Role of Machine Learning in Sustainable Engineering: A Review

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Abstract. Sustainable engineering is the method of modelling or running systems that allow efficient use of products and resources, that is, at a scale which would not endanger the natural habitat or the potential of subsequent generations to reach their own needs. Machine learning has large number of applications such as healthcare, agriculture, security and even in day to day life. In sustainable computing, machine learning also plays a crucial role. The emergence of Machine learning and even its exponentially greater implications on many markets require an evaluation of its implications on sustainable innovation achievement. In this paper, a review of supervised and unsupervised machine algorithms is done which are used in sustainable engineering. Different engineering disciplines such as mechanical, civil, chemical engineering are covered that working on sustainability. As the interpretation of the review it can be stated that there is a wide scope of working on sustainable development though machine learning. Specific machine learning algorithms are required to work on sustainable engineering. This review is helpful for engineers which are working in the field of sustainable development.

1. Introduction

Machine learning is like a revolution for the coming future times. It is an important part of information technology. Which is going to bring a lot of change in the way we live our lives? So, many Machine Learning applications have been developed in this duration. Human beings have always wanted of creating machines which are Intelligent ashumans. Learning and basis on that learning A division of Artificial Intelligence generates some original series (AI). The task of machine learning is to give better and accurate and relevant results to the user than before [1]. We can say Machine learning is a method by which the machine prepares itself to give better results. To do this, the machine understands the data it already has, and then takes the decision by understanding the current. Machine learning algorithms take data as input understand and process it, Calculates by using to statistical formulas then get the most accurate result. We check the result of the machine by using the sample data in the starting and process till the machine gives the new result after understanding the old result.

The purpose of this paper is to explore machine learning applications in sustainable engineering. Machine learning has played a vital role in development of sustainable engineering. In this paper, different engineering areas such as chemical engineering, mechanical engineering, civil engineering area are covered where machine learning is used for sustainable development. The review will be help
for identifying the state of the art done in the sustainable development for different researchers and engineers.

This paper is organized in 5 sections. After the introduction, second section discusses about types of machine learning algorithms, third section is the core part of the paper that discusses about review of sustainable engineering with ML, fourth section is the discussion and last part is the conclusion.

2. Types of Machine Learning Algorithms

Machine Learning Techniques are in following domains; supervised, unsupervised and reinforcement learning. These algorithms are discussed below:

2.1. Supervised Learning

It is task-driven (predict next value). A very strong type of supervised learning is machine learning. Supervised practice is a theory of assessment in which we train the device first. We use such data on which we have already got the correct result. The way a teacher teaches in class and students are taught by him. Using the learned knowledge, students also give new results. Machine learning algorithm uses data sets so that the available unlabelled data can be easily accessed and identified through this medium. The data taken from a very large dataset that has been worked on is called a training dataset. The training dataset is a small part of the data, which we have used and obtained the results. Using Trained Data Set, the algorithms considered processes and find solution of the problems to new data. In this by using the algorithm we find out the relationship between given parameter and testing Data. In the dataset, we get an understanding of how the data works and what the link between the input given and the output is. The outcome is then generalised to be used for the final dataset after this. The number of classes is known [2]. This implies that even after being extended, supervised machine learning algorithms will progress to strengthen, finding new patterns and relationships as new data evolves itself. Some of the major application areas where Supervised Learning is used are:

- Advertisement Popularity: To select advertisement it is also a guided learning task for commercials that will perform well.
- Spam category: If you are using a modern email system, there are chances that we encounter a spam filter which is a supervised learning system.
- Face Recognition: This is used to identify people in real, in photo or in videos. It consists a working model approach that captures a photo, finds features, and judges that a supervised method is who is in the photo (willing to offer a tag).
- Regression: Linear regression is a statistical framework that investigates the interaction between a conditional (target) parameter and a predictor [3].
- Classification: Classification is a supervised learning way in which the computer program learns from the input data and finds some new observations or classifications.

The algorithms mostly included in supervised learning are as follows:- Decision Tree, Random Forest, Linear Regression, KNN, Logistic Regression, SVM, Classification Trees Naïve Bayes, Neural Network, etc.

2.1.1. Linear Regression

That is a type of Predictive analysis. It is commonly used to estimate whether a given set of data is capable for generating output and if the given data set is good for output then what’s the approach is used on that given dataset [4]. A relationship exists between research variables. By Deciding a best fit line described by a system of equations and known as a regression line we can calculate:

\[ Y = a \times X + b \]  \hspace{1cm} (1)

Where Y is a dependent variable, and a is a slope, and X has become an important variable, and b is intercept. The a and b coefficients are calculated by reducing the sum of the square distance difference
between the data points and the regression line to a Minimum. The linear relationship shown between height and width is shown in Figure 1.

![Relation B/w Weight & Height](image)

Figure 1. Linear Relationship Between Heights and Weights

2.1.2. Decision Tree

This is a supervised learning model machine learning technique that used define certain endpoint mostly on basis of the available data. To predict any result this is most commonly used. It is best work on with the problems based on classification and we can predict result on categorical and continuous dependent variables. It is a tool used for Decision Making Purpose. It follows Tree shape Approach for decision making. This is commonly used in Machine learning for decision making purpose. The dataset is divided into two or more related types of sets throughout this algorithm. We put the conditions on the nodes, and according to their result it will further split up [5]. This is achieved on the basis of most relevant attributes/ independent variables to render as unique classes as possible.

![Decision Tree](image)

Figure 2. Decision Tree Based on Different Choices
2.1.3. Random Forest
A sub-component of Supervised Learning is Random Forest. Classification and Regression also use it. Random forest has a lot of decision-making trees in Random Forest. To define a new Problem on the basis of conditions, each tree provides a grouping, and for a specific class, we say “votes” to the tree. The forest decides which party has the majority of votes [6].

2.1.4. KNN (k-Nearest Neighbours)
This algorithm is also the part of supervised Learning. Classification and regression considerations for both, types of participation. In general, to solve classification related problem we used KNN. It analyses, Labelled input data and gives output which is most accurate. K nearest neighbours is an algorithm which, by a maximum vote of its k neighbours, examines all available results and seeks out new cases [7]. The case is recognised by the most famous class among its nearest K relatives, which again is determined by a dissimilarity measure, such as the distance between, Manhattan, Murkowski and Hamming, Euclidean.

2.1.5. Logistic Regression
It is a classification algorithm for testing discrete values based on a specified number of predictor variables. In simple terms it anticipates. The chance of an event happening by fitting the experimental data to a logit form. It's often referred to as logit regression, hence. Since the chance is assumed, its production values lie between 0 and 1 [8]. It is shown in Figure 3.

![Figure 3. Logistic Regression](image)

2.1.6. Support Vector Machine
It can also be a method of classifying where even the overall data item is labelled as an infinite-dimensional space point where every other value is governed by the indication of a special coordinate as the monetary worth [9]. For example, if we had only two characteristics, such as an individual person height and hair length, we would then design these 2 factors in a two-dimensional space where every other independent point has two coordinates (known as Support Vectors). Support Vector Machine is shown in Figure 4.
2.1.7. Naïve Bayes
To use supervised learning approach for solving Classification related Problem we use Naïve Bayes theorem, and it is very helpful in solving problems related to similarity of text n all. It is a probabilistic classifier, meaning that it predicts the likelihood of an object on the basis of given set. It is called Naïve since it believes that a certain feature's occurrence is independent of other features' occurrence [10].

2.2. Unsupervised Learning
It is data-driven (identify clusters). Machine learning is a way of learning without supervision. In unsupervised learning we are not providing any pre-processed data, instead of it we allow the machine to learn itself and give best output which was not discovered earlier. The algorithm recognises connexions between data points in a hypothetical way, with no feedback prescribed from human beings. The number of individuals is undisclosed to us. Algorithms in unsupervised learning are adaptable [11]. Unmonitored learning algorithms can adapt to the data by vividly modifying hidden structures instead of a defined and developed problem statement. The algorithms used in unsupervised-machine learning are K-means, Cluster algorithm, Hierarchical Clustering, Apriori algorithm etc.

2.2.1. K-means
It is a quick and effective way to use a sufficient number of unmonitored algorithms to identify a given set of data that solve the problem of clustering. Clusters are accompanied by their method (assume k clusters). Data points for peer groups that are within a cluster are heterogeneous and homogeneous [12]. Some of the major application areas where Unsupervised Learning is used are:

- **Recommender Systems**: We're most likely to encounter a video recommendation system on online platform like YouTube or Netflix. Generally, these structures are put in the unsupervised domain.
- **Buying Habits**: To keep a check on the buying habits of customers unsupervised learning algorithms are used to segregate customers according to their similar purchasing habits. This help companies to channelize their strategy and focus on that customers which are looking for the same product the company deal with, so companies can recommend them option. Grouping User Logs: For grouping user logs and problems, we can use unsupervised learning. This will allow the company, by designing a product, to define some common problems that consumers consider and address this problem. It helps to give quick response if same problem is faced by other customer.
- **Learning Associations**: Learning affiliation is the mechanism of gaining insights into different product relationships. A perfect example is how incompatible products may specifically affirm an interaction with others.
2.2.2. Reinforcement Learning
It defines learning from errors. It’s a Type of Training given to the machine for decision making purpose. It is Similar to human Learning as human learn directly from the environment. How human beings in their lives learn from available data. Same approach is used in this. It features an algorithm focus on try and learns from the errors. Favourable outcomes are ‘reinforced’ and encouraged, and non-favourable outcomes are ‘punished’ or discouraged. The result is given to the interpreter in any iteration of the algorithm, then determines whether the outcome is appropriate or just not. By learning from this hit and trial approach when the machine finds the right solution. The interpreter promotes the results by giving the algorithm a reward; otherwise the outcome is not positive. The same task is continuously performed before the desired result is identified. The incentive scheme is specifically tied to the success of the outcome in most instances. The software is therefore trained to provide the best feasible solution for the best possible reward. Markov Decision Method, etc are the algorithms used in reinforcement learning [13].

Some of the major application areas where Reinforcement Learning is used are:

- **Video Games**: One of the most common Learning is the virtual playground to play games there reinforcement learning is seen. Mario game is also a familiar example.
- **Industrial Simulation**: It is useful to make our devices learn to complete their tasks while having to go to believe their structures for many engineering manipulators (think assembly lines). Our computers should also be persuaded to use fewer resources so that energy can be saved. More than that, if we break our system, we can start all this within a clone so that we wouldn't waste money.
- **Resource Management**: Reinforcement training is suitable for managing diverse characteristics. It can handle the need for those criteria to be equitable. For example, Google's data centres.

3. Sustainability

Sustainability means meeting your needs today, but at the same time keep in mind that these resources will be used for people in future too. We have to use the resource after thinking about the coming future. The sustainability is made up of on three main pillars; environmental, economic and social—also called as Earth, gain, and human. Basically, the sustainability is used to indicate the functionality, schemes and the steps taken to utilize the resource efficiently. Several examples of sustainable development include:

- **Solution related to Health Issue**
- **Implementing Crop Rotation Farming**
- **Emphasizing more on Sustainable Construction**
- **Practice Recycling**
- **Water Treatment Plant**

Over a very simple, precise reason, sustainability is extremely important; we also shouldn't sustain our status of human beings, the diversity of life on this planet, or the biodiversity of Earth, lest we envelop it. There are indications that sustainability is something we must discuss from all chambers and from the smallest to the largest range. We're supposed to exhaust all energy sources. Literally millions of species would've been abolished. We're aiming to exhaust the forest products. Beyond recovery, we will bruise the community, until we turn. And perhaps the core of the progress falls in our own communities, neighbourhoods, habitats, and around the world, understanding and working for sustainability. Probably the basic needs like water, electricity, public resources are being exploited and consumed more than ever which is not right for our future scenario. Resource - efficient performance is viewed as meeting human evolutionary aspirations preserving the potential of local environments and will provide the essential services and resources of the ecosystems on which society and the economy rely [14]. A structure of society where living conditions and facilities are used is the desired...
performance. Once again to make absolutely sure so all human business interests are followed without violating the integrity and consistency of the natural habitat. Sustainable development can be defined as expansion that meets specified requirements without bargaining the potential to assuage their own desires.

3.1. Sustainable Engineering

Sustainable engineering is the way by which we can build a product using limited resources. By doing this, we not only save the environment, but also save resources for the use of the coming generation. Sustainable engineering requires a joint approach in all forms of engineering and the maintenance of environment is not just the work of Sustainable Engineering, but all the Engineering branches will have to take steps together [15]. It is wise to use technology steadily to improve the life of people. Examples of Sustainable Engineering include:

- Producing products that are less harmful to the environment due to the technology used to make them and also fulfil the need of basic people like food, water, and shelter.
- Recycling greatly benefits the environment and society. After making the product, all the waste that comes out is used in some other way.
- Consolidating environmental and social restraints as well as economic applications into engineering decisions.
- Sustainable Engineering is a way that tells us how to use the resources better so that we can save materials for the future. Some of the common engineering focuses are:
  - Housing and shelter
  - Availability of water that should be supplied to people
  - Processing of food
  - Hygiene and the disposal of waste
  - Production of energy
  - Haulage system
  - Ramping up production in Industrial sector
  - Development of natural resources
  - Trying to clean up wastewater facilities that are hazardous
  - Project preparation to minimise environmental and social consequences
  - Reconstruction of natural ecosystems, Woodlands, reservoirs, springs and watersheds, such as
  - Organizing immediate care for everyone who want it.
  - Waste reduction and implementing it efficiently to help everyone
  - Getting better production methods for garbage extermination and also use elimination
  - Endorsing the effective and innovative utilisation engineering
  - Summary of research work done in sustainable engineering done using machine learning techniques is shown in Table 1.

| S. No. | Year | Author | Proposed Work | ML Technique | Stream | Future Work |
|-------|------|--------|---------------|-------------|--------|-------------|
| 1.     | 2020 | Feifei Yang, David W. Wanik & et al. [16] | Categorizing instability in power outage prediction model training based on machine learning | Many Algorithms of Tree-based ML Regression (DT, RF, BT, and ENS) | Civil Engineering | By applying this framework, the training activities that are ideally suited and reflect the next event and... |
| Year | Authors | Title |
|------|---------|-------|
| 2012 | Athanasios Tsanas, AngelikiXifara [17] | Prediction of residential buildings’ energy efficiency using statistical machine learning methods |
| 2020 | Sushil Kumar Singh, Mikail Mohammed Salim et al. [18] | A computer attempting to learn the sub-slicing method of channels in the sustainable 5G world |
| 2020 | Michelle Sapitang, Wanie M. Ridwan et al. [19] | Machine Learning Framework for Sustainable Hydropower Generation Strategy in Reservoir Water Level Forecasting |
| 2020 | Raffaele Cioffi, Marta Travaglioni et al. [20] | Implementations of Artificial Intelligence and Machine Learning in... |
| Year | Authors | Title | Abstract |
|------|---------|-------|----------|
| 2019 | Mehrbakhsh Nilashi, Abbas Mardani et al. [21] | A tool for evaluating user knowledge by decision-making, text mining and statistical learning strategies with multi-criteria Adaptive Neuro-Fuzzy Inference Method (ANFIS) | Examine the role of spa treatments in the satisfaction of tourists from the context of gender, its use of deep learning models, Random Forest (RF) and incremental learning. |
| 2018 | B. D’Amico, R. J. Myers et al. [22] | New theoretical scenarios in the overall design process engineering for machine learning and neural network applications Neural networks. | - |
| 2020 | Sebastian Schorr, Matthias Möller et al. [23] | The efficacy of predicting the diameter, roundness, straightness and concentration of RF drilled and reamed bores on the basis of characteristics derived from process data Random Forest using Python 3.7 | By each individual key characteristic, find the most efficient method that achieves the highest prediction accuracy on the basis of the process data available. |
| 2017 | Caleb Robinsona, Bistra Dilkinaa et al. [24] | Estimating commercial building energy consumption Random Forest, SVM | Our overview of the key features used by machine learning techniques will help to guide possible efforts to materials and other indexing services that could be implemented for future study, such as Google Scholar. |
### 2018
**Syed Muhammad Raza Abidi, Mushtaq Hussain et al. [25]**
- Collect data that could improve organizational the models' accuracy.
- Classify the misguided participants who have not studied the skill(s) offered by the tutors as an Intelligent Tutoring Method (ITS) 16-homework.
- Naïve Bayes, Regression, Deep Learning, Decision Tree, Random Forest, Mechanical Engineering
- Optimization criteria could be used to build the more accurate method, it is possible to determine other ways of grouping methods, techniques, other structures, and data features can boost the accuracy of forecasting and add accuracy.

### 2016
**Anton O. Oliynyk, Erin Antono et al. [26]**
- Full-Heusler Compounds' High-Throughput Machine-Learning-Driven Synthesis
- Decision Tree
- Chemical Engineering

### 2020
**Hamed Naseri, Hamid Jahanbakhsh et al. [27]**
- By developing a new machine learning methodology, the design of sustainable concrete mixtures
- Support Vector Machine (SVM), Artificial Neural Networks (ANNs), and Linear Regression (LR), Civil and Environmental Engineering
- Sustainability-related structural attributes, including corrosion resistance, resistance to freeze and thaw cycles, resistance to chloride ions and susceptibility to carbonated water, can be taken into account in the design of robust eco-friendly concretes.

### 2013
**A Clifton, L Kilcher et al.**
- Predicting Classification Atmospheric
| Year | Authors | Title and Abstract |
|------|---------|--------------------|
| 2019 | Nasim Eslamirad, Soheil Malekpour Kolbadinejad et al. [29] | Prediction of thermal comfort by implementing supervised machine learning on the green sidewalks of Tehran |
| 2020 | Amalia Luque, Ana De Las Heras et al. [30] | A research model for the optimization of environmental protection, both for goods and industrial facilities or processes, in engineering projects |
| 2020 | Saksham Gulati and Shilpi Sharma [31] | Comprehend the priorities of sustainable development through information engineering, machine learning and through deep learning, resolve the obstacles to a sustainable future. |
| 2020 | Yuxing Ben, Weilu Han et al. [32] | Constructing a general and sustainable solution for machine learning in a real-time drilling method |
| 2019 | Antonio Hidalgoa, Samuel Gabalyb et al. | Study of the Spanish Training Classification Business Administration Analysis of the |
| Year | Authors                                      | Methodologies/Techniques                                                                 | Description                                                                                                                                 |
|------|---------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| 2018 | Syed Muhammad Raza Abidi, Mushtaq Hussain et al. [34] | Confusion forecasting, Effort at algebra assignment in an intelligent tutoring framework by machine learning techniques for progressive improvement of skills | Employment prospects of the active population in order to determine income disparities depending on the extent of digital skills. |
| 2016 | Debaditya Chakraborty, Hazem Elzarka et al. [35] | Generation of accurate weather files using a hybrid machine learning methodology for design and analysis of sustainable and resilient buildings | To generate accurate future weather data for various parts of the world, further research is needed. |
| 2015 | Stefan Blume, Nadine Madanchi et al. [36] | Analysis training for sustainable engineering of production | The course will focus on an implementatio of a more extensive peer-review of the student’s research projects. |
| 2019 | Vijayan Gurumurthy Iyer [37] | Strategic Environmental Assessment (SEA) Process towards the Sustainable Design and Construction of Computer, Communication, Network | - |

Notes:
- n Tree Model
- Computer Engineering and Science, Applied Mathematics and Mechanics
| Year | Authors | Title | Abstract |
|------|---------|-------|----------|
| 2018 | Simona-Vasilica Oprea, Adela Băra [38] | Setting NoSQL and Machine Learning Time-of-Use Import Tariffs for a competitive environment | Clustering and hierarchical methods, Economic Informatics and Cybernetics |
| 2020 | Costanza Conforti, Stephanie Hirmer et al. [39] | The high potential of NLP applications to enhance sustainability of projects | Using UPVs to build sustainable projects, Energy and Power |
| 2019 | Abdelkader Dairia, Tuoyuan Cheng et al. [40] | Introduces to detect data-driven anomalies development of deep learning techniques and clustering algorithms. | Deep Boltzmann (DBM) computer, Computer, Electrical and Mathematical Sciences and Engineering |
| 2108 | Kamal Kumar Ghanshala, Sachin Sharma et al. [41] | Self-organizing technique for efficient spectrum sensing in the Cognitive Radio Vehicular Adhoc Network Environment (CRAVENET) | Learning for Reinforcement, Secure Cyber Computing and Communication |
| 2020 | Mengqi Han, Jianli Duan et al. [42] | Facilitating self sustaining IoT networks | Approach to Evolutionary Algorithms, Electrical and Computer Engineering |
| Year | Authors                                      | Title                                                                 | Technique                                                                 |
|------|---------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------|
| 2019 | Andreas Froemelt, René Buffat et al. [43]   | A heterogeneous bottom-up mechanism to examine environmental impacts caused by consumption | Clustering algorithms, Random Forest Regression, Environmental Engineering |
|      |                                             |                                                                      | Novel policy mechanisms such as personalised communications to raise awareness effectively and channel households into more sustainable consumption behaviours |
|      | DhivyaElavarasan and P. M. Durairaj Vincent [44] | Feasible Agribusiness Systems Crop Yield Estimation Using Deep Reinforcement Learning Model | Recurrent Neural Network, Information Technology and Engineering |
|      |                                             |                                                                      | Probabilistic recommender systems techniques such as knowledge theory, decomposition of probabilistic favouritism-variance, structural prediction methods, approach for probabilistic boosting and bagging, etc. The ambiguity in statistical forecasts should be taken into account to deal with |
| 2105 | Justin Heiermann, Oliver Kramer [45]        | Wind power prediction machine learning ensembles                      | decision trees, k-nearest neighbours and support vector regression, Computing Science |
|      |                                             |                                                                      | Standardize systematic optimization of the ensemble and incorporation into the ensemble of |
| Year | Authors | Title | Methods | Field | Notes |
|------|---------|-------|---------|-------|-------|
| 2018 | Dong-Ki Kang, Eun-Ju Yang et al. [46] | A modern technique of seamless integration for energy-efficient distributed sustainable cell sites. | deep neural network (DNN) | Electrical Engineering | - |
| 2019 | Anli du Preez, Gert Adriaan Oousthuizen [47] | Utilizing systematic method to examine the various machine learning algorithms in the sense of sustainable manufacturing. | neural networks | Industrial Engineering | - |
| 2020 | Xiaomin Chang, Wei Li et al. [48] | A integrated forecasting architecture focused on clustering with two tree-based algorithms to provide PV output power estimation in the short term. | Neuro Fuzzy General Regression (GRNN) and Neural Network Artificial (ANN) | Electrical and Information Engineering | Working to develop a lightweight approach for edge computing devices to further reduce the consumption of natural resources |
| 2014 | Roy Chaoming Hsu, Cheng-Ting Liu et al. [49] | Dynamic power management system (RLTDPM) provisioning for reinforcement learning-based demand efficiency (ToD) to maintain perpetual operation and fulfil the ToD specifications for today's wireless sensor node (EHWSN) energy harvesting. | reinfo cement learning - RLTDPM | Electrical Engineering | - |
| Year | Author(s) | Description | Methodologies |
|------|-----------|-------------|---------------|
| 2017 | Rajib Mukherjee [50] | For the related indicator recognition, the use of machine learning algorithms like k-means coalescing for sustainable process selection and support vector machine logistic regression elimination algorithm (SVM-RFE). | Support vector machine-recursive feature elimination (SVM-RFE), K-means clustering. |
| 2018 | Syed Muhammad Raza Abidi, Mushtaq Hussain et al. [51] | Confusion forecasting Effort at algebra workload in an integrated learning environment by machine learning methods for sustainable development of education. | Naïve Bayes (NB), Decision Tree (DT), Random Forest (RF) |
| 2020 | Shane Kosira, Joshua Heynea et al. [52] | A platform for machine learning for lay-in volume swelling of renewable aircraft leasing specifications. | Neural Network, Principal component analysis (PCA) |
| 2018 | Syed Muhammad Raza Abidi, Mushtaq Hussain et al. [53] | Assumption of uncertainty undertaking algebra homework by machine learning approaches for instructional environmental sustainability in an education management environment. | Naïve Bayes (NB), Random Forest (RF), |
|      | Ricardo Vinuesa, Hossein Azizpour, Iolanda Leite, Madeline | The function of artificial intelligence in instead of using a form of expert | Department of Engineering, Parthenope |

For the construction of a more specific model, a more respectable optimization parameter can be used, other types of classification methods and techniques can be calculated.
4. Discussion

The total 40 paper was taken from different areas to study different tool of machine learning used to improve the sustainable development. Some recent and trending paper is selected and analyze deeply how supervised and unsupervised learning techniques helping the people in different fields to improve the efficiency and focusing towards sustainable development. Some areas like Telecommunications, Physics, Agricultural, Operations Research, Mathematics and others. The most popular Research paper which have the main objective of Promoting the sustainable development and work towards to fulfil its objective were listed here. As the interpretation of the review it can be stated that there is a wide scope of working on sustainable development though machine learning. Specific machine learning
algorithms are required to work on sustainable engineering. Till now it can be seen that only standard algorithms are applied on suitability. There is a need to develop some specific machine learning algorithm for suitability, because sustainability is the future of research.

5. Conclusion
Nowadays, the idea of sustainability has widely been recognized as a compulsive topic for several disciplines. The several methods, tools, techniques, models, and approaches have been used developed and extended for the valuation of sustainability performance. In some research paper people study machine learning algorithm for sustainable development. Like we use Random forest to predict to find out the quality of reamed bores based on given data. This research is mainly focused on the Usage of Machine learning tools in different field for sustainable development. The Existing studies mentioned above, define different fields where we used machine learning technology for demonstrate the green engineering. In most of the studies the basic approach is to increase the effectiveness without harming the nature. Use that products or tools which are safe and use fewer resources. All the documents provides a sequential approach or alternate way was implemented. The machine learning methods will be integrated with the sustainability approach and give best results. Future work will research further machine learning methods to determine the most suitable method for each field whether its electricity, water, crops analysis or in medical field etc. In future we will discuss some more fields in detail where machine learning tools used for green engineering.

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