Abstract

Counterfeit or anomaly detection problem is a very eminent domain that is of immense importance in the field of Mathematics, Computer Science as well as in security concern. Beyond the theoretical field, computing a solution of the problem has huge significance in commercial sphere as well as to prevent forgery in different fields. Most frequently, we have to deal with a huge collection of information associated with various fields that are defined by some parameters. The parameters hold explicit values depending on the problem instance, and there may subsist some data that deviate from these specific values. Consequently, we consider these data items to be anomalous. Now the problem is to distinguish the counterfeited data by means of some testing mechanism of the items. In some of the variants, we even do not know the actual value of the parameter of the standard items as well as the anomalous items. As this problem considers the number of times the testing method is required as its requisite cost, our objective is to minimize that number to minimize the overall cost.

Counterfeit coins problem is the most important variant of these problems, where among a set of identical coins, the weight of some of them deviate from that of a standard coin, i.e. either heavier or lighter, and the objective is to recognize the forged coins by means of weighing. Moreover, the additional goal is to minimize the number of weighings for which it is sufficient to determine the defective coin(s) using only an equal arm balance when the number of odd coins is precisely known. The problem gets complicated with the increase in the number of counterfeit coins in a set. If P is the number of counterfeit coins in a set of n coins, it is not only sufficient to consider whether the counterfeit coins are heavier or lighter in comparison to a genuine coin individually, but we must also consider their mutual relation like equally heavier or lighter, unequally heavier or lighter, etc. Considering all these allied facts, a set of algorithms have been presented in this thesis for solving all variations of single and two counterfeit coins problem.

Keywords: Algorithm, Anomaly Detection, Counterfeiting, Coins Problem, Computational Complexity, Decision Tree.