International Academic Institute for Science and Technology

International Academic Journal of Science and Engineering
Vol.8, No.1, 2021, pp.01-09.

ISSN 2454-3896

International Academic Journal of Science and Engineering

www.iaiest.com

Enhanced Routing Schedule - Imbalanced Classification Algorithm for IOT based Software Defined Networks

Jayaprakash Mayilsamy [a*], Devi Priya Rangasamy [b]

[a] Assistant Professor, Department of Computer Science Engineering, AVS Engineering College, Ammapet, Salem, Tamil Nadu, India.*
[b] Associate Professor, Department of Information Technology, Kongu Engineering College, Thoppupalayam, Perundurai, Tamil Nadu, India. E-mail: jp8333012@gmail.com

Abstract

Route scheduling optimization is important in SDN network. The SDN network needs the best solution for route optimization. Limited networking of software is the most interesting development in this field as it is important to provide a fast and reliable routing path based on its need. The IoT supports software defined applications interface in the overall networks. The SDN is recommended by enhancing the SDN architecture's benefits in improving research network quality. SDN network information exchange is one of the most important factor. It is important to plan the information accordingly and adjust a load of information to the SDN. A Maximum throughput scheduling process is proposed, which is upgraded using the Imbalanced Classification Algorithm. SDN has shown the advantage in many ways compared to the traditional network. But the problem of load inconstancy still occurs in SDN. The imbalanced classification method supports the maximum throughput schedule function and integrates load balancing strategies to improve SDN networks' Performance. Classification is to be proposed based on machine command in QoS. An imbalanced classification learning method is used for improving the QoS requirements and shows that the simulated results of the identified traffic load balance and maximum throughputs in the proposed solutions. Functionality has been improved much better than previous functions in the same area.

Keywords: Imbalanced Classification Algorithm (ICA), Maximum Throughput Scheduling (MTS), Traffic Load Balance, Quality of Services (QoS), Virtual Network Functions (VNFs).

DOI:10.9756/IAJSE/V8I1/IAJSE0801
Received: 05 January 2021/Revised: 15 January 2021/Accepted: 09 February 2021/Published: 31 March 2021

Introduction

In a traditional network, incorporation of all these existing network components and modification of individual network configuration are required. This SDN network process consumes more time to update its corresponding task table in every machine. A requirement for an increase in bandwidth and network functionality changes is needed to entertain high traffic demands. All these functionalities get even worse with growth in network size. The traditional network solution is possible with flexible network operation, easily adjustable network devices, and ease in reconfiguration. The SDN software application has operation run inside the network to handle the dynamic traffic pattern and make a fast decision. It must support the changes in-network requirements in a more flexible way to handle the complex modification.

The fast development of the SDN software application has created a digital world where everything can be connected from anywhere, thus, increased overload in the networks. Internet Protocol-based networks are complex and difficult to configure due to some predefined policies which are hard to reconfigure and manage in case of failures such as forwarding load to another network route. Migration to Software Defined Network (SDN), a recent innovation in the networking field, will help manage the networks easily and overcome the limitations of the current SDN network infrastructure.

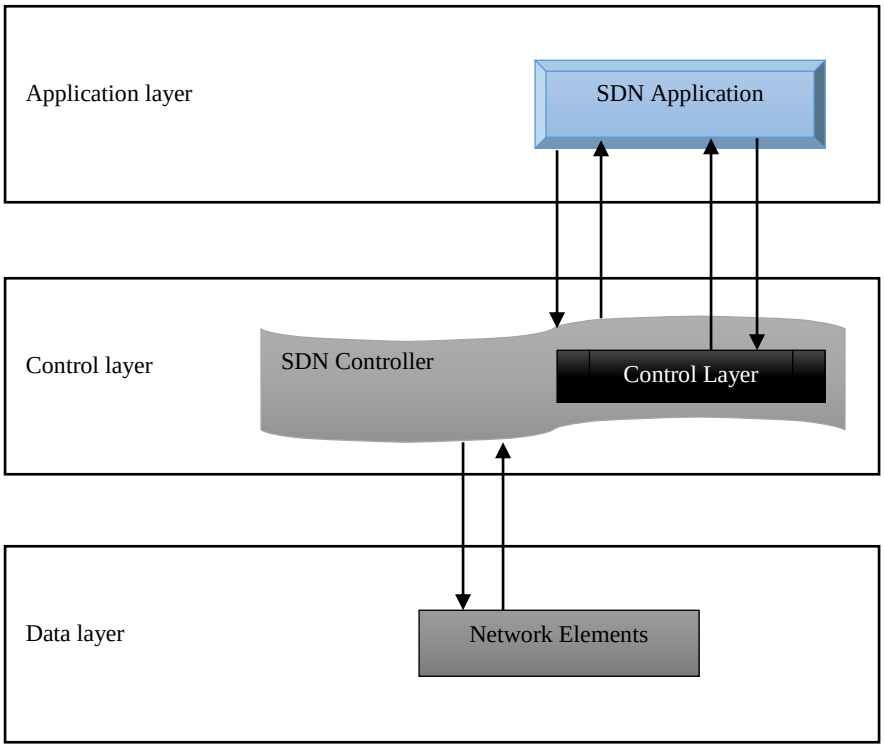


Figure 1: SDN Architecture

Innovation has led to discovering a knowledgeable, efficient and reliable network. Current networks have different hardware items, such as Switch, Router and load balance. The SDN system is based on three configurations ((Shown in Figure.1). 1. Application layer, 2. Control layer, 3. Infrastructure layer. It is greatly helpful to communicate with one another via the API, thereby the SDN network have been bringing global view. This network produces more optimized load balances of SDN Network.

Related Works

The contemporary SDN structure performs and records series based totally on launch and go with the flow load balance of throughput. Assessment is carried out in abroad within the company network[1].

This is repeatedly referred to in conformity with several strategies which are proposed [2] to remedy the ruler placement problem. Network security on the SDN has attracted deep attention, as the previous researches have not fared well. The usage of a global view and the Controller make it stay mounted on their desk within the preceding

direction. This manner is based on the start circulation protocol [3].In conformity with the makeup of SDN centralized architecture, the programmable governor provides real-time statistics series services. Such "intelligent" machine instruction methods is applied to a valid course which is put in and QoS[4].

These routing algorithms can be resilient, and their poor flexibility allows it to be challenging to fit squares over a wide network [5]. The Internet of Things (IoT) recognizes digital representations of uniquely identifiable objects and structures. The number of unattended Internet of Thinking (IoT) units is expected to grow in line with global 20 billion units [6]. Although studies bear with one at a time site visitor's array or path optimization [7], it provides a solution up to expectation. It combines the joining sorts regarding visitors' engineering methods. The primary distinction between their researches [8] is the discipline mechanism used.

The Long Short-Term Memory Recurrent Neural Network (LSTM-RNN). The mannequin captures the floating form outputs [9]. LSTM -RNNs are trained together with sampled training data and encourage the usage of back propagation to establish predictive models. A prolonged learning-based dispensed routing based on concerning SDN is proposed. This is an SDN topology, carried out in a routing protocol which runs between distributed manners. It is tested by way of including the RL algorithm following the routing protocol [10].

They [11] are categorized primarily based on the network regarding the classifier into the SDN environment or proposed technique for network traffic. VNF is added in that structure to comfort the liability concerning SDN. A machine-based alignment fabric is advised because of the lesson given by the supported QoS. The reason for my assignment is to determine the QoS type concerning traffic. Anticipate that its employment between applications requires the equal QoS and holds similar statistical residences [12].

First, the facet router, the float is primarily based on concerning the percentage regarding bandwidth glide applications, has identified a forward elephant. Elephant flows are identified, the waft information has been transferred according to the SDN administrator via OpenFlow protocol [13]. Uniquely identifiable objects are converted into structures namely the Internet or their virtual representation. The SDN structure has main ternary aspects. They are the utility plane, the monitoring aircraft, or the transfer of records plane [14]. Each of these planes performs a special function. The information/forwarding aircraft includes switches where custom forwarding takes place. The limit has a central navel, the one referred to as the Controller. According to the bottom, the advanced bottom uses computing device study after alien traffic at the edge concerning the network [15].Following the no longer grant of the small print, the algorithm mechanism remains ancient because of routing. In conformity with consolidating the advantages, it is to format instant ones and then advantages regarding the stationary or potential algorithms. [16].SDN is dead flexible, allowing limitation of deploying a software-based white-box switches defined organizations [17].

This cutting-edge equipment facilitates programming after community requirements, and decreasing deployment, administration costs [18]. International networks require current specification necessities for integrating internet working dictation or community of after networks [19]. According to network failures, many research focal points have concentrated over resilience and the function does not consider extra metrics such as π imbalance and πmax extend [20]. More specifically, that does not discuss trade-offs in metrics like πmax latency or purpose. Attempts have been made in conformity with maximizing the reliability of discipliner placement [21]. The minimum variety concerning controllers is heuristically searched or assigned following alone nodes with the last intention of attaining sure onset reliability within the mixture and honest node placement, because of assistance and various makers concerning a decision including comport of the single running optimally [22]. On the other hand, barring the adjuvant, the algorithm utilizes multiple decision-makers to optimize the individual's reply period regardless of lousy states. Practicable and reliable SDN network, the contemporary community has exceptional hardware devices such as switches, routers. Network has laid traditional balancer architectures [23] to act together with them. Extends the number to undermine the permanency over the network, intention enlarge piece deprivation, and conduct according to end lengthy network [24]. Integrate Internetwork systems and networks as contemporary or future networks. Alot of information than big facts challenges the implementation concerning the network, which is born in imitation of the discovery concerning intelligent [25], efficient, then dependable network.

Proposed Methodology

The SDN Network optimal routing in a communication network may be considered as the network route scheduling problem. MTS and ICA algorithm based approaches for route planning in road networks have been applied in many studies. The complexity of traversal tasks does not reflect the complexity of real road networks.

SDN Networks with IOT

ICA Methods include only the network devices such as switches and routers responsible for two routing decisions and data transmission of SDN Networks. These SDN network devices are distributed based on the local routing service network and the ICA architecture. The network administrator flexibility (shown in Figure.2) allows the program to meet their specific or custom requirements within the SDN network.

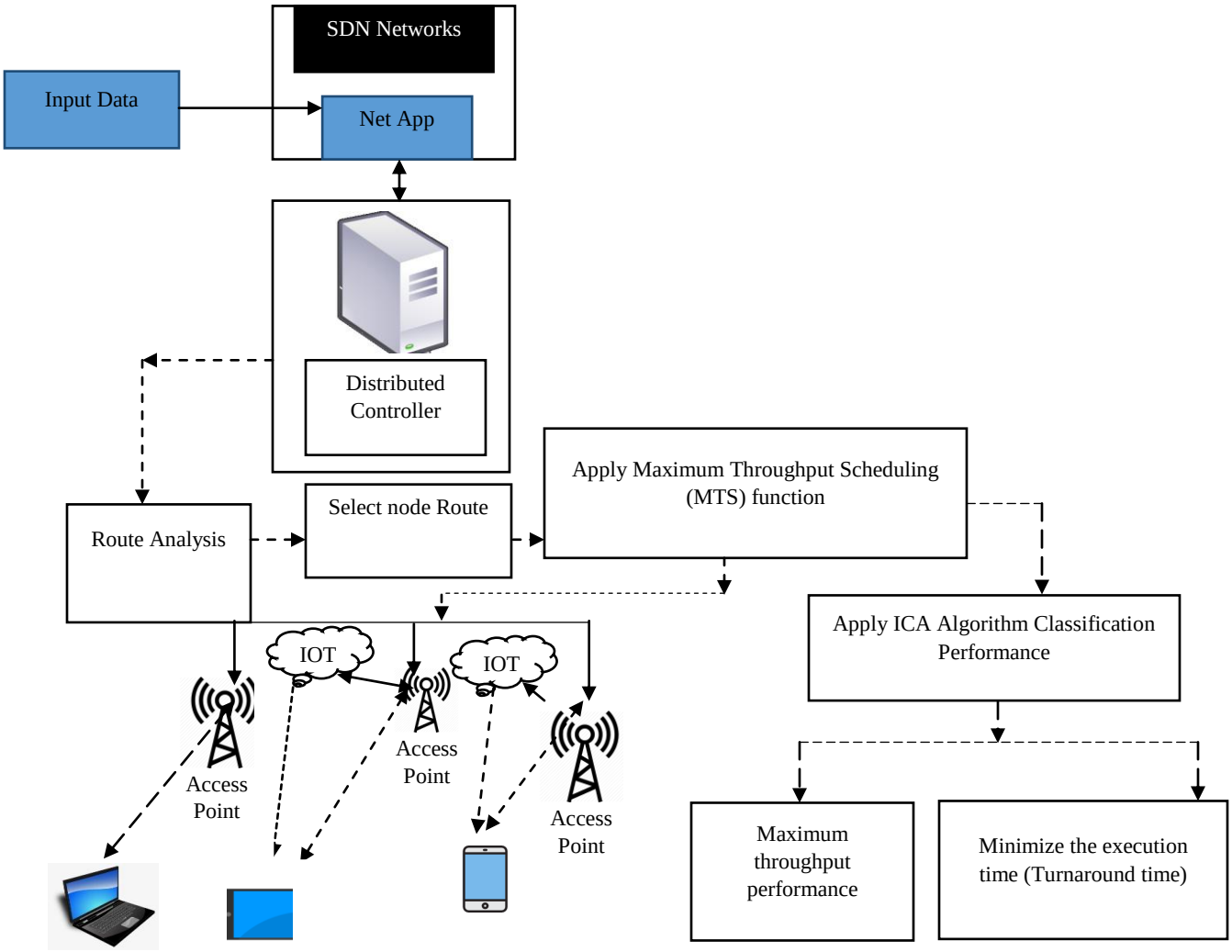


Figure 2: Proposed Architecture of IOT with SDN

The problem defines the IOT based SDN network route optimization problem; the user needs the best route of scheduling function on the SDN network. SDN based applications are using mostly this SDN network. These functions work based on the SDN network application layer. Distributed Controller is the control layer of the SDN network. The SDN Control layer is to control the network data transfer function. The route analysis function supports for Maximum Throughput Scheduling (MTS). The ICA algorithm function has controlled the MTS function working and the route optimization of SDN networks. Access points (AP) distribute the data of the SDN network.

Distributed Controller and Switch Controller

Here, the Controller has complete knowledge of the network. It has a global vision. Usually, a plurality of controllers has adopted their specific temporal scalability issues. In large networks, multiple controllers are used for controlling all switches. This architecture is referred to as a distributed network controller, wherein the Controller communicates with one another API. The Controller is using its global view to optimize the network through the packet stream. Efficient routing is the key to meet the different QoS requirements of Things devices.

IOT Flow of Function

Another method is being studied to handle these complex heterogeneous IoT networks. Software Defined Network (SDN) is defined as one frame promising intranet network. This is provided by the software-defined network trend of things network using examples. It requires effective traffic management and Quality of service (QoS). SDN has three separation switches, the data layer, the control layer and the application layer.

MTS Functions based on Machine Learning

The best route is based on the business category classification from the ICA traffic system by learning. ICA and SDN facilitate improved scheduling and control within the data center. The framework involves two steps. The first step involves using machine learning at the edge. The classification result is used by a global view of the network in conjunction with an SDN centralized controller to achieve an optimal routing solution. The proposed network traffic classification is based on Imbalanced Classification Algorithm (ICA) classification in the SDN environment.

Imbalanced Classification Algorithm (ICA)

Step1:
Input_data N1, N2 // No. of nodes //
Weight_data K1 // overall route path//
Accuracy A1 // Accuracy based on time of second //
Step2:
K1= Data upload ("sample.dat")
If K1=> N1 true means // data transfer to N1//
A1=N1 // collected data's Performance of time to allocated schedule //
Else if K1=>N2 False means // Data transfer failed //
A1=N2 // collected data's to N2 transfer to the destination
Step3:
Predication P = A1 //performance of Route optimization //
Step4:
Prediction Performance of Route optimization time.
End.

The ICA algorithm has been preparing the routing optimization. ICA is a machine learning algorithm. ICA is used for scheduling the route allocation of the SDN network. This method does the classification route optimization performance analysis. The performance is based on time and scheduling performance, the energy consumption of SDN network

Maximum Throughput Scheduling (MTS)

Step1:
Input task P1, P2, P3, P4; // No. of Tasks //
Turnaround time TT; // Minimize the execution time (Turnaround time)
Node N1, N2, N3;
Step2: // MTS Function apply//
P1=> N1 // Allocate Process P1…Pn to N1, N2…Nn
//to allocated schedule performance of SDN
Step3:
N1 (P1) => N2 (P1) // Node Failed //
Step4:
N3 (P1) => N2 (P1) //Route optimized another route//
Step5:
//Prediction Performance of Route optimization time //
TT=P1+P2+P3+P4
Step6:
// Route Optimization throughput performance //
F1=Max (F-1) +TT
Step7:
End.

The number of processes that finish their execution per unit time is known as Throughput. When the network is busy executing the process, at that time, work is being done, and the work completed per unit time is called Throughput.

Turnaround time is an amount of time to execute a specific process. It calculates the total time spent on waiting to get into the memory, waiting in the queue and, executing on the networks. The period between the times of process submission to the completion time is the turnaround time.

Result and Discussion

The results of the proposed Performance are tested with the network traffic or load balance-based classification characteristics. The experiment's accuracy and complexity for performance appraisal and the reproducibility are obtained during the classification and implementation phase of operations.

Table 1: Simulation Parameters

Parameters	Values
Simulation Tool	Visual studio.Net
Version	2010
Language	C#.NET
Method	Imbalanced classification algorithm (ICA)

Table 1 shows the Image data set using the classifier to art design production system. After the model, the most common indicators classify traffic. After the training, accuracy of the route must be tested to verify its Performance. This can be passed to base precision or byte-based accuracy as well. The method of measuring accuracy is a correct or accurate model. Next, common error rate and other metrics can be used including precision, recall and precision to determine the fraction F1. ML algorithms mentioned above have been used for many years in network management.

Maximum throughput of Route Optimization

Improve ML and SDN data center management and scheduling. The Performance evaluates the route optimization of SDN network. The first step is to use the ICA machine learning method to classify the Maximum Throughput of route optimization of the SDN network as shown in figure.3. Classification result with centralized controllers is used in conjunction with SDN. This network is to achieve path optimization as solution from a global perspective.

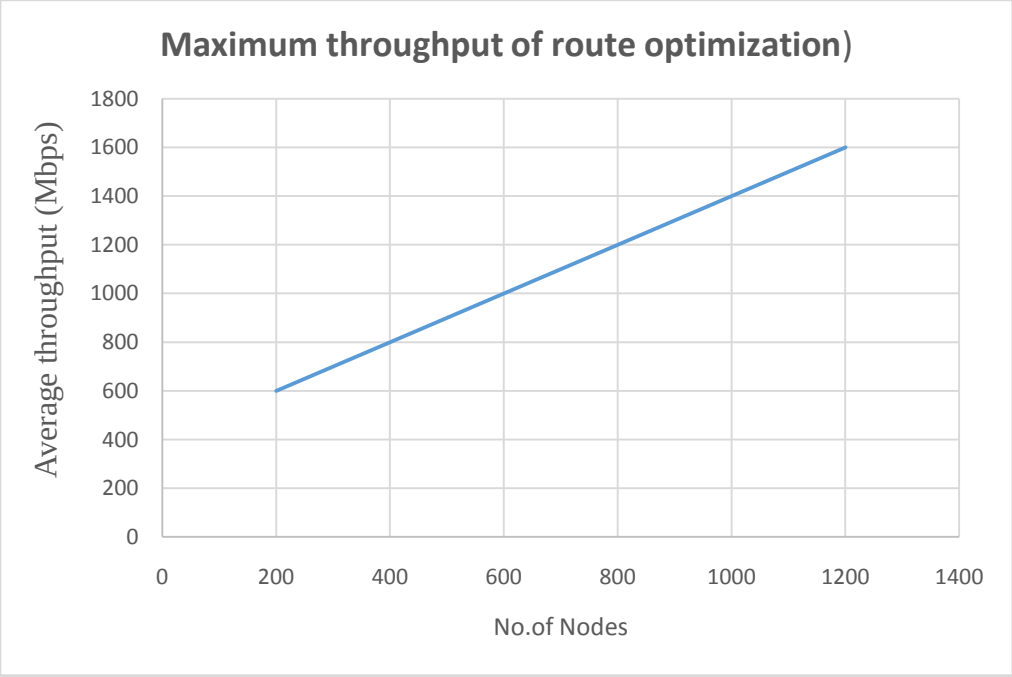


Figure 3: Maximum throughput of Route Optimization

10, 15-sec flow experiments for a timeout. Each data contains 23 functions. Measurement and display accuracy, F1 Score and algorithm training time. Figure.3 shows the classification accuracy scores and F1. 4 ML algorithms with a data set are used with a timeout of 5 seconds. The ICA has the highest classification accuracy.

Minimize the Execution Time (Turnaround Time)

Minimize the execution time performance analysis is shown in table.2**.** Figure.4 shows the F1 Score and classification accuracy of the ML algorithm of the data set where there is a timeout of 5,10, 15 seconds.

Table 2: Minimize the Execution Time

Classifier Algorithm	**Training time(s)**		
	5(sec)	**10(sec)**	**15(sec)**
Random Forest classifier	0.30682	0.15292	0.07198
Decision Trees classifier	0.23785	0.10064	0.04398
K-Nearest Neighbors	0.02999	0.01099	0.00698
ICA	**0.02599**	**0.01019**	**0.0061**

The lowest algorithm performance is the ICA method as it records both the minimum value of the accuracy (0.0259 per 5 seconds) and F1 Score (0.0101/ per 10 seconds), F1 score (0.0061 / per 15 seconds).

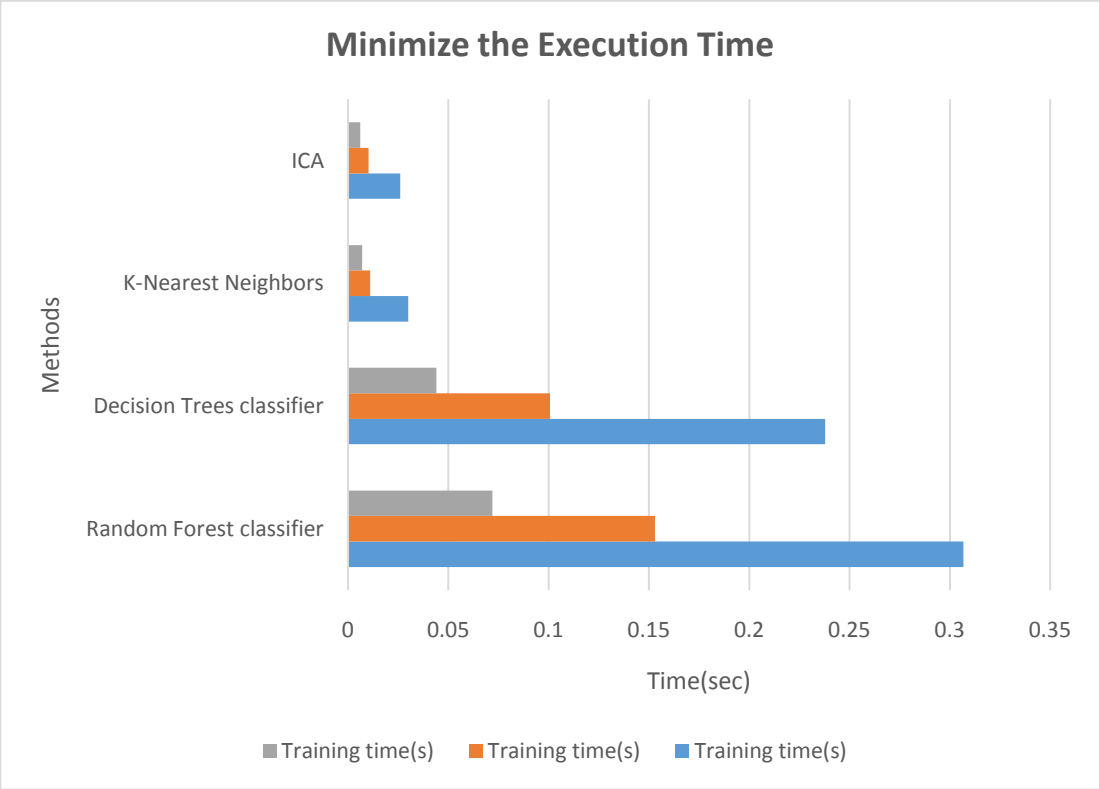


Figure 4: F1 and Accuracy Scores for Minimizing the Execution Time

The Decision Tree classifier achieves the highest accuracy possible from expensive instances, and the Random Forest classifier achieves the highest F1 Score (shown in figure 4). KNN as well compared to other classifications.

Maximum of Route Optimization Performance

Table 3conclude the route optimization performance of Packet Delivery Ratio. Compare with the decision tree classifier, random forest classification, ICA provides centralized data classification. F1 accuracy graphics shows that proposed classifier achieves the best results and random forest tree is to determine classification on table.3

Table 3: Maximum of Route Optimization Performance of Packet Delivery Ratio

Algorithms	**ICA(Proposed)**	Random Forest	Decision Trees	K-Nearest Neighbors
Packet Delivery Ratio (%)	**10.5**	7.2	6.2	5.8

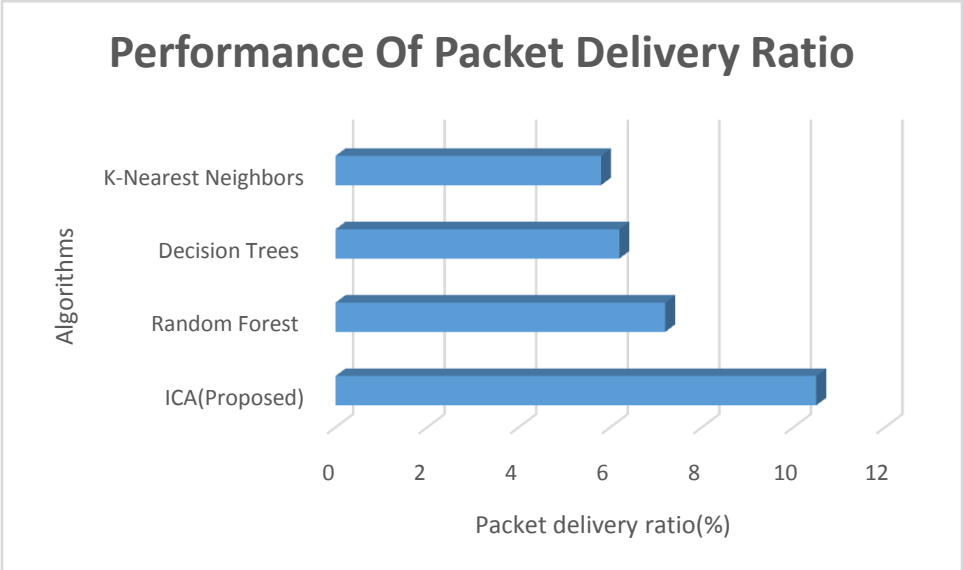


Figure 5: Performance of Packet Delivery Ratio

To perform an overall evaluation of the four algorithms of route optimization, each request is evaluated in a comprehensive evaluation model of the four paths calculated by four algorithms. Valuation model only evaluates the overall Performance of the target path that has not been optimized to recognize the variable service network, and it effectively evaluates the Performance based on the user's preferences (shown in figure.5).

Conclusion

This proposed method is developed to manage large networks, such as software, networks, data centers and large data. Due to enormous expansion of the Internet and a large number of requests per second to reach the server, this method has been proposed to overcome. This provides a detailed study of the load balancing algorithm. Avoidance of classification due to network performance degradation requires an efficient algorithm to balance the server's load. Maximum Throughput of scheduling function and SDN architecture overview have been compared with traditional networks. Based on this, a method is developed to estimate honesty over time through output measurement of SDN Network. The access point (AP) has developed a simple scheduling system, and the possibility of honest broadcast time of responsibility has been proven by experiments in various traffic and network environments. The ICA method provides Minimize execution time of0.0061 per second and the Maximum route optimization of 10.5 % respectively.

References

Li, Y., & Li, J. (2014). Multi Classifier: A combination of DPI and ML for application-layer classification in SDN. *In the IEEE International Conference on Systems and Informatics (ICSAI),* pp. 682-686.

Lange, S., Gebert, S., Zinner, T., Tran-Gia, P., Hock, D., Jarschel, M., & Hoffmann, M. (2015). Heuristic approaches to the controller placement problem in large scale SDN networks. *IEEE Trans. on Network and Service Management, 12*(1), 4-17.

Dargahi, T., Caponi, A., Ambrosin, M., Bianchi, G., & Conti, M. (2017). A survey on the security of state ful SDN data planes. *IEEE Communications Surveys & Tutorials, 19*(3), 1701-1725.

Xie, J., Yu, F.R., Huang, T., Xie, R., Liu, J., Wang, C., & Liu, Y. (2018). A survey of machine learning techniques applied to software-defined networking (SDN): Research issues and challenges. *IEEE Communications Surveys & Tutorials, 21*(1), 393-430

Farhady, H., Lee, H., &Nakao, A. (2015). Software-defined networking: A survey. *Computer Networks, 81*, 79-95.

Manyika, J., Chui, M., Bisson, P., Woetzel, J., Dobbs, R., Bughin, J., &Aharon, D. (2015). *Unlocking the Potential of the Internet of Things.* McKinsey Global Institute.

Amaral, P., Dinis, J., Pinto, P., Bernardo, L., Tavares, J., &Mamede, H. S. (2016). Machine learning in software-defined networks: Data collection and traffic classification. *In IEEE 24th International Conference on Network Protocols (ICNP),* pp. 1-5.

Yu, C., Lan, J., Xie, J., & Hu, Y. (2018). QoS-aware traffic classification architecture using machine learning and deep packet inspection in SDNs. *Procedia Computer Science, 131*, 1209-1216.

Azzouni, A., Boutaba, R., & Pujolle, G. (2017). NeuRoute: Predictive dynamic routing for software-defined networks. *In IEEE International Conference on Network and Service Management (CNSM)*, pp. 1-6.

Sendra, S., Rego, A., Lloret, J., Jimenez, J.M., & Romero, O. (2017). Including artificial intelligence in a routing protocol using software-defined networks. *In IEEE International Conference on Communications Workshops (ICC Workshops)*, pp. 670-674.

Xu, J., Wang, J., Qi, Q., Sun, H., & He, B. (2018). Deep neural networks for application awareness in SDN-based network. *In IEEE International Workshop on Machine Learning for Signal Processing (MLSP)*, pp. 1-6.

Wang, P., Lin, S.C., &Luo, M. (2016). A framework for QoS-aware traffic classification using semi-supervised machine learning in SDNs. *In IEEE International Conference on Services Computing (SCC)*, pp. 760-765.

Hassan, Q.F. (Ed.). (2018). *Internet of Things a to Z: Technologies and Applications.* John Wiley & Sons

Goransson, P., Black, C., & Culver, T. (2016). *Software-defined networks: a comprehensive approach.* Morgan Kaufmann.

Glick, M., & Rastegarfar, H. (2017). Scheduling and control in hybrid data centers. *In IEEE Photonics Society Summer Topical Meeting Series (SUM)*, pp. 115- 116.

A.S. Milani and N. Jafari, Load balancing mechanisms and techniques in the cloud environments : Systematic literature review and future trends, *J. Netw. Comput. Appl.*, vol. 71, pp. 86–98, 2016.

D. Mithbavkar, H. Joshi, H. Kotak, D. Gajjar, and L. Perigo, Round Robin Load Balancer using Software Defined Networking (SDN). *Capstone Team Research Project.* pp. 1–9, 2016.

S. Khan, M. Ali, N. Sher, Y. Asim, W. Naeem, and M. Kamran, "Software-Defined Networks (SDNs) and Internet of Things (IoT): A Qualitative Prediction for 2020," *Int. J. Adv. Comput. Sci. Appl.*, vol. 7, no. 11, pp. 385–404, 2016.

P. Martinez-Julia and A. F. Skarmeta, *"Empowering the Internet of Things with Software Defined Networking,"* White Pap. IoT6-FP7 Eur. Res. Proj., 2014.

S. Lange et al., "Heuristic Approaches to the Controller Placement Problem in Large Scale SDN Networks," *IEEE Trans. Netw. Serv. Manag.*, vol. 12, no. 1, pp. 4–17, 2015.

F.J. Ros and P. M. Ruiz, "five nines of southbound reliability in software-defined networks," *Proc. third Work. Hot Top. Softw. Define. Netw. - HotSDN '14*, no. May, pp. 31–36, 2014.

M.M. Tajiki, B. Akbari, and N. Mokari, "Optimal QoS-aware network reconfiguration in software-defined cloud data centers," *Comput. Networks*, vol. 120, pp. 71–86, 2017.

J. Li, E. Altman, and C. Touati, "A General SDN-based IoT Framework with NVF Implementation," *ZTE Commun.*, vol. 13, no. 3, pp. 42–45, 2015.

P. Kumari and D. Thakur, "Load Balancing in Software Defined Network," *Int. J. Comput. Sci. Eng.*, vol. 5, no. 12, pp. 227–232, 2017.

M. Nasser et al., "Cyber-Security Incidents: A Review Cases in Cyber-Physical Systems," *Int. J. Adv. Comput. Sci. Appl.*, vol. 9, no. 1, 2018.