Environmental Informatics

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Abstract

Environmental Informatics is the science of information applied to Environmental Science. The use of computers, digital technology and modeling to solve the Environmental problems is called Environmental Informatics .Thus by Environmental Informatics , we mean application of data science to Environmental problems. The aim of this paper is to focus on Modeling in Environmental Informatics.

Key words : Environmental Informatics, Modeling

Introduction

Informatics is the study that deals with the structure, properties and communication of information by storing or processing information . Environmental Informatics is the application of data science to environmental problems. Data Science is the subset of information science that focuses on large multidimensional data sets, often complex structure. By Environmental information, we mean data about the state of earth's biosphere.

Characterisation of Environmental Informatics - The following trends are recently considered

i) Environmental monitoring by means of remote sensing and the combination of data streams from all over the world.

ii) A policy for sharing and integrating environmental information across political and organisational boundaries

.iii) Advance model-based data analysis techniques, shifting the focus from data to dynamic system structure

iv) Industrial applications of environmental information processing, aiming at higher ecological efficiency of the economic system.

A Typology of Environmental Information Processing Systems:

i) **Monitoring and Control systems**- Monitoring systems deals with the automation of measurements in water, air, soil, nose and radiation control. This includes basic data analysis such as aggregation of time series data, the classification of environmental objects or the identification of hazardous substances based on measured data.

ii) **Conventional information systems :** These are employed for the input , storage ,structuring, integration, retrieval, and the presentation of various kinds of environmental information such as raw measurement data, description of environmental objects, as well as documents such as enviornmental regulations or literature references.

iii) **Computational evaluation and analysis systems :** These support environmental data processing using complex numerical /statistical analysis methods and modeling techniques. These also include the simulation of various environmental scenarious.

iv) **Planning and decision support system** : This helps in decision maker by offering criteria for the evaluation of alternatives or for justifying decisions. e.g. for environmental impact analyses, for handling hazardous substances , for water resource management or for technological risk assesment.

v) **Integrated environmental information systems** : These cannot be related to the systems mentioned above because they consists of multiple components serving various purposes.

Modeling and Simulation :

These techniques have been employed in the environmental sector for more than three decades. The first application emerged from water resource management .Today the following types of simulation models are used for advanced data analysis tasks, for decision support, planning, or for process control.

The task of Environmental Informatics in environmental modeling is to provide adequate tools that enable users to build simulation models ,i.e. by graphical modeling languages, modeling and simulation systems.

Computer Graphics and Visualization : Employing computer graphics methodology for scientific visualization of complex environmental data is significant because there is still a lack of knowledge about casual relationships and regularities in environmental systems.

Knowledge-based Systems : More recently knowledge-based systems , in particular expert systems or Neuronal Nets (Keller 1995) were also applied to environmental information processing .Knowledge-based approaches are especially relevant for interpretation of image data from monitoring systems such as aerial photographs and satellite sensor data.

Modeling environmental systems (e.g. road traffic pollution) requires powerful software tools which account for the hetrogenous enviornmental domain with a wide range of modeling methodologies involved .

A Knowledge based Simulation System as Development Tool

A simulation tool named as DYNAMIS IIx was developed at the University of Hamburg as a research prototype. This includes comfortable graphical modeling, hierarchical model design.

Graphical Modeling : This model structure is presented graphically by a model diagram in a special system diagram window. The diagram is built up by selecting predefined model variable symbols from a menu under mouse control and by linking them by connecting lines in a way consistent with the given simulation methodology.

Hierarchical Modeling :This very helpful in the environmental field for building comprehensive environmental modes.

Knowledge -based Support :Simulation specific knowledge is included in the simulation systems making use of knowledge-based techniques to support inexperienced users in model building proficency. Knowledge bases provided by the system incorporate knowledge on given simulation methodologies.

Conclusion : Today's problems are complex in nature and involve large amount of data. They require computers and modeling to solve them. Environmental Informatics brings together enhanced data collecting and knowledge integration using tools as computer science, GIS, remote sensing , data based management , data visualisation and modeling.

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