Approach to Sustainable Development Scenario using Machine Learning Algorithms

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Abstract:- The world is evolving at a fast pace but the attention to resources has been neglected by mankind for several decades. It is high time we aim at development which is sustainable and good for the present and future generation. In this paper we will be exploring how machine learning algorithms can help us choose the best materials, approach ,style, process, design for Sustainable development.

I. INTRODUCTION

When we see a curtain , pillow cover , cushion cover etc we appreciate the colours , design and pattern. But what if we get all this with also keeping the process sustainable?This is what we will be exploring in this paper using machine learning algorithms[1]. Also tuning and modern optimisation techniques will be explored in this paper.

II. MATERIAL SCIENCE

Commodities like pillows, cushion cover, curtains all look the best nowadays but what about the world . Factors like energy efficiency , recycle factor , polymer used, biodegradability need to be considered while looking the best.

> ➢ *Material Factors*

We are defining term called material factors so that this can be used as variable in our machine learning algorithms.The material factors are Energy Efficiency, Biodegradable Index,Recycle factor, Water wastage and Carbon Factor . These material factors are inspired from Urban systems[2]

III. MACHINE LEARNING ALGORITHMS

The machine learning algorithms we will be using are Supervised ,Unsupervised and Semi Supervised learning. Supervised learning methods include Decision Trees(DT), Naive Bayesian Classifier (NB), Linear Discriminant Analysis(LDA), K-nearest Neighbours(KNN), Support vector machine(SVM) and Neural networks(NN). Unsupervised learning methods include Gaussian Mixture Model(GMM), Hidden Markov Model(HMM) and Principal Component Analysis(PCA).Semi Supervised learning consists of Generative Models(GM), Graph based methods (GB)and Self Training methods(ST)

After using these algorithms with our material factors that are Energy Efficiency(EE), Biodegradable Index(BI),Recycle factor(RF), Water wastage(WW) and Carbon Factor(CF) we found the following impact factor(<100) of each of the variables

Table 1 The Importance of Material factors for Different Machine Learning Algorithms

Algorithm	EE impact	BI impact	RF impact	WW impact	CF impact
DT	1.2	77.44	88.22	44.3	33.3
NB	1.3	77.6	75.22	22.321	2.22
LDA	0.2	55.53	83.22	34.43	3.4
KNN	4.4	54.24	54.3	44.22	4.4
SVM	4.4	42.242	23.22	23.2	33.2
NN	2.1	33.3	63.22	33.342	33.3
GMM	7.9	2.3	0.212	41.44	98.11
HMM	17.3	3.3	0.11334	99.33	98.11
PCA	33.32	3.3233	0.1414	22.432	23.31
GM	2.233	2.232	3.44	34.333	23.1
GB	66.64	4.12	4.4373	52.11	33.1
ST	33.3	3.41	2.1224	24.33	12.2

From the above we table it can be observed that Supervised learning considered (BI) and (RF) to be important for sustainability. While Unsupervised learning considered (EE) as important factor and Semi Supervised learning considered (WW) as important factor for the process of sustainability.

While Hidden Markov Model gave high points to (WW)factor, Gaussian Mixture Model considered (CF) factor as the most important. (BI) was considered important when it came to Decision Trees and the Naive Bayesian Classifier. Neural networks gave the least priority which is to (EE).

IV. OPTIMIZATION METHODS

Optimization methods are (in the sense of Machine Learning Algorithms) ways that make our algorithm better which in our case will help in sustainability development.Common methods that suit are use case best are Nesterov accelerated gradient[3],

Stochastic gradient descent[4], Alternating Direction Method of Multipliers[5] and Newtons' method[6].

V. CONCLUSION

Thus we have successfully implemented machine learning algorithms for sustainable production and studied how factors such as Carbon factor, Biodegradable Index, Energy Efficiency, Recycle factor and Water wastage effect the process of Sustainable development. Sustainable production is need of the hour and as humans we must all contribute in different ways to the cause so that our future generations can live peacefully.

MACHINE LEARNING OVERVIEW

Machine Learning is the subset of Artificial Intelligence which allows machines to learn and show improvement from experience without being programmed.It uses algorithms to identify different patterns, analysing data and making decisions

Machine learning algorithms works by feeding them large amounts of data, use algorithms to learn from the data and improve performance over time and by using insights they have learned to make informed decisions

➢ *Different Types of Machine Learning are :*

- Supervised learning : Algorithms build a mathematical model of data that contains both the inputs and desired outputs
- Unsupervised learning : Algorithms find the structures in data that has not been labeled
- Semi Supervised learning : Falls between supervised and unsupervised learning.
- Weakly Supervised Learning : Training labels are noisy, limited or imprecise

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