PhD Proposal

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Title

3D HMM based Clustering in Wireless Networks for Anomaly Detection and Diagnosis

Main Objectives and Proposed Approach

In Wireless Networks, optimal resource allocation and higher quality of service is of great importance for the network management teams and consequently for the respective clients. The traffic load and users movement on different access points (APs) in a wireless covered area varies from time to time and depends on a number of factors such as timely usage pattern, mobility pattern, accessible APs in the neighborhood, etc. One of the prominent objectives of this work is to inspect the evolving structure of the wireless networks and its inherent dynamics by exploring the spatial proximity of APs and their timely usage pattern simultaneously. The most appropriate approach for this purpose is applying 3D Hidden Markov Models to perform clustering on different spots of the wireless region considering both the temporal and spatial properties of the APs. From the perspective of network management, this work participates in a) traffic load prediction of places by learning the usage pattern of the collaborating APs in each place, b) anomaly detection tasks by building the normal models of various spots and measuring any deviation from the normal models, and c) diagnosing potential causes of harmful detected changes (anomalies) by observing the altering pattern of the entire network or any special place by focusing in the vicinity.

Research Questions

How far in the future the traffic load can be predicted with bounded error? Does the traffic load prediction help in optimal resource allocation and preserve the quality of service?

Does this advanced clustering method provide the network managers with a comprehensive knowledge of the existing changes in the wireless network?

Having captured the dynamics of the wireless network in this way, how accurate will be the diagnostics activities and presenting the root causes of anomalies occurred?

Main Keywords or Phrases

Hidden Markov Model (HMM), Wireless Communication, Pattern Recognition, Network Management, Clustering, Anomaly Detection, Diagnosing

References

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Relevant Conferences and Journals

1. Consumer Communications and Networking Conference (CCNC), IEEE
2. ACM international conference on Mobile computing and networking (ACM SIGMOBILE)
3. IEEE Computer and Communications Societies, IEEE Annual Joint Conference (INFOCOM)

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