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STUDYING THE UNCERTAINTY OF ENTROPIC SYSTEMS

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Abstract
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This article discusses the unit of uncertainty and the measure of disorder in a system. The main features and types of uncertainties are given. The main ways to reduce uncertainties are presented.

Keywords: Uncertainty, entropy, combination methods, conceptualization, model.

Introduction

A characteristic feature of our time is the constant presence of a person in a state of increasing external and internal uncertainty [1].

Recently, uncertainty estimation in many measurement fields has been considered a trivial task, and in digitalized countries, infrastructure is closely linked to programming and automation [2].

Uncertainty is a multifaceted and multidimensional concept, characteristic of any scientific field. In the past, numerous attempts were made to differentiate its types and sources, which resulted in a generally accepted classification [3].

Entropy is a measure of disorder or uncertainty in a system. In physics, it relates to the level of chaos or dispersion within a system. In information theory, it reflects the degree to which a message is unexpected or informative. Now, in physics, the term "entropy" is often used to describe the degree of disorder or chaos in a system. The higher the entropy, the more disorder there is.

Entropy also plays an important role when we talk about technical systems, especially in the context of efficiency processes and systems development.

So, in technical systems, entropy is often associated with two important concepts: thermal entropy and information entropy [4].

1. Thermal entropy: In the context of engineering, thermal entropy is very important, especially in thermodynamics. It is associated with energy loss and heat dissipation in the system, which leads to an increase in entropy in the system. For example, thermal entropy plays a large role in processes where energy is converted, such as internal combustion engines or power plants.

2. Information entropy: in the context of information systems and data transmission, the concept of information entropy becomes key. Here, entropy is related to the amount of information a message carries, as well as the level of disorder or uncertainty in the data being transmitted. Information theory, developed by Claude Shannon, uses the concept of information entropy to measure the "clutter" in messages or data.Это только небольшой обзор технических неопределенностей, которые могут возникать в процессе разработки новых технологий и продуктов.

Analysis begins with conceptualization. This is a set of assumptions regarding the structure of the cadastre or sector. Assumptions and methodological choices determine data and information needs. In this case, there may be certain interactions between data and assumptions, as well as methodological choices [5].

Models can be as simple as arithmetic multiplication of activities and emission factors for each category and then summing across all categories, but they can also include complex process models specific to individual categories.

Methods for combining input uncertainties to obtain uncertainty estimates for individual categories and the overall result.

Below are the main features and types of uncertainties:

Time of occurrence: *Prospective, Retrospective;*

Factors of origin: *Economic, Political, Social, Natural;*

Environment: *Internal, External;*

Time to implement the solution: *Short-term, Long-term;*

Information reliability: *Low, Medium, High;*

Number of targets: *Single, Multiple;*

Nature of uncertainties: *Objective, Subjective.*

Reducing uncertainties. Uncertainties must be reduced as much as possible in the process of compiling a model of the object. It is especially important to ensure that the model and collected data are a true representation of the real world [6]. When focusing efforts on reducing uncertainty, priority should be given to those asset inputs that have the greatest impact on the overall inventory uncertainty, as opposed to inputs that have little or no importance for the assessment. Tools for prioritizing where uncertainty needs to be reduced include analyzing key categories and assessing the contribution of uncertainties in specific categories to the overall uncertainty in the facility.

Depending on the cause of the uncertainties, they can be reduced in seven extended ways:

• Improved conceptualization. Improving the content of selected structural assumptions can reduce uncertainty.

• Improvement of models. Improvements in model structure and parameterization can lead to a better understanding and characterization of systematic and random errors, as well as a reduction in these causes of uncertainty.
• Improving representativeness. May involve stratification or other sampling strategies. This is particularly important for the agriculture, forestry and land use sector categories in the cadastre, but also has other applications, for example wherever different technologies operate within the same category.
• Use of more accurate measurement methods. Measurement error can be reduced by using more accurate measurement techniques, avoiding simplifying assumptions, and ensuring that measurement technologies are used and calibrated appropriately.
• Collect more measurement data. The uncertainty associated with random sampling error can be reduced by increasing the sample size. Both variance and random error can be reduced by filling in data gaps. This also applies to measurements and surveys.
• Elimination of known risk of deviation. Achieved by ensuring that instrumentation is properly installed and calibrated, that models or other assessment procedures are appropriate and representative as specified in decision trees and other guidelines for methodological selection in sector volumes, and that expert judgment is systematically applied.
• Improved state of knowledge. In general, improving the understanding of the categories and processes leading to emissions and removals can help identify and correct incompleteness problems.

Conclusion

The study of uncertainty in entropic systems is a task that has profound implications for understanding both physical processes and broader phenomena related to information and uncertainty. The study of uncertainty in entropic systems is an important step towards a deep understanding of the world in all its manifestations.

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