

Detecting malfunctioning wireless sensors with group testing algorithms

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In the last few years wireless sensors became very popular and prevalent. Management of these sensors must include the capability of recognition the defected ones. Separate tests on each sensor can be expensive and ineffective. A well-known mathematical method, group testing provides an effective solution for this problem. In group testing problems the goal is to find a small set of “defected” elements in a basic set. Suppose that we have an n element set with m defected ones. It is allowed to test a subset and the test is positive if the subset contains at least one defective element. Considering the example motivated by the sensors, the goal is to find every malfunctioning sensor. This condition gives us a $\log \binom{n}{m}$ theoretical lower bound for the number of test - in the worst case. In this paper we present a novel group testing algorithm to detect every defective sensor in at most $\log \binom{n}{m} + cm$ steps, where c is a constant not greater than 4.

References:

- [1] Damaschke, Peter. "Optimal randomized group testing: A canonical form and the one-defective case." *ICALP2011GT (informal proceedings), Zürich (2011)*: 55-67.
- [2] Tošić, Tamara, Nikolaos Thomos, and Pascal Frossard. "Distributed sensor failure detection in sensor networks." *Signal Processing* (2012).