

Target Localization using Beacon Nodes: A Group Testing Perspective

Venugopalakrishna Y. R.

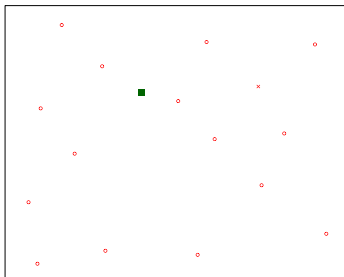
ECE Dept., IISc, Bangalore

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Outline

- Introduction to the Problem
- Problem Setup
- Group Testing
- Simulation Results

Problem Setup

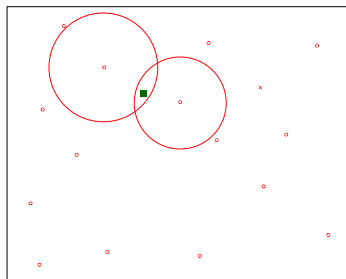


- In a geographical area A , locate a target using beacon nodes
- Beacon nodes and target are distributed uniformly at random locations

Problem Setup

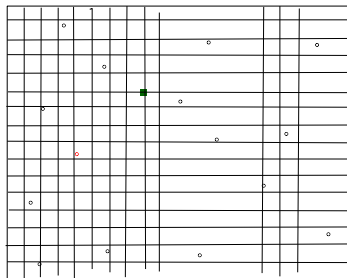
- Beacon nodes transmit with pre-decided transmit powers
- Target compares the received power from a beacon to a pre-decided threshold P_{th} , and decides it could hear a beacon or not
- Target conveys this information (a binary vector) to the central node
- Assumption on signal propagation: Free-space path-loss model

A Simple method of localizing

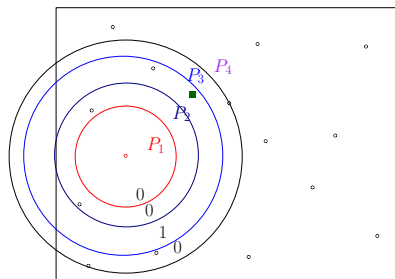


- Central node localizes the target to the intersection region

Group Testing based Localization

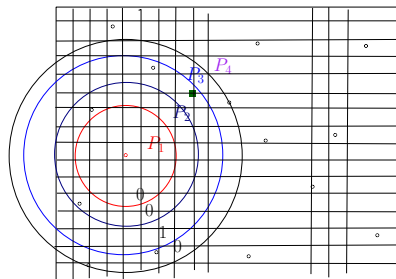


Group Testing based Localization Algorithm



- A beacon node transmit at power levels P_1, P_2, P_3 etc.
- Target forms a binary resultant vector using received power measurements Eg. 0010, repeats this for for all beacons

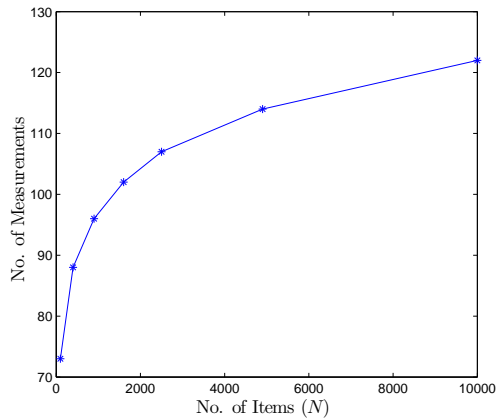
Group Testing based Localization



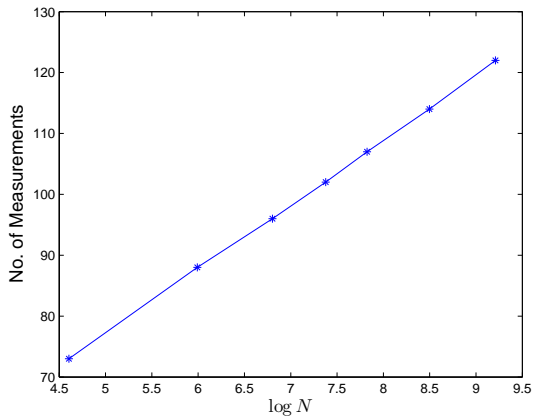
Simulation for Random Design

- $N = 100, 400, 900, ..$
- No. of Targets= 1
- Prob. of choosing an item in a given test= 0.1
- Accuracy: 90%

Random design



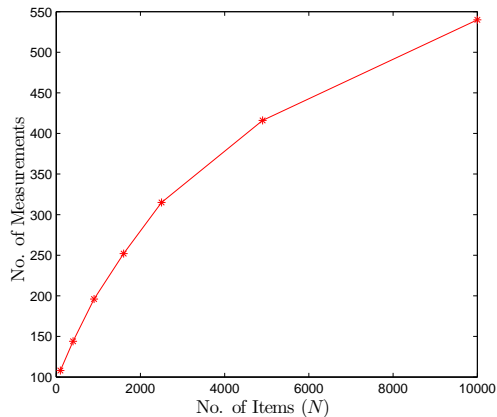
Random design



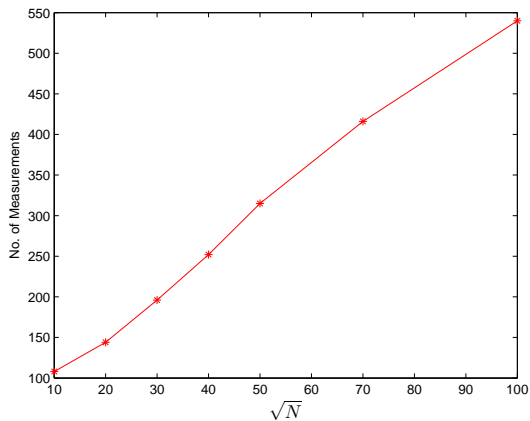
Simulation for Localization using Group tests

- $N = 100, 400, 900, ..$
- No. of Targets= 1
- Prob. of choosing an item in a given test= 0.0817
- Accuracy: 90% with the cell identified exactly

Localization using Group tests



Localization using Group tests



Thank You