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PAPER - 01

Mobility Speed Effect and Neural Network Optimization for Deep MIMO Beamforming in mmWave Networks

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ABSTRACT

Beamforming for millimetre-wave (mmWave) frequencies has been studied for many years. It is considered as an important enabling technology for communications in these high-frequency ranges and it received a lot of attention in the research community. The special characteristics of the mmWave band made the beamforming problem a challenging one because it depends on many environmental and operational factors. These challenges made any model-based architecture fit only special applications, working scenarios, and specific environment geometry. All these reasons increased the need for more general machine learning based beamforming systems that can work in different environments and conditions. This increased the need for an extended adjustable dataset that can serve as a tool for any machine learning technique to build an efficient beamforming architecture. Deep MIMO dataset has been used in many architectures and designs and has proved its benefits and flexibility to fit in many cases. In this paper, we study the extension of collaborative beamforming that includes many cooperating base stations by studying the impact of User Equipment (UE) speed ranges on the beamforming performance, optimizing the parameters of the neural network architecture of the beamforming design, and suggesting the optimal design that gives the best performance for as a small dataset as possible. Suggested architecture can achieve the same performance achieved before with up to 33% reduction in the dataset size used to train the system which provides a huge reduction in the data collection and processing time.

KEYWORDS

Coordinated beamforming, mmWave, DeepMIMO, Mobility Speed, Parameter Optimization.

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PAPER - 02

Wireless Networks Performance Monitoring Based on Passive-Active Quality of Service Measurements

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ABSTRACT

Monitoring of the performance of wireless network is of vital importance for both users and the service provider which should be accurate, simple and fast enough to reflect the network performance in a timely manner. The aim of this paper is to develop an approach which can infer the performance of wireless ad hoc networks based on Quality of service (QoS) parameters assessment. The developed method considers the QoS requirements of multimedia applications transmitted over these kind of networks. This approach is based on the ideas of combination of both active and passive measurement methods. This approach uses an in-service measurement method in which the QoS parameters of the actual application (user) are estimated by means of dedicated monitoring packets (probes). Afterwards, these parameters are combined to produce and assess the application's overall QoS using the fuzzy logic assessment and based on the measured QoS parameters estimated using the probe traffic. The active scheme is used to generate monitoring probe packets which are inserted between blocks of target application packets at regular intervals. While the passive monitoring is utilized to act as a traffic meter which performs as a counter of user packets (and bytes) that belong to the application (user) traffic flow that is subjected to monitoring. After simulating the developed technique, it offered a good estimation for the delay, throughput, packet losses and the overall QoS when using different probe rates.

KEYWORDS

Quality of Service, network monitoring, passive measurement, active measurement, fuzzy logic.

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PAPER - 03

Towards Fog-Assisted Virtual Reality MMOG with Ultra-Low Latency⋆

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ABSTRACT

In this paper, we propose a method to realize a virtual reality MMOG (Massively Multiplayer Online Video Game) with ultra-low latency. The basic idea of the proposed method is to introduce a layer consisting of several fog nodes between clients and cloud server to offload a part of the rendering task which is conducted by the cloud server in conventional cloud games. We examine three techniques to reduce the latency in such a fog-assisted cloud game: 1) To maintain the consistency of the virtual game space, collision detection of virtual objects is conducted by the cloud server in a centralized manner; 2) To reflect subtle changes of the line of sight to the 3D game view, each client is assigned to a fog node and the head motion of the player acquired through HMD (Head-Mounted Display) is directly sent to the corresponding fog node; and 3) To offload a part of the rendering task, we separate the rendering of the background view from that of the foreground view, and migrate the former to other nodes including the cloud server. The performance of the proposed method is evaluated by experiments with an AWS-based prototype system. It is confirmed that the proposed techniques achieve the latency of 32.3 ms, which is 66 % faster than the conventional systems.

KEYWORDS

Cloud game, fog computing, positional tracking, rendering of 3D game view.

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PAPER - 04

Prediction Algorithm for Mobile Ad Hoc Network Connection Breaks

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ABSTRACT

A Mobile Ad-Hoc Network (MANET) is a decentralized network of mobile node that are connected to an arbitrary topology via wireless connections. The breakdown of the connecting links between adjacent nodes will probably lead to the loss of the transferred data packets. In this research, we proposed an algorithm for link prediction (LP) to enhance the link break provision of the ad hoc on-demand remote protocol (AODV). The proposed algorithm is called the AODV Link Break Prediction (AODVLBP). The AODVLBP prevents link breaks by the use of a predictive measure of the changing signal. The AODVLBP was evaluated using the network simulator version 2.35 (NS2) and compared with the AODV Link prediction (AODVLP) and the AODV routing protocols. The simulation results reveal the effectiveness of AODVLBP in improving network performance in terms of average end-to-end delay, packet delivery ratio, packet overhead ratio, and packet drop-neighbour break.

KEYWORDS

MANET, AODV, Link break, Prediction, Routing protocol

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PAPER - 05

Peer to Peer Approach based Replica and Locality Awareness to Manage and Disseminate Data in Vehicular Ad Hoc Networks

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ABSTRACT

Distributed Hash Table (DHT) based structured peer-to-peer (P2P) systems provide an efficient method of disseminating information in a VANET environment owing to its high performance and properties (e.g., self-organization, decentralization, scalability, etc.). The topology of ad hoc vehicle networks (VANET) varies dynamically; its disconnections are frequent due to the high movement of vehicles. In such a topology, information availability is an ultimate problem for vehicles, in general, connect and disconnect frequently from the network. Data replication is an appropriate and adequate solution to this problem. In this contribution, to increase the accessibility of data, which also increases the success rate of the lookup, a method based on replication in the Vanet network is proposed named LAaR-Vanet. Also, this replication strategy is combined with a locality-awareness method to promote the same purpose and to avoid the problems of long paths. The performance of the proposed solution is assessed by a series of in-depth simulations in urban areas. The obtained results indicate the efficiency of the proposed approach, in terms of the following metrics: lookup success rate, the delay, and the number of the logical hop.

KEYWORDS

Vehicular Ad-hoc Network (VANET), Structured P2P Systems, Distributed Hash Table (DHT), Locality Awareness, Replication.

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PAPER - 06

Scenarios of Lifetime Extension Algorithms for Wireless Ad Hoc Networks

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ABSTRACT

An Algorithm to extend sensor lifetime and energy is implemented for different scenarios of ad hoc and wireless sensor networks. The goal is to prolong the lifetimes of sensors, covering a number of targeted zones by creating subsets of sensors, in which each subset covers entirely the targeted zones. Probabilistic analysis is assumed in which each sensor covers one or more targets, according to their coverage failure probabilities. Case studies of different sensor subsets arrangements are considered such as load switching, variable target load demands as well as a perturbation in sensor planner locations.

KEYWORDS

Ad hoc, case studies, failure probability, sensor lifetime, subsets, WSN

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Using Machine Learning to Build a Classification Model for IoT Networks to Detect Attack Signatures

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ABSTRACT

Internet of things (IoT) has led to several security threats and challenges within society. Regardless of the benefits that it has brought with it to the society, IoT could compromise the security and privacy of individuals and companies at various levels. Denial of Service (DoS) and Distributed DoS (DDoS) attacks, among others, are the most common attack types that face the IoT networks. To counter such attacks, companies should implement an efficient classification/detection model, which is not an easy task. This paper proposes a classification model to examine the effectiveness of several machine-learning algorithms, namely, Random Forest (RF), k-Nearest Neighbors (KNN), and Naïve Bayes. The machine learning algorithms are used to detect attacks on the UNSW-NB15 benchmark dataset. The UNSW-NB15 contains normal network traffic and malicious traffic instants. The experimental results reveal that RF and KNN classifiers give the best performance with an accuracy of 100% (without noise injection) and 99% (with 10% noise filtering), while the Naïve Bayes classifier gives the worst performance with an accuracy of 95.35% and 82.77 without noise and with 10% noise, respectively. Other evaluation matrices, such as precision and recall, also show the effectiveness of RF and KNN classifiers over Naïve Bayes.

KEYWORDS

Internet of Things, Security, Classification model, Machine learning, Random Forest, k-Nearest Neighbors, Naïve Bayes.

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PAPER - 08

Network Anomaly Detection based on Late Fusion of Several Machine Learning Algorithms

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ABSTRACT

Today's Internet and enterprise networks are so popular as they can easily provide multimedia and ecommerce services to millions of users over the Internet in our daily lives. Since then, security has been a challenging problem in the Internet's world. That issue is called Cyberwar, in which attackers can aim or raise Distributed Denial of Service (DDoS) to others to take down the operation of enterprises Intranet. Therefore, the need of applying an Intrusion Detection System (IDS) is very important to enterprise networks. In this paper, we propose a smarter solution to detect network anomalies in Cyberwar using Stacking techniques in which we apply three popular machine learning models: k-nearest neighbor algorithm (KNN), Adaptive Boosting (AdaBoost), and Random Decision Forests (RandomForest). Our proposed scheme uses the Logistic Regression method to automatically search for better parameters to the Stacking model. We do the performance evaluation of our proposed scheme on the latest data set NSLKDD 2019 dataset. We also compare the achieved results with individual machine learning models to show that our proposed model achieves much higher accuracy than previous works.

KEYWORDS

Network Security, Intrusion Detection System, Anomaly Detection, Machine Learning

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