# An Entropy Based Method For Resource Leveling





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Entropy Applications in Environmental and Water Engineering John Wiley & Sons
Focuses On an Emerging Field in Water EngineeringA broad treatment of the Tsallis entropy theory presented from a water resources engineering point of view, Introduction to Tsallis Entropy Theory in Water Engineering fills a growing need for material on this theory and its relevant applications in the area of water engineering. This self-contained

*Framework to Evaluate Entropy Based Data Fusion Methods in Supply Chain Management* MDPI
This dissertation explores data fusion methodology to deduce an overall inference from the data gathered from multiple heterogeneous sources. Typically, if there existed a data source in which the data were reliable and unbiased, then data fusion would not be necessary. Data fusion methodology combines data form multiple diverse sources so that the desired information - such as the population mean - is improved despite redundancies, inaccuracies, biases, and inflated variability in the data. Examples of data fusion include estimating average demand from similar sources, and integrating fatality counts from different media sources after a catastrophe. The approach in this study combines "inputs" from distinct sources so that the information is "fused." Another way of describing this process is "data integration." Important assumptions are 1. Several sources provide "inputs" for information used to estimate parameters of a probability distribution. 2. Since distributions for the data from the sources are heterogeneous, some sources are less reliable. 3. Distortions, bias, censorship, and systematic errors may be more prominent in data from certain sources. 4. The sample size of sources data, number of "inputs," may be very small. Examples of information from multiple sources are abundant: traffic information from sensors at intersections, multiple economic indicators from various sources, demand data for product using similar retail stores as sources, polling data from various sources, and disaster count of fatalities from different media sources after a catastrophic event. This dissertation seeks to address a gap in the operations literature by addressing three research questions regarding entropy base data fusion (EBDF) approaches to estimation. Three separate, but unifying, essays address the research questions for this dissertation. Essay 1 provides an overview of supporting literature for the research questions. A numerical analysis of airline maximum wait time data illustrates the underlying issues involved in EBDF methods. This essay addresses the research question: Why consider alternative entropy-based weighting methods? Essay 2 introduces 13 data fusion methods. A Monte Carlo simulation study examines the performance of these methods in estimating the mean parameter of a population with either a normal or lognormal distribution. This essay addresses the following research questions: 1. Can an alternative formulation for Shannon's entropy enhance the performance of Sheu (2010)'s data fusion approach? 2. Do symmetric and skewed distributions affect the 13 data fusion methods differently? 3. Do negative and positive biases affect the performance of the 13 methods differently? 4. Do entropy based data fusion methods outperform non-entropy based data fusion methods? 5. Which data fusion methods are recommended for symmetric and skewed data sets when no bias is present? What is the recommendation under conditions of few data sources? Essay 3 explores the use of the data fusion method estimates of the population mean in a newsvendor problem. A Monte Carlo simulation study investigates the accuracy of the using the estimates provided in Essay 2 as the parameter estimate for the distribution of demand that follows an exponential distribution. This essay addresses the following research questions: 1. Do data fusion methods with relatively strong performance in estimating the parameter mean estimate also provide relatively strong performance in estimating the optimal demand under a given ratio of overage and underage costs? 2. Do any of the data fusion methods deteriorate or improve with the introduction of positive and negative bias? 3. Do the alternative entropy formulations to Shannon's entropy enhance the performance of the methods on a relative basis? 4. Is the relative rank ordering performance of the data fusion methods different in Essay 2 and Essay 3 in the resulting performances of the methods? The contribution of this research is to introduce alternative EBDF methods, and to establish a framework for using EBDF methods in supply chain decision making. A comparative Monte Carlo simulation analysis study will provide a basis to investigate the robustness of the proposed data fusion methods for estimation of population parameters in a newsvendor problem with known distribution, but unknown parameter. A sensitivity analysis is conducted to determine the effect of multiple sources, sample size, and distributions.

Dynamics of Parallel Robots CRC Press
With almost every business application process being linked with a web portal, the website has become an integral part of any organization. Satisfying the end user□s needs is one of the key principles of designing an effective website. Because there are different users for any given website, there are different criteria that users want. Thus, evaluating a website is a multi-criteria decision-making problem in which the decision maker□s opinion should be considered for ranking the website. Multi-Criteria Decision-Making Models for Website Evaluation is a critical scholarly resource that covers the strategies needed to evaluate the navigability and efficacy of websites as promotional platforms for their companies. Featuring a wide range of topics including linguistic modelling, e-services, and site quality, this book is ideal for managers, executives, website designers, graphic artists, specialists, consultants, educationalists, researchers, and students.

Entropy Based Moment Selection in Generalized Method of Moments Springer Science & Business Media
Keywords: weak identification, redundancy, relevant moment selection, entropy, GMM.

**The Maximum Entropy Method** Springer Nature
A single-valued neutrosophic set has king power to express uncertainty characterized by indeterminacy, inconsistency and incompleteness. Most of the existing single-valued neutrosophic cross entropy bears an asymmetrical behavior and produces an undefined phenomenon in some situations.

**Entropy-Based Parameter Estimation in Hydrology** CRC Press
Rubinstein is the pioneer of the well-known score function and cross-entropy methods. Accessible to a broad audience of engineers, computer scientists, mathematicians, statisticians and in general anyone, theorist and practitioner, who is interested in smart simulation, fast optimization, learning algorithms, and image processing.

*Maximum Entropy Based Evolutionary Optimization of Water Distribution Networks Under Multiple Operating Conditions and Self-adaptive Search Space Reduction Method* Springer Science & Business Media
Discover the mathematical riches of 'what is diversity?' in a book that adds mathematical rigour to a vital ecological debate.

**Application of Entropy Theory in Hydrologic Analysis and Simulation** IGI Global
Recently many researchers are working on cluster analysis as a main tool for exploratory data analysis and data mining. A notable feature is that specialists in di?erent ?elds of sciences are considering the tool of data clustering to be useful. A major reason is that clustering algorithms and software are ?exible in thesensethatdi?erentmathematicalframeworksareemployedinthealgorithms and a user can select a suitable method according to his application. Moreover clusteringalgorithmshavedi?erentoutputsrangingfromtheolddendrogramsof agglomerativeclustering to more recent self-organizingmaps. Thus, a researcher or user can choose an appropriate output suited to his purpose,which is another ?exibility of the methods of clustering. An old and still most popular method is the K-means which use K cluster centers. A group of data is gathered around a cluster center and thus forms a cluster. The main subject of this book is the fuzzy c-means proposed

by Dunn and Bezdek and their variations including recent studies. A main reasonwhy we concentrate on fuzzy c-means is that most methodology and application studies infuzzy clusteringusefuzzy c-means,andfuzzy c-meansshouldbe consideredto beamajortechniqueofclusteringingeneral,regardlesswhetheroneisinterested in fuzzy methods or not. Moreover recent advances in clustering techniques are rapid and we requirea new textbook that includes recent algorithms.We should also note that several books have recently been published but the contents do not include some methods studied herein.

**Biomedical Signal and Image Examination with Entropy-Based Techniques** Springer

This book reconsiders statistical methods from the point of view of entropy, and introduces entropy-based approaches for data analysis. Further, it interprets basic statistical methods, such as the chi-square statistic, t-statistic, F-statistic and the maximum likelihood estimation in the context of entropy. In terms of categorical data analysis, the book discusses the entropy correlation coefficient (ECC) and the entropy coefficient of determination (ECD) for measuring association and/or predictive powers in association models, and generalized linear models (GLMs). Through association and GLM frameworks, it also describes ECC and ECD in correlation and regression analyses for continuous random variables. In multivariate statistical analysis, canonical correlation analysis, T2-statistic, and discriminant analysis are discussed in terms of entropy. Moreover, the book explores the efficiency of test procedures in statistical tests of hypotheses using entropy. Lastly, it presents an entropy-based path analysis for structural GLMs, which is applied in factor analysis and latent structure models. Entropy is an important concept for dealing with the uncertainty of systems of random variables and can be applied in statistical methodologies. This book motivates readers, especially young researchers, to address the challenge of new approaches to statistical data analysis and behavior-metric studies.

*Entropy Measures for Data Analysis* Springer Science & Business Media

Selection of material handling equipment for typical conditions and handling environment is one of the multi attribute decision making problem. The objective of the research paper is to implement and validate multi attribute selection of automated guided vehicle for material handling purpose. The present paper proposes a single valued neutrosophic set with entropy weight based multi attribute decision making technique.

**Entropy Guided Transformation Learning: Algorithms and Applications** University of Illinois Press

Scientific knowledge grows at a phenomenal pace--but few books have had as lasting an impact or played as important a role in our modern world as The Mathematical Theory of Communication, published originally as a paper on communication theory more than fifty years ago. Republished in book form shortly thereafter, it has since gone through four hardcover and sixteen paperback printings. It is a revolutionary work, astounding in its foresight and contemporaneity. The University of Illinois Press is pleased and honored to issue this commemorative reprinting of a classic.

**The Mathematical Theory of Communication** Infinite Study

The aim of this book is to outline the concept of entropy, various types of entropies and their implementation to evaluate a variety of biomedical signals/images. The book emphasizes various entropy-based image pre-processing methods which are essential for the development of suitable computerized examination systems. The recent research works on biomedical signal evaluation confirms that signal analysis provides vital information regarding the physiological condition of the patient, and the efficient evaluation of these signals can help to diagnose the nature and the severity of the disease. This book emphasizes various entropy-based image pre-processing methods which are essential for the development of suitable computerized examination systems for the analysis of biomedical images recorded with a variety of modalities. The work discusses the image pro-processing methods with the Entropies, such as Kapur, Tsallis, Shannon and Fuzzy on a class of RGB-scaled and gray-scaled medical pictures. The performance of the proposed technique is justified with the help of suitable case studies, which involves x-ray image analysis, MRI analysis and CT analysis. This book is intended for medical signal/image analysts, undergraduate and postgraduate students, researchers, and medical scientists interested in biomedical data evaluation.

**Entropy-Based Parameter Estimation in Hydrology** Springer Science & Business Media

This thesis presents a practical method for calculating and representing entropy- based metrics for a set of bibliographic records evolving over time, in support of Dr. Michael Saboe's dissertation research which addressed the ability to measure software technology transfer. The implementation of the analysis methodology for determining the information- temperature of evolving datasets containing bibliographic records is described. The information-temperature metric is based on information entropy and is used to relate the maximum complexity of a system to the current complexity. The implementation of the analysis methodology required using data mining techniques to prepare the datasets. Additionally, since the information-temperature metric derived from Saboe's work was a new emerging concept, the data analysis methodology had to be refined several times in order to obtain the desired results. An iterative software development paradigm was used to write the application in 3 iterations using Visual Basic. At the end of the implementation the data analysis process became systemized allowing the outlining of the steps to compute the temperature of datasets, and it is estimated that the learning curve of the analysis can be reduced by 50 percent through integration and packing of the analysis functions into a stand-alone application with an intuitive user interface.

**Entropy and Diversity** Infinite Study

Forty years ago, in 1957, the Principle of Maximum Entropy was first intro duced by Jaynes into the field of statistical mechanics. Since that seminal publication, this principle has been adopted in many areas of science and technology beyond its initial application. It is now found in spectral analysis, image restoration and a number of branches ofmathematics and physics, and has become better known as the Maximum Entropy Method (MEM). Today MEM is a powerful means to deal with ill-posed problems, and much research work is devoted to it. My own research in the area ofMEM started in 1980, when I was a grad uate student in the Department of Electrical Engineering at the University of Sydney, Australia. This research work was the basis of my Ph.D. the sis, The Maximum Entropy Method and Its Application in Radio Astronomy, completed in 1985. As well as continuing my research in MEM after graduation, I taught a course of the same name at the Graduate School, Chinese Academy of Sciences, Beijingfrom 1987to 1990. Delivering the course was theimpetus for developing a structured approach to the understanding of MEM and writing hundreds of pages of lecture notes.

*Information Processing in Medical Imaging* IGI Global

This book constitutes the refereed proceedings of the Third International Conference on Fuzzy Systems and Knowledge Discovery, FSKD 2006, held in federation with the Second International Conference on Natural Computation ICNC 2006. The book presents 115 revised full papers and 50 revised short papers. Coverage includes neural computation, quantum computation, evolutionary computation, DNA computation, fuzzy computation, granular computation, artificial life, innovative applications to knowledge discovery, finance, operations research, and more.

**NS-Cross Entropy-Based MAGDM under Single-Valued Neutrosophic Set Environment** MDPI

Entropy Guided Transformation Learning: Algorithms and Applications (ETL) presents a machine learning algorithm for classification tasks. ETL generalizes Transformation Based Learning (TBL) by solving the TBL bottleneck: the construction of good template sets. ETL automatically generates templates using Decision Tree decomposition. The authors describe ETL Committee, an ensemble method that uses ETL as the base learner. Experimental results show that ETL Committee improves the effectiveness of ETL classifiers. The application of ETL is presented to four Natural Language Processing (NLP) tasks: part-of-speech tagging, phrase chunking, named entity recognition and semantic role labeling. Extensive experimental results demonstrate that ETL is an effective way to learn accurate transformation rules, and shows better results than TBL with handcrafted templates for the four tasks. By avoiding the use of handcrafted templates, ETL enables the use of transformation rules to a greater range of tasks. Suitable for both advanced undergraduate and graduate courses, Entropy Guided Transformation Learning: Algorithms and Applications provides a comprehensive introduction to ETL and its NLP applications.

*Fuzzy Systems and Knowledge Discovery* Springer

Since the pioneering work of Shannon in the late 1940's on the development of the theory of entropy and the landmark contributions of Jaynes a decade later leading to the development of the principle of maximum entropy (POME), the concept of entropy has been increasingly applied in a wide spectrum of areas, including chemistry, electronics and communications engineering, data acquisition and storage and retreival, data monitoring network design, ecology, economics, environmental engineering, earth sciences, fluid mechanics, genetics, geology, geomorphology, geophysics, geotechnical engineering, hydraulics, hydrology, image processing, management sciences, operations research, pattern recognition and identification, photogrammetry, psychology, physics and quantum mechanics, reliability analysis, reservoir engineering, statistical mechanics, thermodynamics, topology, transportation engineering, turbulence modeling, and so on. New areas finding application of entropy have since continued to unfold. The entropy concept is indeed versatile and its applicability widespread. In the area of hydrology and water resources, a range of applications of entropy have been reported during the past three decades or so. This book focuses on parameter estimation using entropy for a number of distributions frequently used in hydrology. In the entropy-based parameter estimation the distribution parameters are expressed in terms of the given information, called constraints. Thus, the method lends itself to a physical interpretation of the parameters. Because the information to be specified usually constitutes sufficient statistics for the distribution under consideration, the entropy method provides a quantitative way to express the information contained in the distribution.

**Entropy-based non parametric method for the analysis of categorical longitudinal data (An)-Database design for longitudinal survey data** Springer Science & Business Media

Entropies and entropy-like quantities play an increasing role in modern non-linear data analysis. Fields that benefit from this application range from biosignal analysis to econophysics and engineering. This issue is a collection of papers touching on different aspects of entropy measures in data analysis, as well as theoretical and computational analyses. The relevant topics include the difficulty to achieve adequate application of entropy measures and the acceptable parameter choices for those entropy measures, entropy-based coupling, and similarity analysis, along with the utilization of entropy measures as features in automatic learning and classification. Various real data applications are given.

*An Entropy-Based Hierarchical Search Result Clustering Method by Utilizing Augmented Information* CRC Press

The dissertation focuses on the application of entropy theory in hydrologic analysis and simulation, namely, rainfall analysis, streamflow simulation and drought analysis. The extreme value distribution has been employed for modeling extreme rainfall values. Based on the analysis of changes in the frequency distribution of annual rainfall maxima in Texas with the changes in duration, climate zone and distance from the sea, an entropy-based distribution is proposed as an alternative distribution for modeling extreme rainfall values. The performance of the entropy based distribution is validated by comparing with the commonly used generalized extreme value (GEV) distribution based on synthetic and observed data and is shown to be preferable for extreme rainfall values with high skewness. An entropy based method is proposed for single-site monthly streamflow simulation. An entropy-copula method is also proposed to simplify the entropy based method and preserve the inter-annual dependence of monthly streamflow. Both methods are shown to preserve statistics, such as mean, standard deviation, skenwess and lag-one correlation, well for monthly streamflow in the Colorado River basin. The entropy and entropy-copula methods are also extended for multi-site annual streamflow simulation at four stations in the Colorado River basin. Simulation results show that both methods preserve the mean, standard deviation and skewness equally well but differ in preserving the dependence structure (e.g., Pearson linear correlation). An entropy based method is proposed for constructing the joint distribution of drought variables with different marginal distributions and is applied for drought analysis based on monthly streamflow of Brazos River at Waco, Texas. Coupling the entropy theory and copula theory, an entropy-copula method is also proposed for constructing the joint distribution for drought analysis, which is illustrated with a case study based on the Parmer drought severity index (PDSI) data in Climate Division 5 in Texas.

*Algorithms for Fuzzy Clustering* CRC Press

From engineering fluid mechanics to power systems, information coding theory and other fields, entropy is key to maximizing performance in engineering systems. It serves a vital role in achieving the upper limits of efficiency of industrial processes and quality of manufactured products. Entropy based design (EBD) can shed new light on various flow processes, ranging from optimized flow configurations in an aircraft engine to highly ordered crystal structures in a turbine blade. Entropy Based Design of Fluid Engineering Systems provides an overview of EBD as an emerging technology with applications to aerospace, microfluidics, heat transfer, and other disciplines. The text extends past analytical methods of Entropy Generation Minimization to numerical simulations involving more complex configurations and experimental measurement techniques. The book begins with an extensive development of basic concepts, including the mathematical properties of entropy and exergy, as well as statistical and numerical formulations of the second law. It then goes on to describe topics related to incompressible flows and the Second Law in microfluidic systems. The authors develop computational and experimental methods for identifying problem regions within a system through the local rates of entropy production. With these techniques, designers can use EBD to focus on particular regions where design modifications can be made to improve system performance. Numerous case studies illustrate the concepts in each chapter, and cover an array of applications including supersonic flows, condensation and turbulence. A one-of-a-kind reference, Entropy Based Design of Fluid Engineering Systems outlines new advances showing how local irreversibilities can be detected in complex configurations so that engineering devices can be re-designed locally to improve overall performance.