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The 14th Economic International Conference: Strategies and Development Policies of Territories: International, Country, Region, City, Location Challenges | May 10-11, 2018 | Stefan cel Mare University of Suceava, Romania

Strategies and Development Policies of Territories: International, Country, Region, City, Location Challenges

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Eugenia IANCU, Aurel BURCIU

https://doi.org/10.18662/lumproc.93

How to cite: Iancu, E., & Burciu, A. (2018). Techniques used in Artificial Intelligence for Selecting Waste by Category for Bio-Processing. In C. Năstase (ed.), *The 14th Economic International Conference: Strategies and Development Policies of Territories: International, Country, Region, City, Location Challenges | May 10-11, 2018 | Stefan cel Mare University of Suceava, Romania* (pp. 434-440). Iasi, Romania: LUMEN Proceedings. https://doi.org/10.18662/lumproc.93

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Techniques used in Artificial Intelligence for Selecting Waste by Category for Bio-Processing

Eugenia IANCU[1*], Aurel BURCIU[2]

Abstract

Waste, the inevitable result of human activity is a topical issue due to quantitative growth and diversification; their degradation is a danger to the environment and for the health of the population. The development environments of knowledge - based systems currently existing have interface components with high level, object - oriented programming languages, database management, etc., and some applications of artificial intelligence are developed in languages such as C, Prolog, ADA, etc. In this context, the main components of a system based on knowledge in the selection of waste models are: Creating and administering the database, Database Query, Statistical Data Processing, Artificial Intelligence Applications.

Data and knowledge to be stored and processed within a system in the waste domain refer to certain categories that are subject to recycling and aggression of environmental factors. The waste description and experiments in this area generate two categories of data, namely: 1. descriptive data, 2. experimental data. The data that describes the source material of the waste (descriptive data) is predominantly knowledge that will be represented in the database within an evolutionary universal data structure.

In this paper are presented a series of theoretical aspects regarding one of the techniques used in artificial intelligence, namely the recognition of forms for selection waste patterns. Form recognition is a technique of artificial intelligence, which has as object classification of a set of objects, processes or events, regardless of their nature. Given a division into classes of known forms, it must be indicated to which class belongs an unknown form. Determination of belonging to a class is done taking into account the similarity of the unknown form to the forms of the class.

[1] Stefan cel Mare University, Suceava, Romania, E-mail: eiancu@seap.usv.ro
[2] Stefan cel Mare University, Suceava, Romania, E-mail: aurelb@usv.ro

https://doi.org/10.18662/lumproc.93
Corresponding Author: Eugenia IANCU
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Keywords:

Recognition forms, waste, artificial intelligence, database, knowledge.

1. Introduction

Selective collection and recycling of waste is of real importance given the harmful nature of certain categories of waste. Inappropriate storage produces negative effects and destruction by inappropriate processes causes harmful emissions and highly concentrated and polluting residues. A cathode ray tube of a television pollutes 50 square feet of soil for 30 years. A spent battery, thrown into the trash can and then reached the landfill, can pollute 1m square of land and 10l of water. In Romania, 65,000 tons of waste electrical and electronic equipment reach the landfill every year.

The danger of migration of pollutants from the soil to the groundwater or surface, and thereafter the culture is extremely high due to the accumulation of these substances in animal and vegetable bodies in the human body in the end, as the last link in the food web. Soil quality has been degraded by irrational use of methods that would have to treat and improve its quality. The use of fertilizers, pesticides, improper disposal of waste, plus inappropriate irrigation and erosion have caused the soil to be subject to intense pollution.

2. Problem Statement

Waste generally is not limited to, polyethylene paper, plastics, pieces of cotton, leather, coal, old newspapers, garbage bin, broken furniture, abandoned materials. As Katiyar [8], Arsad [2] and Zekkos [12], waste is influenced by external factors such as geographic location, population lifestyle, energy sources and weather. Waste management activities include; collection, transport, treatment and disposal of waste. Waste management standards are still poor and overcome in many developing countries with poor documentation of waste generation, inefficient storage and collection systems, and the disposal of toxic and hazardous waste [3].

The various waste disposal methods used are open dumping, recycling, storage, composting and incineration. Waste recycling, including photocopied, plastic, mug, glass, aluminum and other metals, is cheap and saves resources, money, and energy and reduces emissions 10]. Some of the medical waste finds its way into open storage, which can lead to the recovery

of objects and their reuse, with serious health implications due to the transmission of infectious diseases. [4], [1].

Manohara and Belagali [9] have shown that incineration is a better disposal method if the waste comes from plastics, non-degradable polyethylene paper and hazardous waste that is hazardous. Testing all components of waste was a difficult and time-consuming task. Paolo [11] investigated the effect of waste separation and stressed that a separate collection plays an irreplaceable role in waste management. Dixon and Langer [5] presented a model for the classification of the residual components according to their type, shape, size and material, to which they added a wide range of physical and mechanical properties of waste that seem to affect the properties of the waste.

3. Organization of data on the collection, evaluation and selection of waste for bio-processing

Data on the selection of waste stored in a database describing the entries is the waste by category classified by type of material, shape, size, etc. Entries (samples) stored in the database belong to types of waste, each type being described by a number of attributes (descriptors). Descriptive data may be accompanied by images representing the shape or other images obtained through [6]. According to the collection, evaluation and storage of evidence (inputs) in the database, data specific to the types of waste, evaluation data and conservation data will be obtained. Assessment data and conservation data (landfill) are common to all types of waste of the same type, and characterization and evaluation differ from one type to another and result from statistical processing performed on data from experimental measurements and laboratory analyzes on quantities of waste [7]. In other words, collection and storage activities are described by the same attributes for all categories of waste, and the characterization and evaluation are described by different attributes from one category to another. Figure 1 illustrates the activities of collecting, evaluating and storing entries in the database and recording the data in the registers and the database.

For each of the types of data, some examples are given below, with the indication that in the definition of the data structure the possibility of adding new descriptions (evolutionary structure) should be considered.

Identification data: Entry no., Entry name, Classification (Variety), Origin (City, County (area), Country), Date of collection, Source of collection, Geographical data

Preservation data: Deposit code, Sample number, Properties

Evaluation data: Place of assessment (Country, Research Institution, Assessor),

Waste data: (Structure, Size, etc.)

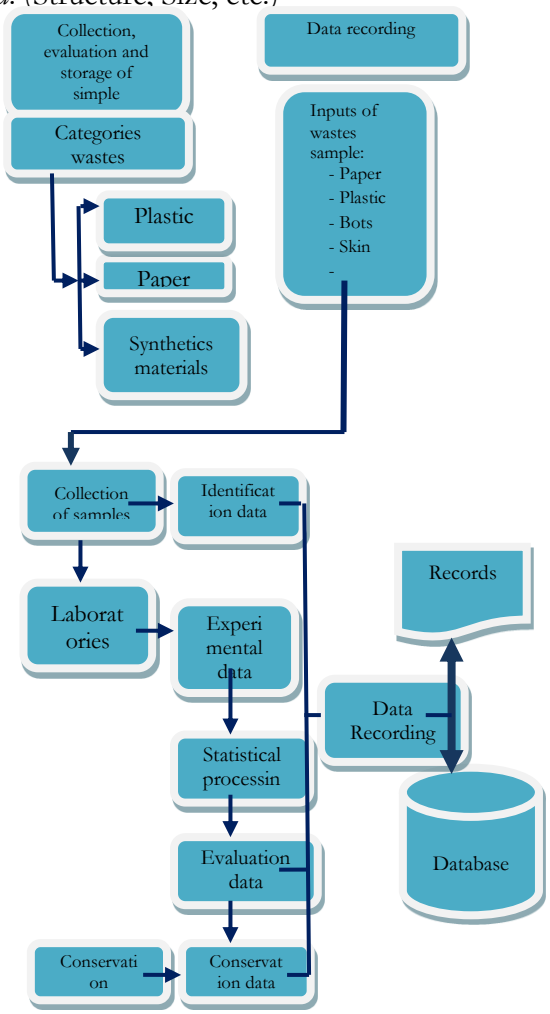


Fig. 1. Setting up the waste selection database

Each category of waste within a type will be defined by corresponding values of the attributes that define that category. From the examples presented, it can be seen that the description of the material from which the wastes originate is predominantly knowledge that can be processed in a knowledge-based system containing interface components with high-level programming languages, database management systems data, and some applications of artificial intelligence.

The establishment of the waste database must be based on a well-defined input data structure. The schema of the data structure is shown in Figure 2.

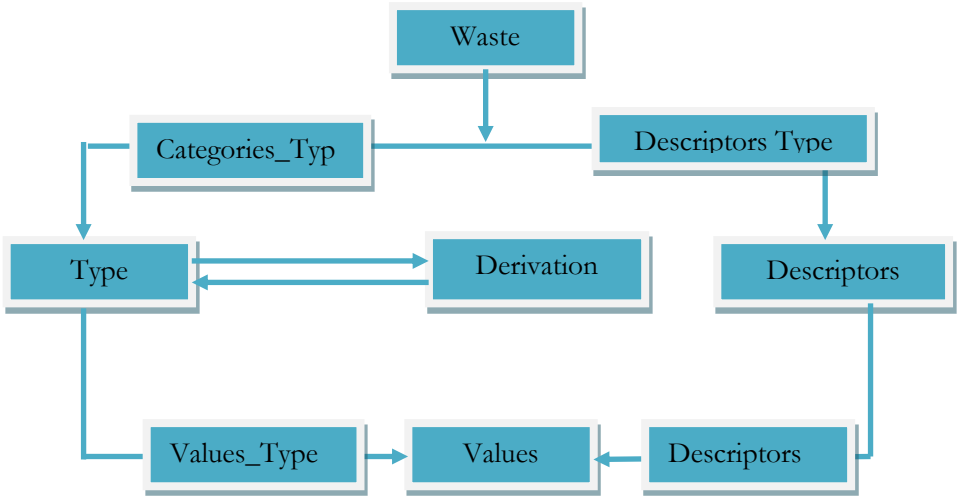


Fig. 2. Diagram of the data structure within a network SGBD

The major drawback of using a networking system is the difficulty of making complex queries and the fact that pointers need to be managed by the user. In order to obtain satisfactory response times, all types of pointers (NEXT, PRIOR, OWNER) must be provided for the links, which would increase the need for disk space for data storage.

In the relational data model, an expandable database structure is defined by the following relationship schemes (tables):

Categories (Cod_s, Name_s) - waste category catalog
Descriptors (Cod_d, Name_name, Type_d) - attribute list
Where:
Type_d = 1 - collection
Type_d = 2 - evaluation
Type_d = 3 – conservation
D_Categories (Code_c, Code_d) - Define categories
Inputs (Cod_s, Code_i, Name_i) - list of entries (categories) by types
D_Inputs (Cod_i, Code_d, Val_d) - Define entries

In this representation, the definition of entities in the database is done by loading the above tables, so the database structure is a highly generating evolutionary structure that dynamically expands by simply loading the database tables.

For documentation on waste materials, the following database query requests can be made: the waste category catalog, the description of the types, the list of entries belonging to a category, the entry documentary entry (entry description), and the list of entries satisfying the conditions specified at the time query.The research questions will operationalize the research problem, showing what part of the problem is being solved by this article's contribution. If preferred, in this chapter there can also be presented the objectives of the research.

This chapter could include the Purpose of the Study, or Hypotheses, if the research is based on validating certain hypotheses.

4. Conclusions

A category of information that can be provided in the database and knowledge of the system is the description of the waste in terms of the composition of each waste. In the waste assessment activity, particular attention is paid to the types of waste collected.

In this respect, research in this field aims at:

- waste recognition and classification;
- determination of the relationship between different categories of waste;
- to determine the correlations between the characteristics and the optimal values of certain parameters for waste categories with certain predefined characteristics.

Classification and recognition problems can be solved by methods specific to the field of artificial intelligence (form recognition, knowledge bases and expert systems, neural networks), and optimization problems by defining and using regression models.

By using forms recognition techniques, it is possible to obtain outputs in various representations including: lists, graphs, describing class membership, grouping in classes, etc.

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