

A Study of Components and Benefits of Organic Waste using Decision Tree: A Classifier in Data Mining

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Abstract: Population in India has been growing at a rapid rate. With this increase, there has also been an increase in the amount of wastes being produced especially in the urban cities. Increase in population has led to increase in waste material. Sources of waste are various, generated from industries, agriculture and domestic, but waste management's schemes are few and improper. Domestic waste is the one generated in huge amount. There are waste management scheme being used by government and non – government organization to properly dispose and manage waste. Due to increase in habitat in various geographic areas and due to mismanagement of people living in a particular geographic area- people throw waste material anywhere they wish in and around they live. This effect the environment like surface water gets contaminated, soil gets contaminated, pollution increases, leachate occurs,etc. all these creates adverse effect on the human being and ecosystem. This paper gives a brief study of the components organic waste and its benefits on human beings and ecosystem by using decision tree classifier of datamining.

Keywords: Classification, Decision table, Decisontree, Ecosystem, Hazardous, Lethal, Prediction, Organic waste.

1. INTRODUCTION:

Data mining is a tool which helps to discover unknown facts in the database. It also helps us to classify data and make certain prediction based on available data. Increasing population, changing consumption patterns, economic development, urbanization and industrialization result in the increased generation of solid waste and a diversification of the types of the waste[9]. Improper disposal of waste, and even some “proper” yet inefficient methods of waste management, affects everyone in more ways than offensive aromas and unsightly clutter[8]. Data mining is a powerful technology with great potential that helps to extract hidden pattern. Data mining tools predict future trends and behaviours. Data mining helps us to classify the data. With the help of classifier model of data mining, waste created by human being, especially domestic waste is classified into 2 categories viz. organic and inorganic waste. Following table 1.1 below shows type, sub type and sources of wastes.

Type	Sub types	Sources
Organic	Food/ Wood/ Paper	Food scrap, yard(leaves,grass,bushes) waste, wood, process residues. Scraps, cardboard, newspaper, magazines, bags, boxes, papercups.
	Plastic	Bottles, packing papers, containers,lids,cups
Inorganic	Glass	Bottles, broken glass, light bulbs, colour glass.
	Metal	Can, foil, tins, non-hazardous aerosol can,appliances, railings,bicycles
	Others	Textile, leather, rubber, multi laminated, e-waste, appliances,ash,other inert materials.

Table 1.1 Classifications of Types of Waste.

Waste generated can also be classified into urban and rural waste. When we classify the waste generated from both urban and rural area, we find that the quantity of waste collected from urban area is more as compared to that of rural area. And that to food is wasted in more quantity, which forms organic waste. Such a huge amount of waste is difficult to manage by the Municipal Corporation of district. Urban solid waste management is considered to be one of the most serious environmental problems confronting developing countries [2]. Waste management simply means the collection, transport, processing or disposal, managing and monitoring of waste materials to minimize its consequences on humans and environment. Sustainable Waste Management is one of the major challenges that developing nations faces, with the mandate to balance between their economic & social development while keeping environmental performance[3].

Disposing a waste has huge environmental impacts and can cause serious problems on human beings and ecosystem. If organic waste is not properly disposed, it rots and gets decay which may cause hazardous effect on ecosystem. Classification and predictions are two forms of data analysis that can be used for extracting models describing important classes or to predict future data trends. Classification is a data mining function that assigns items in a collection to target categories or classes. The goal of classification is to accurately predict the target class for each case in the data. Decision trees are probably one of the most common and easily understood tools.

2. OBJECTIVE:

The objective of the research paper is simply to reduce, reuse and recycle the organic waste hence, securing

ecosystems thus achieving social and economic objectives. Developing cognizance among the people to use organic waste in more idle way.

3. Recent Reviews.

Many related study has already being done for proper disposal and re-cycle of waste management. In 2014, Nasser Ayoub , FarayiMusharavati , and Hossam A.Gabbar has developed a detailed methodology for Socio-Technological System, STS, a robust modular system that dynamically changes in response to social activities and deals with the problem from micro and macro details levels, that deals with converting waste to final products to adapt new technologies[4]. In 2015, Karen A. Hudson-Edwards and Bernhard Dold aimed at bringing together studies in the areas of mine waste characterization, management, and remediation, to review the current state of knowledge and to develop improvements in current schemes [3]. In 2016, Hakizimana Leopord , Dr. Wilson Kipruto Cheruiyot and Dr. Stephen Kimani presented a survey and analysis for existing techniques on both classification and regression models techniques that have been applied for diseases outbreak prediction in datasets[7]. In 2017, Adrienn Buruzs,

Miklós F. Hatwágner, László T. Kóczy has explore that due to the complexity and uncertainty occurring in sustainable waste management systems, they have propose the use of Fuzzy Cognitive Map (FCM) and Bacterial Evolutionary Algorithm (BEA) methods to support the planning and decision making process of integrated systems, as the combination of the FCM and BEA seem to be suitable to model complex mechanisms such as IWMS[9]. Many more reviews have been done and methodologies have been introduced to reduce the adverse the effect of improper waste management.

4. METHOD:

Decision tree in data mining builds classification and regression models in the form of tree structure. Decision tree classifiers are the popular method for of classification- it is easy to understand how decision tree works and they are known for their accuracy [12]. Following figure 2.1 shows decision for the classification of wastes depending on types and its sources of generation.

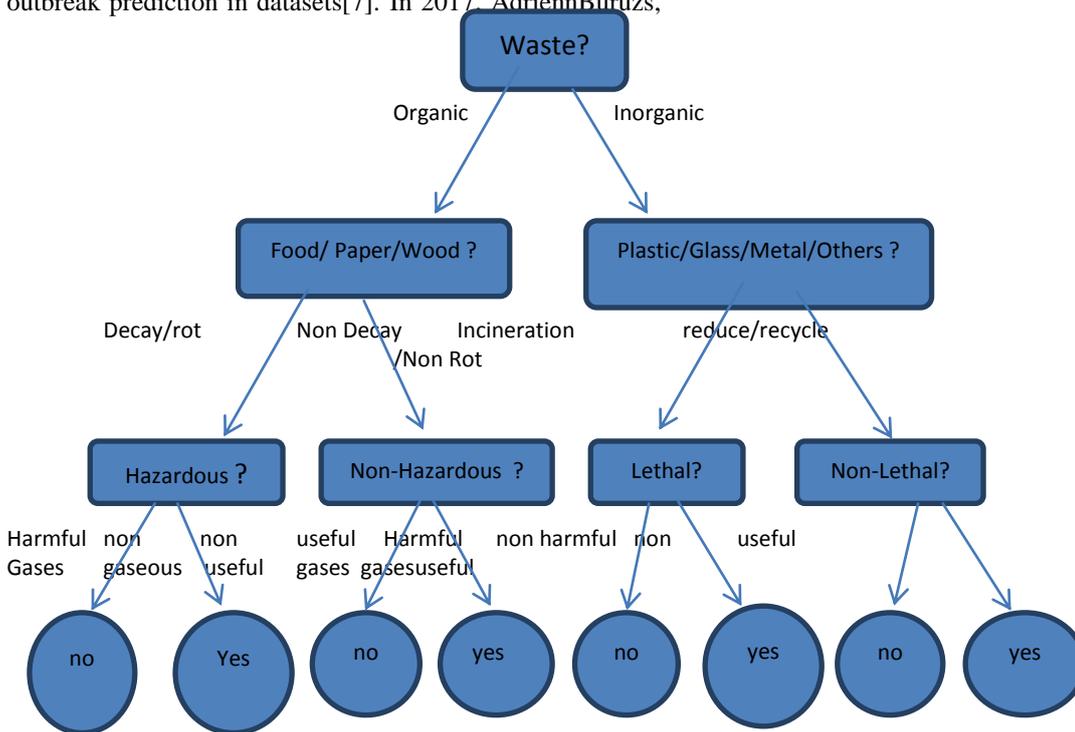


Fig.2.1 Decision Tree for Waste Material Bifurcation

Above fig.2.1 represents the concept of Waste material bifurcation whether waste is hazardous or non-hazardous. Internal nodes are denoted by rectangle shows whether waste is hazardous or non-hazardous, lethal or non-lethal.

Leaf nodes are denoted by oval nodes shows “yes” or “no” specifying whether harmful or useful. Based on above classifications, fig. 2.2 is designed which is decision tree for organic waste.

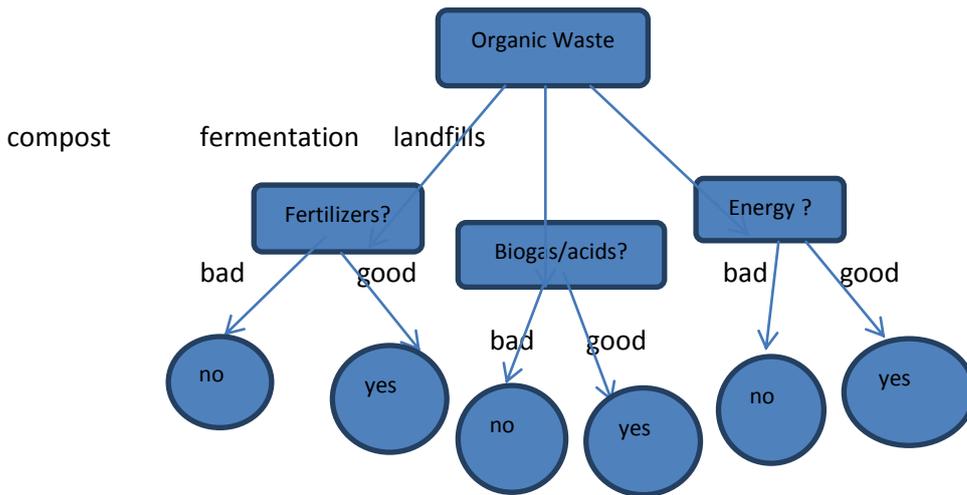


Fig. 2.2 Decision Tree for Organic Waste

Fig 2.2 tree shows the classification of organic waste material. It is a misunderstanding the waste materials are harmful, rather waste materials is useful too. Organic wastes is classified to create compost, fertilizers and can be

landfilled. The root node has three internal nodes classified into “good” or “bad” depending on their component created from it viz. fertilizers, biogas/acids and energy.

Rules	Compost (Fertilizer)	Y	Y	Y	Y	N	N	N	N
	Fermentation (Biogas/acid)	Y	Y	N	N	Y	Y	N	N
	Landfill (Energy)	Y	N	Y	N	Y	N	Y	N
Actions	Hazardous					✓	✓	✓	✓
	Non Hazardous	✓	✓	✓	✓				

Fig. 2.3 Decision table for Organic Waste

Decision tree (fig.2.2) and decision table (fig.2.3) above specifies that even though waste is considered as harmful, hazardous or lethal but it is not always. It creates useful components too. Organic waste can be used to prepare compost, fertilizers and biogases, can be fermented and if buried deep in land called landfills to form gases and fuels. It generate a renewable source of energy and is non-polluting which is worthy for both human beings and ecosystem.

Following are the components of organic waste:

- a. Landfills (Energy): Landfills is the best way to tackle waste growth. A landfill is a carefully designed structure built into or on top of the ground, in which trash is separated from the area around it[13]. After decomposition of waste in landfills, it gives out gases like methane and Carbon dioxide, which in turn is used to generate energy.
- b. Compost (Fertilizers): Composting is recycling of kitchen wastes, leftover crop residues, weeds,

grasses, leaves and manures. Composting is essentially a natural process based on the progressive degradation of biological material with the help of aerobic bacteria (living with access to air). Compost is made of biodegradable fractions, especially the biological residues of plant origin from households and gardens; cut grass, leaves, branches, remainders of fruit and vegetables, waste.

- c. Fermentation (Biogas): Fermentation is a metabolic process that converts sugar to acids, gases, or alcohol. It occurs in yeast and bacteria, and also in oxygen-starved muscle cells, as in the case of lactic acid fermentation.

Benefits of the components of organic waste:

- a. Land fill:
 - 1. The gases generated are used to move turbines in power plants.
 - 2. It is used to keep trash isolate from rest of the environment.

3. It is good way to utilize waste thus overcoming the hazardous and lethal effect on human beings and ecosystems.
4. It can be reclaimed and can be used as parks or farming land.

b. Compost :

1. It contains a lot of nutrients.
2. It reduces soil erosion, need of fertilizers and pesticides, need of water.
3. It helps to overcome the incidence of plant root and leaf diseases and stimulate the growth of healthy plants.
4. It has a higher commercial value and is economical.
5. It helps to decrease antibiotic levels in manures, which can be taken up by crops growing on manure land.
6. Compost can also be stored easily, so it can be applied when soil and weather conditions are optimal.

c. Fermentation:

1. It is generated has a clean fuel so, it has calorific value.
2. It does not produce any smoke and it is non-polluting.
3. It can be supplied to pipe line to houses for cooking purpose and is economical.
4. It has convenient ignition temperature, since it burns readily.

4. CONCLUSION:

Since there is no balance between the production and the consumption of food we intake, lot of organic waste is created. Waste material generated whether organic or inorganic, not only adversely affects human beings but also affects the ecosystem. The classifiers like decision tree and decision table in data mining are the superlative way that helps to classify waste through which benefits can be predicted. The benefits discussed above are vital to maintain clean and healthy environment. Through this we have attempted to create awareness among people about waste management.

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