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Multi-User Interference Cancellation Schemes in Energy Efficient Cluster Based Transmission of WSCN

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ABSTRACT: Future wireless networks are expected to be heterogeneous with dense deployment of pico (small cell) base stations (BSs) overlaid with traditional macro BSs. There are two performance bottlenecks in such heterogeneous networks (HetNet): the interference issue and cell-edge effect. We propose to combine cell-free BS-user association (BUA), power control and dynamic user side interference cancellation (IC) to mitigate these bottlenecks. By dynamically selecting the "best" serving BSs for each user, the cell-free BUA can exploit the multi-BS diversity gain to mitigate the interference and cell-edge effect. Furthermore, the user side IC eliminates the strong cross-tier interference. We formulate the joint optimization of cell-free BUA, power allocation and user side IC as a weighted sumrate (WSR) maximization problem, and propose a WMMSE alternating optimization algorithm to solve it. Specifically, a generalized WMMSE method is proposed to solve the power optimization subproblem with non-differentiable WSR function. Furthermore, by exploiting the specific problem structure, low complexity search methods are designed to find the optimal solutions of the combinatorial cell-free BUA and user-side IC subproblems. The proposed algorithm is shown to converge to a stationary solution of the joint problem. Simulations verify the significant gain of the proposed solution over existing solutions.

KEYWORDS: Cluster, HetNet, Basestation, User Association, Interference Cancellation.

I. INTRODUCTION

A heterogeneous system is system associating PCs and different gadgets with various working frameworks as well as conventions. For instance, neighborhood (LANs) that associate Microsoft Windows and Linux based PCs with is additionally utilized as a part of remote systems utilizing distinctive get to innovations. For instance, a remote system which gives an administration through a remote LAN and can keep up the administration when changing to a phone system is known as a remote heterogeneous system. In HetNet, the thick arrangement of pico BSs with little scope territories can fundamentally enhance the ghastly proficiency per unit zone. Then again, the overlaid full scale BSs with bigger scope regions can be utilized to wipe out the scope openings.

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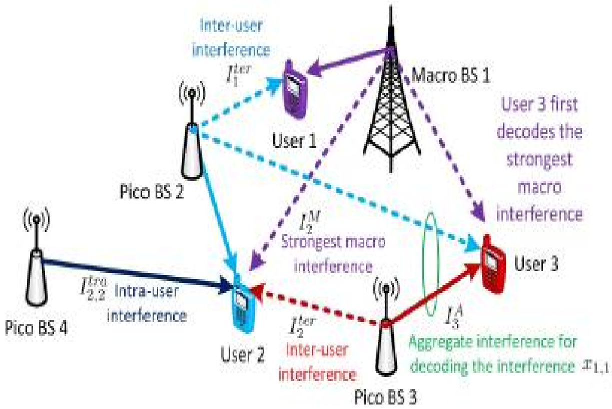

Figure 1: Illustration of interference and achievable rate under the cell-free BUA and user side IC. The serving BS sets of the three users are $\mathcal{B}_1 = \{1\}$, $\mathcal{B}_2 = \{2, 4\}$ and $\mathcal{B}_3 = \{3\}$.

Regardless of the critical advantages of HetNet, the impedance in HetNet is more entangled than conventional cell systems. To begin with, to evade underutilization of pico BSs, cell run development has been acquainted in HetNet with grow the scope locale of pico BSs. With CRE, the serving BS of a pico cell client may never again be the BS with the most grounded got flag quality and consequently the pico cell client may get solid cross-level impedance from the closest large scale BS. To address this issue, different improved between cell impedance coordination plans have been proposed in LTE and LTE-A, for example, the practically clear sub-outlines Sensor systems are thick remote systems of little, minimal effort sensors, which gather and disperse ecological information. One of the essential advantages of remote sensor systems is their autonomy from the wiring expenses and limitations. Remote sensor systems are made out of an arrangement of profoundly arranged conveyed sensors, which are exceptionally delicate to the earth and equipped for correspondence with each other through remote channels.

Sensor systems have numerous little gadgets furnished with sensors, handling circuits and remote handsets.

II. PROBLEM ANALYSIS

Small cell deployments as well as hierarchical deployments with overlay macrocells have the potential to lead to a situation where a lot of the cells are barely loaded. This applies particularly to situations in which the traffic load varies over the time of the day. Under highload situations, the most favourable solution may be to provide coverage using several smallcells, whereas in low load situations, the network management could shut down the cells with only a few users in them. Self-organising mechanisms as well as signalling protocols are required to detect such situations, and to be able to redirect users to other cells, as well as to be able to adjust the network coverage. A common myth in the wireless engineering community is that rain and atmosphere make millimetre-wave spectrum useless and inefficient for mobile communications. However, if one takes into consideration the fact that today's cell sizes in urban environments are on the order of 200 m, it becomes quite obvious that mm-wave cellular technology can indeed overcome these issues (Li et al. 2009).

III. PROPOSED METHODOLOGY

A clustering approach that incorporates, beyond classical location-based metrics, the effects of the time-varying BS load. Clustering enables intra-cluster coordination among the base stations for the purpose of optimizing the downlink performance via load balancing. Within each cluster, the BSs adopt an opportunistic sleep-wake mechanism to reduce the energy consumption. Due to inter-cluster interference, the clusters have to compete with one

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another to make decisions on improving the energy efficiency via a dynamic choice of sleep and active states. We cast the problem of dynamic sleep state selection as a non-cooperative game between clusters of BSs. To solve this game, we propose a distributed algorithm using notions from Gibbs-sampling.

IV. LITERATURE SURVEY

In 2006,Guoliang Xing, Chenyang Lu and Robert Pless proposed "Co Grid: an Efficient Coverage Maintenance Protocol for Distributed Sensor Networks".

They proposed the critical challenge of sustaining long-term operation on limited battery energy. Coverage maintenance protocols can electively pro- long network lifetime by maintaining sufficient sensing coverage over a region using a small number of active nodes while scheduling the others to sleep. We present a novel distributed coverage maintenance protocol called the Coordinating Grid (Co-Grid).

In contrast to existing coverage maintenance protocols which are based on simpler detection models, Co-Grid adopts a distributed detection model based on data fusion that is more consistent with many distributed sensing applications. Co-Grid organizes the net- work into coordinating fusion groups located on overlapping virtual grids. Through coordination among neighboring fusion groups, Co-Grid can achieve comparable number of active nodes as a centralized algorithm, while reducing the network reconguration time by orders of magnitude. Co- Grid is especially suitable for large and energy-constrained sensor networks that require quick reconguration in response to node failures and environmental changes.

In 2007, YuexuanWanga, Francis C.M. Laub and YuezhouLvaproposed "An Approximate Approach for Area Coverage in Wireless Sensor Networks".

They proposed critical issue that has a major bearing on the quality of sensing over the target region. In this paper, we study the coverage of a region P with a transparent boundary and transparent obstacles. A transparent obstacle is an area in which a sensor cannot be deployed but through which sensing signals can pass. For cost-electiveness, our problem is to deploy the minimum number of sensors to cover excluding the obstacles.

This problem is challenging mainly due to the fact that the target region is continuous. A straight-forward idea is to sample a finite set of crucial coverage points in P, thus making the coverage space discrete. Most existing approaches, however, tend to either require too many sampled points, which lead to increased running time, or have an inferior coverage of the region. We propose a discretization approach which converts the area coverage problem into the problem of Minimum Geometric Disk Cover with Candidate Positions (MGDCCP) which is proved to be strongly NP-hard. We present a polynomial-time approximation scheme (PTAS) based on the shifting strategy for the MGDCCP problem.

Specifically, our approach guarantees covering a (1 >") fraction of the region with probability no less than (1 < h) using at most (1 + 1l)2h sensors, where h is the theoretical minimal number of sensors needed to cover the region P, l is a positive integer parameter in the shifting strategy, and " 2 (0; 1) is the covering tolerance. Furthermore, we show that our proposed approach is output-sensitive with time complexity that is polynomial in the input size and the optimal solution size. Therefore, for any fixed parameter l and ", the coverage accuracy, the running time, the approximation ratio and the success probability are all bounded.

In 2007,Sudha Krishnamurthy, John A. Stankovic and TarekAbdelzaherproposed Energy Efficient Surveillance System Using Wireless Sensor Networks".

The focus of surveillance missions is to acquire and verify information about enemy capabilities and positions of hostile targets. Such missions often involve a high element of risk for human personnel and require a high degree of stealthiest. Hence, the ability to deploy unmanned surveillance missions, by using wireless sensor networks, is of great practical importance for the military. Because of the energy constraints of sensor devices, such systems necessitate an energy-aware design to ensure the longevity of surveillance missions. Solutions proposed recently for this type of system show promising results through simulations. However, the simplified assumptions they make about the system in the simulator often do not hold well in practice and energy consumption is narrowly accounted for within a single protocol. In this paper, we describe the design and implementation of a running system for energy-efficient

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surveillance. The sys- tem allows a group of cooperating sensor devices to detect and track the positions of moving vehicles in an energy- efficient and stealthy manner.

We can trade off energy- awareness and surveillance performance by adaptively adjusting the sensitivity of the system. We evaluate the performance on a network of 70 MICA2 motes equipped with dual-axis magnetometers. Our results show that our surveillance strategy is adaptable and achieves a significant extension of network lifetime. Finally, we share lessons learned in building such a complete running system.

V. APPLICATIONS OF WIRELESS SENSOR NETWORK

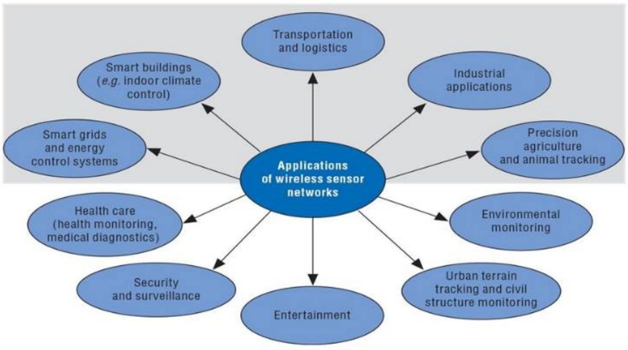

Fig.2 Applications of Wireless Sensor Network

Wireless sensor networks facilitate the monitoring and controlling of physical environments from remote locations, with enhanced accuracy. They have applications in a variety of fields such as environmental monitoring, military purposes and gathering of sensing information in inhospitable locations. Dense networks for environment sensing and data collection. Sensors are equipped with both data processing and communication capabilities. They measure different parameters from the environment and transform them to electric signals. The prime advantage of sensors is their capability to operate unattended in harsh environments. Wireless sensor networks have a high utility in a variety of industrial, medical, consumer and military applications.

VI. EXPERIMENTAL RESULTS

CREATED NETWORK

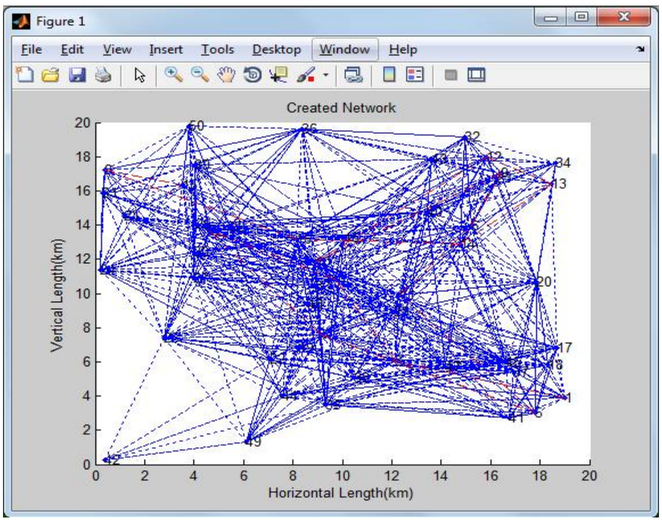

Fig 3 Created Network

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In this simulation, we consider a single macro cell underlaid with an arbitrary number of SBSs and UEs uniformly distributed over the area. All the BSs share the entire spectrum and thus, suffer from co-channel interference.

ENERGY HARVESTED CLUSTER SELECTION

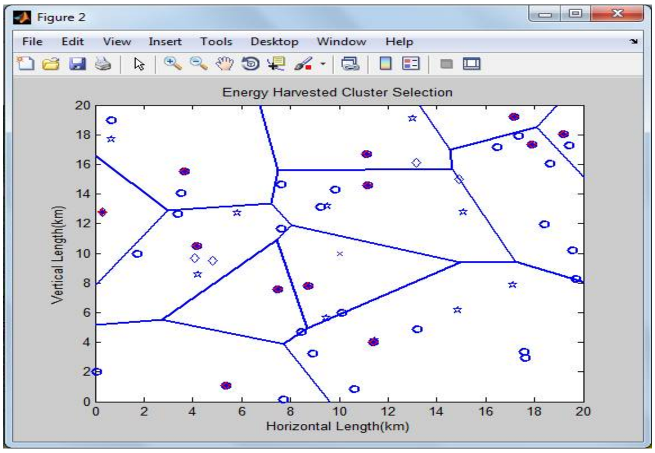

Fig 4 Energy Harvested cluster selection

Conventional network operation referred to hereinafter as“ classical approach” in which BSs always transmit. For further comparisons, we consider a random BS ON/OFF switching with equal probability and finally an uncoordinated learning based ON/OFF mechanism without forming clusters.

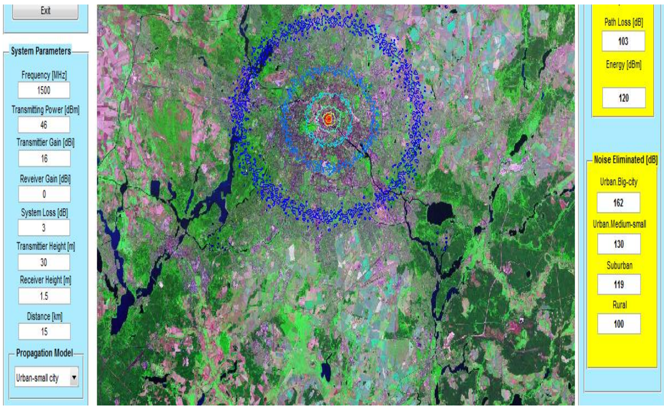

Fig 5 Clustered coverage region

They are referred to as “learning with k-mean clustering”, “learning with spectral clustering”, and “learning with P2PBSclustering” hereinafter, respectively. For all these three clustering methods, the clusters remain unchanged for an interval.

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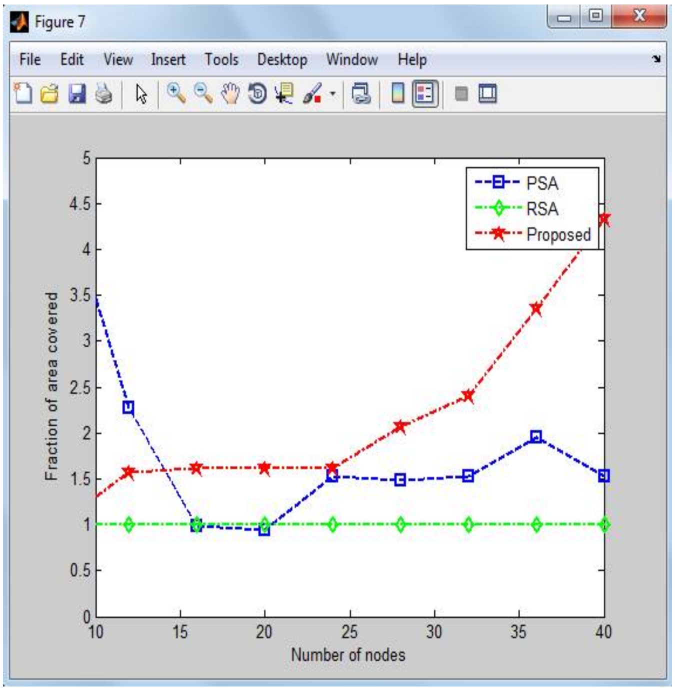

Fig 6 Performance of node corresponding to area covered

The changes in have the same effects on both systems with 30 UEs and 60 UEs. It can be noted that the benefit of clustering to reduce the average increases with the number of UEs compared to learning without.

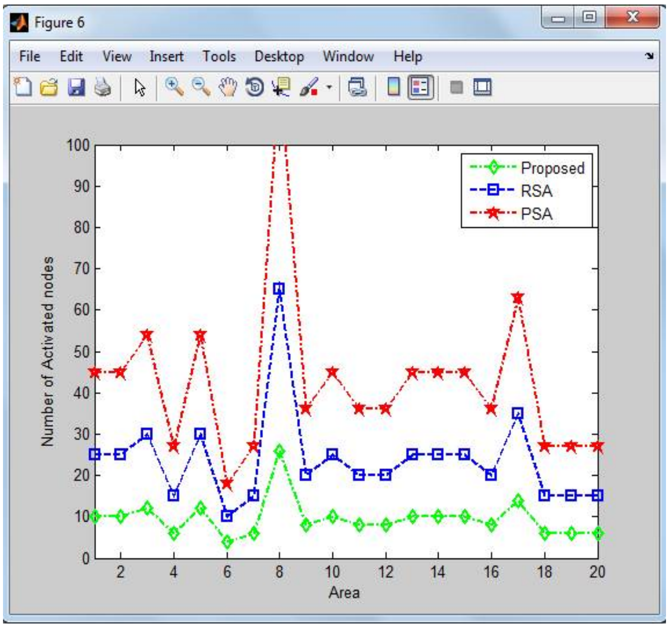

Fig 7 Cumulative function

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The CDF of the BSs' load for 50 UEs. Here, the random ON/OFF method exhibits a large number of BSs with low load. Similar to the CDF of BSs' energy learning and the dynamic clustering yield a higher number of switched-OFF BSs.

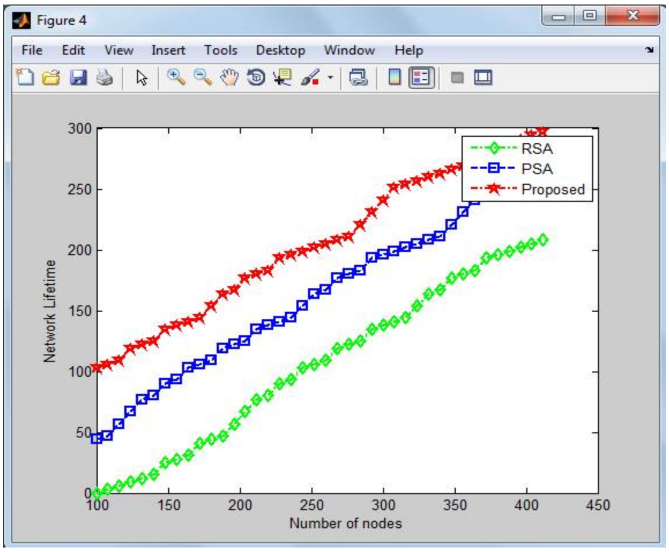

Fig 8 Distributed learning analysis

VI. CONCLUSION

A dynamic cluster-based ON/OFF mechanism for small cell base stations. Clustering allows clustered base stations to coordinate their transmission while the clusters compete with one another to reduce as per cluster cost based on conclusion. A dynamic cluster-based ON/OFF mechanism for small cell base stations. Clustering allows clustered base stations to coordinate their transmission while the clusters compete with one another to reduce a per cluster Mcost based on their energy consumption and time load due to their traffic. In this regard we have formulated the per-cluster cost minimization problem as a non cooperative game among clusters. To solve the game, we have proposed a distributed algorithm and an intra-cluster coordination method using which base stations choose their transmission modes with minimum overhead. Our proposed clustering method uses information on both the locations of BSs and their capability of handling the traffic and dynamically form the clusters in order to improve the overall performance.

The joint optimization of BUA, power allocation and user side IC in HetNet is formulated as a WSR maximization problem. We first transform the problem into a more tractable form. Then we propose an efficient WMMSE-AO algorithm to solve a stationary solution of the transformed problem. Specifically, in each iteration, the non-convex non-smooth power allocation subproblem is first solved using a generalized WMMSE algorithm which is a generalization of the WMMSE algorithm in [14] to the case with non-differentiable WSR objective function. Then the combinatorial user side IC subproblemis solved using a greedy IC algorithm, which is able to find the optimal solution with only linear complexity. Finally,simulations show that the proposed scheme has significant gain over various baselines.

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