

Applications of Advanced Statistical Techniques in Health Related Data: A Review

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Short Communication

Abstract: There are myriad search and statistical techniques for optimization problems in the world. Researchers in Medical Science need an efficient tool to tackle their problems. Statistics as science help to quantify the contribution of chance and as an art helps individual clinician make valid diagnostic, prognostic or therapeutic decisions. Statistics plays an important role in measuring, understanding, and describing the overall health and well-being of a population. Biostatistics as a subject evolved from the application of statistics in various research aspects of biomedical care, and public health. This paper presents a review of literature of Applications of Advanced statistical techniques for monitoring and evaluation of the system in medical science & we present some generalities about the new types of Statistical Technique have been made in order to achieve many new developments in Medical Sciences.

Keywords: Operation Research, Health Data etc.

Introduction

In human life Health plays important role as someone say a thought that “Health is Wealth”, So health sector should be improved in services, research etc. The health care services are designed to meet the health needs of the community through the use of available knowledge and resources. Health data provide information about the occurrence of certain diseases and health conditions. Measuring how many people dies each year and why they have died is one of the most important means along with gauging how various diseases and injuries are affecting the living of assessing the effectiveness of a country’s health system. Having those Health related data helps health authorities determine whether they are focusing on the right kinds of public health actions that will reduce the number of preventable deaths and disease. There are different types of Health related data have been collected by government, semi-government agencies, private agencies & organization. So these collected data should be presented in well statistical analysis techniques. So from that we get fruitful findings and government should look after that & improved lacked health services.

In last few decade different statistical techniques is used to assess data in epidemiology and public health are critical for identifying the causes of disease, modes of

transmission, appropriate control and prevention measures, and for prioritizing and evaluating activities. Research in medicine and public health has been both a beneficiary of this new methodology and a source of new problems, to the extent that statistics applied to medical Research – biostatistics – can now a day’s be considered a discipline in its own right. In fact, biostatistics has become a defined branch of science that uses an intricate combination of statistics, probability and computing to resolve problems in the biomedical sciences. The number of challenges is arrived in terms of new development in medical field, so we need the new improvement in techniques to resolve the new problems. Some basic statistical techniques like Descriptive statistics, t-test, ANOVA, factor analysis, correlation, Many Whitney-U test were frequently used in Health Related Data. Though some new statistical techniques analyses were introduced into Public Health Related Data, the trends of frequently used analysis of statistical techniques stayed relatively steady. In this we compiled & reviewed the application of different advanced statistical techniques like Operation Research, Meta-Analysis, Artificial Neural Network etc.

Advanced statistical Techniques

1. Operation Research (OR)

Operations Research, also known as Decision Science or Management Science, existed as a scientific discipline since the 1930s. Operational research (OR) encompasses a wide range of problem-solving techniques and methods applied in the pursue of improved decision-making and efficiency, such as simulation, queuing and other stochastic-process models, Markov decision processes, Econometric methods, Data Envelopment Analysis, Decision Analysis. Operation research originated in the efforts of military planners during World War II. OR has been used in a wide range of areas from Military Operations, Economics, Urban planning, Sports, and Forestry to Agriculture and Communications. In public health, operations researchers have made important recommendations in drug treatment, AIDS prevention,

and organ donation, Supply Chain Management of Blood Banks, Evaluating the Efficiency of Hospitals' Preoperative Services Using DEA. Designing Pediatric Formularies for Childhood Immunization Using Integer Programming Models. Satyanarayana, Jaydeva & Ramakrishna [1] utilized Data Envelopment Techniques for evaluating efficiency of Indian Rural Health Care Programs. One of the major issues in health care is waiting times (waiting for surgery, wait lists for transplants, location of emergency services, etc.) and most health care queuing problems are too complex to be analyzed theoretically. Therefore, simulation is a popular alternative. Operations research provides HIV programming with mechanisms for learning how to integrate HIV-specific services with primary health care, and other health priorities including tuberculosis, malaria, prenatal and postnatal, sexual and reproductive health. Malhotra & Zodpey in [2] demonstrated that Operation research can deal with wide ranging issues in public health system, disease prevention and control along with community issues. Esen and Setin [3] represented applications of OR techniques to cancer treatment and also show that combination and additional therapies other than radiotherapy and chemotherapy also encouraged to cooperate with OR. OR is critical in identifying which approaches are effective in the fields, which are not, and why; it seeks to improve the number and quality of services and programme outputs and outcomes by optimizing programme inputs and processes. In our view There are many dazzling opportunities to apply operations research ideas to health related data and there practical contributions to the design, evaluation and operation of public health activities.

2. Artificial Neural Networks (ANN)

The foundation of neural networks in a sense begins with biology. The human brains consist of an estimated 10 billion neurons (nerve cells) and 6000 times as many synapses (connections) between them. An artificial neuron network (ANN) is a computational model based on the structure and functions of biological neural networks. Information that flows through the network affects the structure of the ANN because a neural network changes - or learns, in a sense - based on that input and output. It is considered as nonlinear statistical data modeling tools where the complex relationships between inputs and outputs are modeled or patterns are found. ANN has been utilized for Classification, Clustering, Pattern association, Function approximation, Control, Optimization & Prediction. It has several applications in the field of Character recognition, Image compression, Stock market prediction, Travelling salesman problem, Manufacturing & Engineering. Artificial Neural Networks (ANN) is currently received a

great deal of attention in research area of public health and it is believed that they will receive extensive application to health Sector in the next few years. At the moment, the research is mostly on modeling parts of the human body and recognizing diseases from various scans (e.g. cardiograms, CAT scans, ultrasonic scans, etc.) for the detection of cancer and heart problems, and for the analysis of diverse types of medical image (including tumor detection in ultra sonograms, classification of chest x-rays, tissue and vessel classification in magnetic resonance images, estimation of skeletal age from x-ray images, and assessment of brain maturation). ANNs are used experimentally to model the human cardiovascular system and renal transplantation. ANN has been used in medicine for the clinical functions of diagnosis, prognosis and survival analysis, and decision support. Ganeshan, Venkatesh, Rama & Palani [4] reviewed that ANN can be effectively used for lung cancer diagnosis to help oncologists to plan for a better medication and provide the patient with early diagnosis. Artificial Neural Networks (ANNs) perform well in pattern recognition, and are suitable for signal processing (EEG, ECG, and hemodynamic signals), as well as image processing (mammography, chest radiographs, Tomography, nuclear medicine imaging, magnetic resonance). Lee & Park [5] present common task in health sector is to classify and predict symptomatic status of HIV/AIDS patients also to identify relationships even when input data is very complex, ill defined and ill structured and accuracy of ANN for evaluating diagnosis. In our opinion ANN are likely to make major contribution for early diagnosis, prediction and classification of status of diseases. Much research work remains to be done in this field.

3. Meta-Analysis

The term meta-analysis was coined in 1976; although, the first meta-analysis is attributed to Pearson (1904), who analyzed data from five studies on the correlation between the vaccination for enteritis fever and its mortality. It is statistical techniques to combine results from different studies and obtain a quantitative estimate of the overall effect of a particular intervention or variable on a defined outcome i.e., it is a statistical process for pooling data from many clinical trials to glean a clear answer. Meta-analysis is just one type of secondary analysis, in other words, it is a secondary analysis used for integration (synthesis) of the results derived from multiple primary analyses. Meta-analysis produces a stronger conclusion than can be provided by any individual study. Nowadays, meta-analysis is usually referred as the statistical component in a systematic review which has a clearly defined research question and uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect

and analyze data from the studies that are included in the review. It is powerful statistical tool used in social science, ecology, research, medicine, education, psychology. Another example is the development of clinical prediction models, where meta-analysis may be used to combine data from different research centers or even to aggregate existing prediction models. One approach frequently used in meta-analysis in health care research is termed 'inverse variance method'. Sandoval & Zarate [6] reviewed it becomes relevant because they are essential for evidence-based medicine. Signed differential mapping is a statistical technique for meta-analyzing studies on differences in brain activity or structure which used neuro imaging techniques such as MRI. Different high throughput techniques such as microarrays have been used to understand Gene expression. MicroRNA expression profiles have been used to identify differentially expressed MicroRNA in particular cell or tissue type or disease conditions or to check the effect of a treatment. A meta-analysis of such expression profiles was performed to derive novel conclusions and to validate the known findings. It is not only applied to clinical trials but also several interesting field like observational studies, dose response, diagnostic test. Sathian B. et. al. [7] suggested it is powerful when there are many studies with low statistical power and it is a hallmark of evidence-based medicine. M. Bauer, A. Leavens & K.Schwartzman [8] uses Meta-Analysis for better assessment of the benefits and limitations of TB control interventions, and may assist health care providers to better target physical and psychosocial support. In our view Meta-analysis is a commanding tool when used thoughtfully. Meta-analysis has an important role in medical research, public policy, and clinical practice. A meta-analysis needs to fulfill several key requirements to ensure the validity of its results. It is imperative that researchers, policy-makers, and clinicians be able to critically assess the value and reliability of the conclusions of meta-analyses.

Conclusion

This paper reviews an Application of advanced statistical techniques in Health Related Data. Health Related Data plays important role in the human life so from past some decades an advance statistical technique have been developed with computer and most of the Researcher, Statistician, Analyst found that these new advanced statistical techniques will play very important role in the prediction, monitoring, evaluating, summarizing & analyzing the Health Related data.

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