

# Understanding User Behavior Based on Their Usage Patterns from 802.11 logs

## Introduction

- Wireless LANs (802.11 networks) are increasingly common in most organizations, cities, universities etc.
- It is increasingly important to understand trends in the usage pattern of these networks.
- In this study, we learned APs behavior and predict future behavior of AP from the limited 802.11 log data.

## Benefits

- Crucial for workload analysis of the network, capacity planning and potential network optimizations.
- Useful in the management of the physical space e.g. at FEUP.
- Useful for traffic engineering of APs and resource provisioning for QoS sensitive applications.

## Methods and Approaches

- We employ the use of probabilistic graphical model as seen in fig2.
- We extract daily number of unique users and the number of events for all APs for 86 days.
- We pick randomly one AP and divide its usage information into training set (50 days) and test set (33 days).
- We compute the conditional probability table in fig.2 from the training data and calculate the likelihood of the test data given the model in fig 3.

## Related Literature

- D.Kotz et al (2006). Evaluating Next-Cell Predictors with Extensive Wi-Fi Mobility Data, IEEE Transactions on Mobile Computing.
- Papadopouli et al: A Comparative Measurement Study of the Workload of Wireless APs in Campus Networks. IEEE International Symposium on Personal Indoor (2008).
- D Kotz et al (2007) Periodic properties of user mobility and AP popularity. Proceedings of IEEE Infocom.

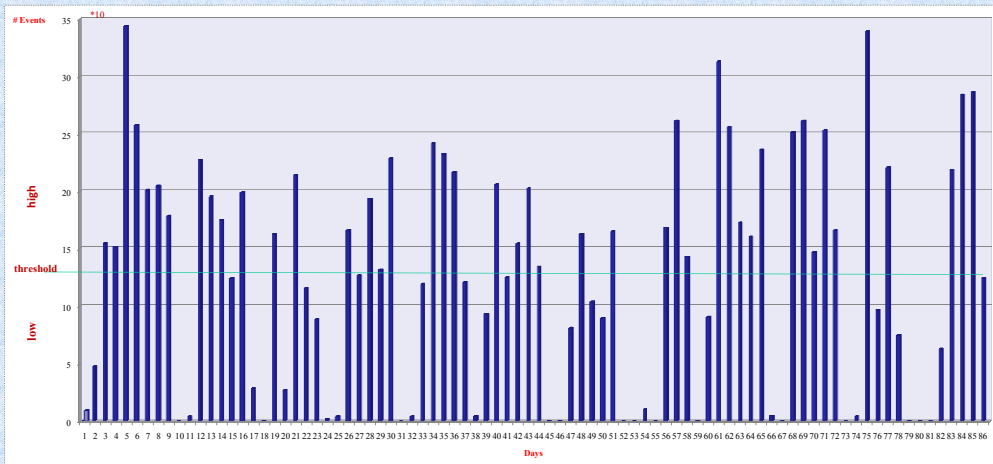


Fig1: Plot of the #event vs days for the randomly picked AP

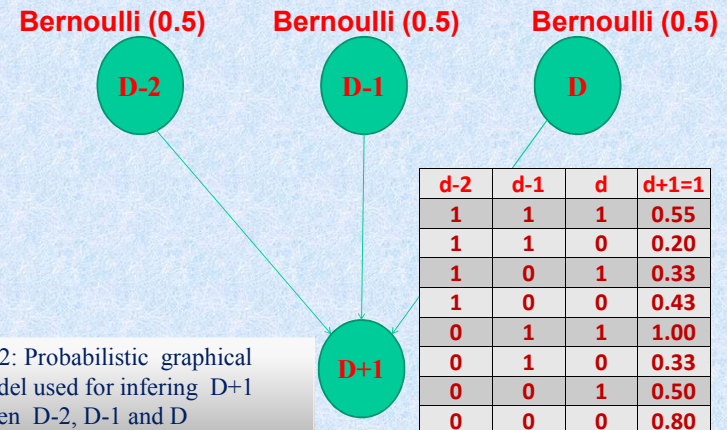


Fig2: Probabilistic graphical model used for inferring D+1 given D-2, D-1 and D

Model	d+1  d	d+1  d-1	d+1  d-2	d+1  d,d-1	d+1  d,d-2	d+1  d-1,d-2	d+1  d,d-1,d-2
likelihood	9.161	9.625	10.217	9.681	9.676	9.728	9.892

Fig3: Likelihood for the test data given each model

## Conclusions

- Events for the next day (D+1) can be better predicted when D-2 is observed as seen in Fig3.
- The current day D has little effects in prediction of the number of events for the next day.
- When all three days are observed D,D-1 and D-2 an improved prediction is expected.
- Future work, we intend to include in the graphical model other AP usage information and information from other APs.