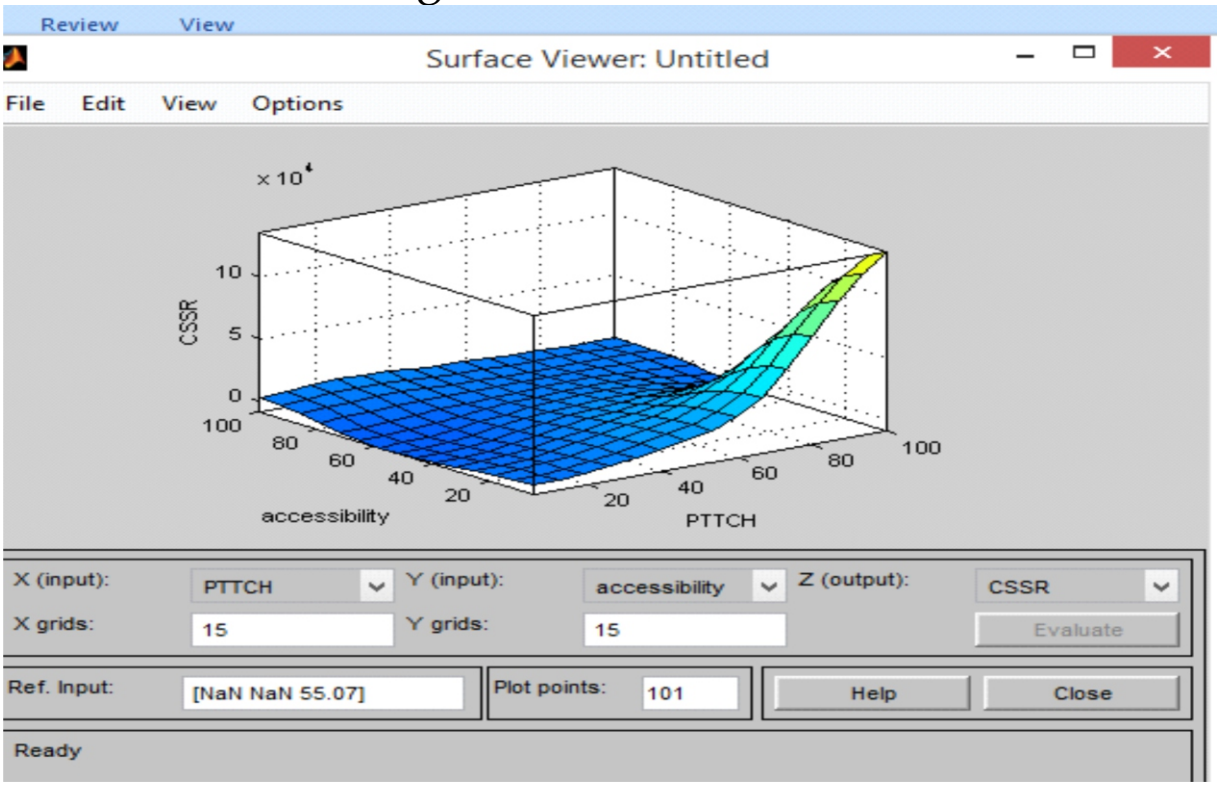
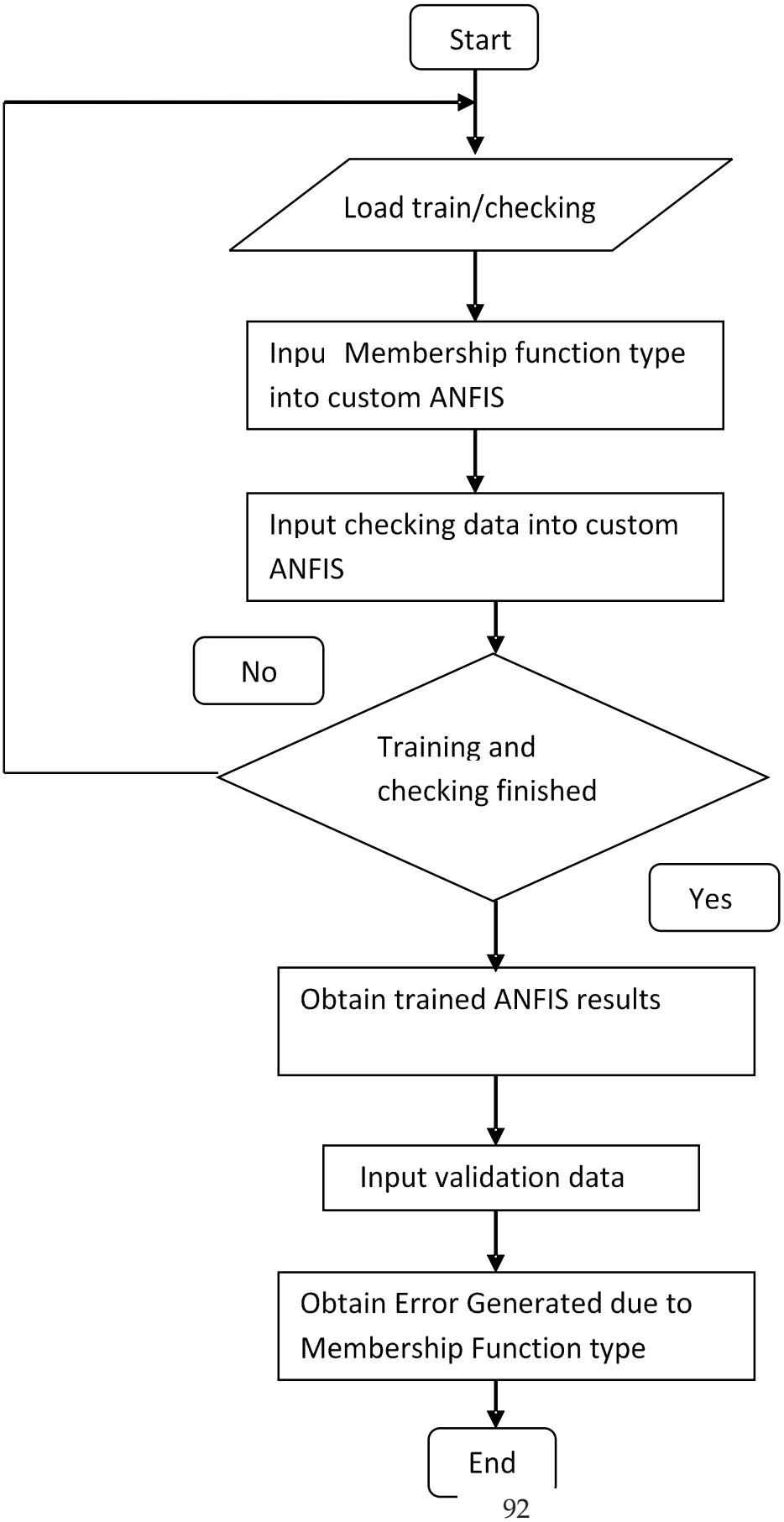


Fig4. 6. ANFIS flow diagram for the result above.



Discussion

The ANFIS based-model developed and generate RMSE and correlation coefficient of 0.2485 and 0.9771. These shows that the model can be used for prediction of CSSR validation, using the inputs because of its low values with respect to RMSE and good correlation coefficient.

Conclusion

From the analysis carried out on the developed ANFIS-based model, the model can be used to predict Call Set-up Success Rate (CSSR) using it variables due to the low values obtained from the Root Mean Square Error (RMSE) (less than 5%) and Correlation Coefficient analysis (CoA) closeness to absolute one. The values obtained are; RMSE (ANFIS-based) = 0.2485, CoA (ANFIS-based) = 0.9771.

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