

SOME DECISION MAKING METHODS APPLICABLE TO THE MEDICAL SCIENCES

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1. Introduction and summary

Decision making problems are often encountered in the medical sciences. In this paper, two types of problems are investigated, namely, medical diagnosis and planning of medical research. For medical diagnosis, we consider the use of statistical decision functions in minimizing the risks and error probabilities, and methods and advantages in some semiautomated diagnoses. The existence of certain types of optimal decision functions are proved, and methods for obtaining some of these decision functions are discussed. For planning of medical research, an optimal method is given for the selection of research projects under budget limitation. A certain estimation problem related to that optimal method is investigated. Both parametric and nonparametric methods of estimation are given.

2. Medical diagnosis

2.1. *A description of the problem.* By medical diagnosis we mean the act of recognizing the disease of a patient, and of classifying his state of health. In terms of the standard statistical decision theory, the problem may be analyzed and formulated as follows.

2.1.1. *The state space.* Let θ denote the disease that a given patient has (or the state of health of a given person). The state space Ω is defined as the set of all diseases having similar symptoms to those which the patient shows. We assume that Ω contains a finite number of elements $\theta_1, \dots, \theta_m$, where the θ_i correspond to either no disease, or one or several diseases. The probability that $\theta = \theta_i$, that is, the patient has disease θ_i , is denoted by p_i , which may be known or unknown.

2.1.2. *The action space.* The objective of medical diagnosis is, of course, to identify the disease of the patient. However, in some cases, a clean cut decision

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