Academic Journal of Nawroz University (AJNU), Vol.12, No.1, 2023
 e-ISSN: 2520-789X
https://doi.org/10.25007/ajnu.v12n1a1677

A Survey on Using Machine Learning and Deep Learning based Iris Recognition

Rogash Younis Masiha
Researcher, Duhok, Kurdistan Region of Iraq

ABSTRACT

Computers now have the ability to learn without explicit programming thanks to the branch of computer science known as machine learning. There are many computing tasks that require machine learning since it is difficult to create and program explicit methods that work well. Applications range from email filtering to spotting malicious employees attempting to compromise data to spotting network intruders. To teach computers how to use data to solve a specific problem is one of the fundamental aims of machine learning. There are a lot of uses for machine learning, such as fraud detection and training classifiers on email messages to distinguish between spam and non-spam communications. This article will concentrate on machine learning fundamentals, tasks, and techniques, as well as numerous machine learning algorithms.
Keywords: Machine Learning, Deep Learning, Iris Clustering, AI.

1. Introduction

Machine learning may learn directly from examples, data, and experience thanks to a subfield of artificial intelligence called machine learning. Machine learning systems allow computers to carry out certain tasks intelligently by learning from data rather than by following pre-programmed rules, which enables them to carry out complicated procedures. Growing computer processing power has supported the essential features of these systems, while expanding data accessibility has encouraged machine learning systems to be taught on a large pool of instances. In the discipline itself, algorithmic improvements have also increased the potency of machine learning. As a result of these developments, machines that previously performed noticeably below human capabilities can now execute some jobs better than people. Each day, a large number of individuals work with machine learning-based systems, such as image recognition systems. The idea of machine learning is widely employed nowadays and is the foundation of intelligent systems [1]. Machine learning has the ability to enable potentially game-changing advancements in a variety of fields as the discipline matures, and the social and economic benefits that will follow are considerable. Machine learning is developing methods in the healthcare industry that can help doctors diagnose certain ailments more accurately or quickly. It offers the ability to better focus assistance to those in need or customize services for consumers for public services. The enormous amount of data that is currently available to researchers is being made sense of by machine learning, providing new insights into biology, physics, and medicine [2].

1.1 Aims of Machine Learning

Customer survival value modeling is crucial for an online store, but it also works in many other sectors. In this strategy, businesses utilize machine learning algorithms to recognize their most valued clients, comprehend their requirements, and keep them as clients. These value models analyze enormous volumes of consumer data to pinpoint high-spending customers, devoted brand evangelists, or a mix of these characteristics. Models of customer lifetime value are particularly good at forecasting the future sales that a specific customer will bring in over the course of a specific time period. By motivating high-value clients to engage with their brand more frequently, this information aids businesses in concentrating their marketing efforts. Client lifetime value models assist businesses in deciding where to invest their money on customer

acquisition who are similar to existing high-value customers [3].

1.2 Benefits of Machine Learning

Every online application today uses machine learning in some capacity, as it has evolved into a tool that businesses use to address a variety of issues. Data is the real foundation for all work that can be done in life, and the decisions that are made based on this data will determine whether or not society keeps up with development or falls behind it. Additionally, given how quickly technologies in this area are evolving and how widely machine learning is being used, practical applications of the technology may quickly increase corporate profits. For instance, because they have adopted machine learning as the best method for creating models, developing strategies, and scheduling future operations, industries frequently require specialized systems in order to analyze their massive amounts of data and information accurately and efficiently [4].

2. Literature Review

A subset of artificial intelligence called machine learning employs methods (like deep learning) that let machines use knowledge to get better at tasks. The learning process is founded on the principles of (feeding data into an algorithm, using this data to train a model, testing and distributing the model, and distributed model consumption for an automated predictive task) [5].

2.1 Machine Learning Applications

machine learning software The following are just a few examples of the numerous machine learning applications that are now a necessary part of daily life [6, 7]:

1. Image Recognition: Used to identify people, objects, locations, and other things, it is one of the most widely used machine learning applications that is well known to most people.
2. Speech Recognition is a popular modern application of machine learning that transforms spoken instructions into written text. This application is readily apparent when using the voice search feature on the Google search engine.
3. Knowledge of Traffic Routes and Traffic Forecasting: It is also one of the applications that have become popular with many car users, in order to know the correct way to reach the destination, and these applications have also become predictive of traffic, in terms of whether they are empty or very congested roads, and perhaps the best example of these applications is the maps program that it provides. Google for users.
4. Recommend some Commercial Products: Entertainment companies like Netflix and many e-commerce companies like Amazon that offer cinematic shows and games to draw in the largest audience use machine learning extensively to promote their products.
5. Self-driving Automobiles: It appears that self-driving cars are currently one of the most popular applications for machine learning, as major automakers, including Tesla, the pioneer in this field, rely on it to produce high-tech and efficient vehicles.
6. Applications for cleaning up spam and malware: One of the newest uses for machine learning is in the sorting of spam and malicious emails so that they are sent to the spam mailbox rather than the user's primary mailbox.
7. Virtual Assistants: One of the newest and most well-liked uses of machine learning is the emergence of a number of virtual assistants, including Google Assistant, Alexa, Cortana, Siri, and others, all of which have started to assist people in finding the information they need by using voice commands.
8. Detection of Electronic Fraud and Fraud: When a person uses the Internet to conduct some banking transactions, machine learning applications have become helpful in assisting that person in identifying fraud and fraud to which they may be exposed.
9. Trading Activities in the Stock Market: This is one of the most recent applications of machine learning, which is currently widely utilized in the stock and financial markets to anticipate market swings and detect market patterns.
10. Medical Diagnosis: To aid doctors and experts in making diagnoses of illnesses, machine learning and artificial intelligence applications are increasingly extensively utilized in the medical industry. Additionally, they are able to identify certain disease-prone regions of the human body,

such as the brain and brain tumors, swiftly and simply.

11. Language Machine Translation: This is another application that has gained popularity and is frequently used because it eliminates the need for a person to learn the native tongue of the country or region they are traveling to. Google Translate is perhaps the most well-known example of a language machine translation application.

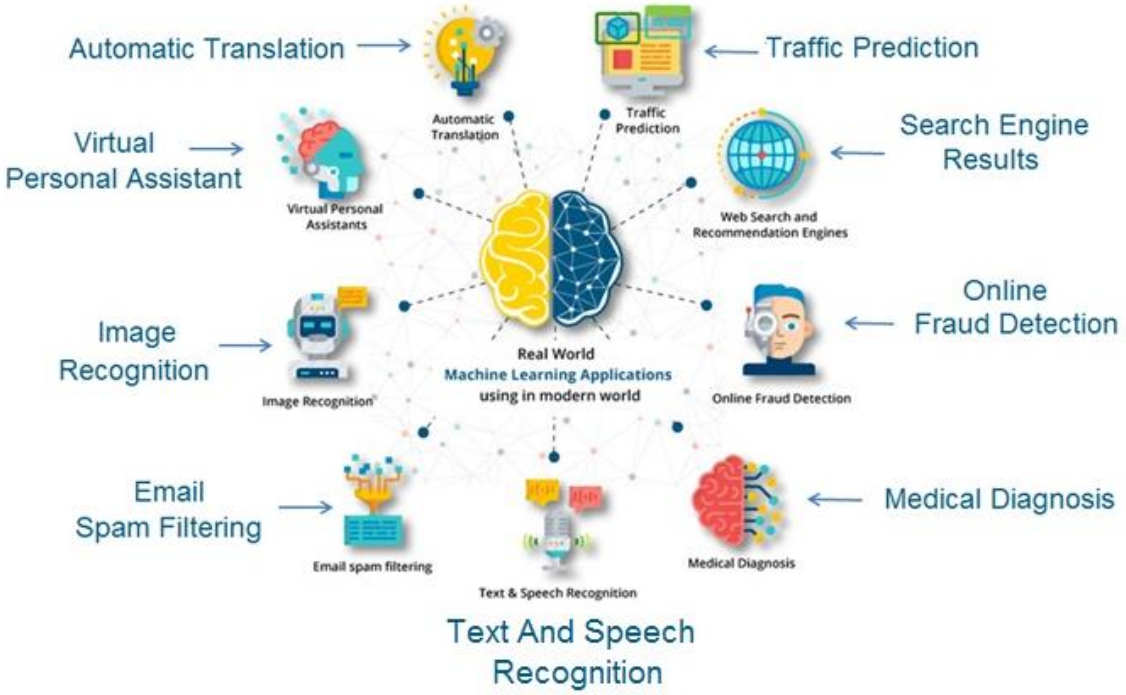


Figure 1: Machine Learning Applications [8]

3. Artificial Intelligence

The main benefit of AI technology lies in its enormous ability to improve the performance and production of all institutions, by creating advanced technologies called algorithms, which work to understand and analyze many tasks on a large scale in record time, that no human can achieve, and that of course would It brings great benefits at all levels [9,10].

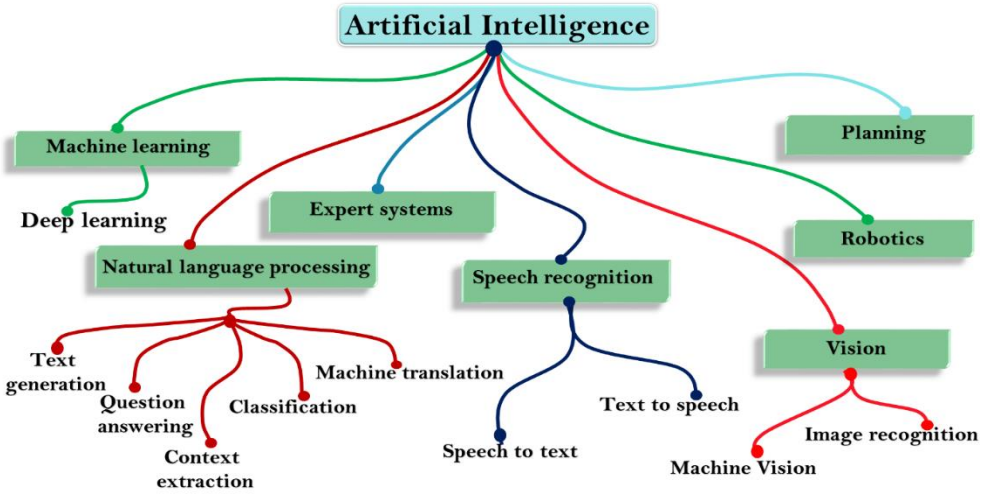


Figure 2: Artificial Intelligence Diagram

3.1 Machine Learning Algorithm

Machine learning is a branch of artificial intelligence (AI) that focuses on building systems that learn from the data they ingest, or improve performance. Systems or gadgets that mimic human intellect are referred to by the wide phrase "artificial intelligence" [1]. Although the phrases machine learning and artificial intelligence are frequently used interchangeably and are frequently addressed together, they have different meanings. While all machine learning techniques fall under the umbrella of artificial intelligence, not all AI falls under this umbrella. Machine learning in business is prevalent today. Machine learning algorithms are crucial in ensuring that our interactions with banks, online retailers, and social media platforms are quick, easy, and safe. Machine learning and the technologies around it are rapidly evolving, and we are just beginning to explore its capabilities. [12,13].

- The most popular machine learning algorithms are those that are supervised. With this paradigm, data scientists serve as mentors and start instructing the algorithms on how to draw conclusions. In supervised learning, algorithms are trained using a data set that has already been categorized and has preset outputs, similar to how a kid learns to recognize fruits by remembering them from a picture book. Algorithms like logistic and linear regression, multilayer classification, and support vector machines are examples of supervised machine learning.
- Unsupervised machine learning employs a more autonomous method in which computers learn to recognize intricate patterns and processes without close or ongoing supervision from humans. Training for unsupervised machine learning is done using data that does not include explicit ratings or outputs. Unsupervised machine learning is like a youngster learning to recognize fruit by observing colors and patterns rather than remembering names with the aid of a teacher, to continue the analogy of educating children. The kid will sort the images into groups based on commonalities between them, then assign each group a new categorization. The classification algorithm, primary and independent component analysis, and association rules are examples of unsupervised machine learning methods.
- • The sole method for teaching software or robots to operate at a high level is reinforcement learning. In a class of situations known as reinforcement learning, a worker must function in a given environment and learn how to perform via feedback. In this style, the student must choose which behaviors would yield the best results rather than being instructed what to do. Through his experience, he has efficiency.
- Semi-supervised learning is supervised learning, in which the training data contains a few labeled examples, and a large number of unlabeled examples.
- • Incrementally based learning A series of approaches for classification and regression known as instance-based learning provide a class label or prediction based on how similar the query is to its closest neighbors in the training set. Instance-based learning algorithms do not abstract from particular cases, in contrast to other approaches like decision trees and neural networks. Instead, they just store all the information, and when a query is made, they look at the nearest neighbor to determine the response.
- • The K-Nearest Neighbor The supervised machine learning technique known as the k-nearest neighbors (KNN) can be used to tackle classification and regression issues. It is simple to use and comprehend, but it has the critical problem of becoming increasingly obvious as the amount of data in use increases.

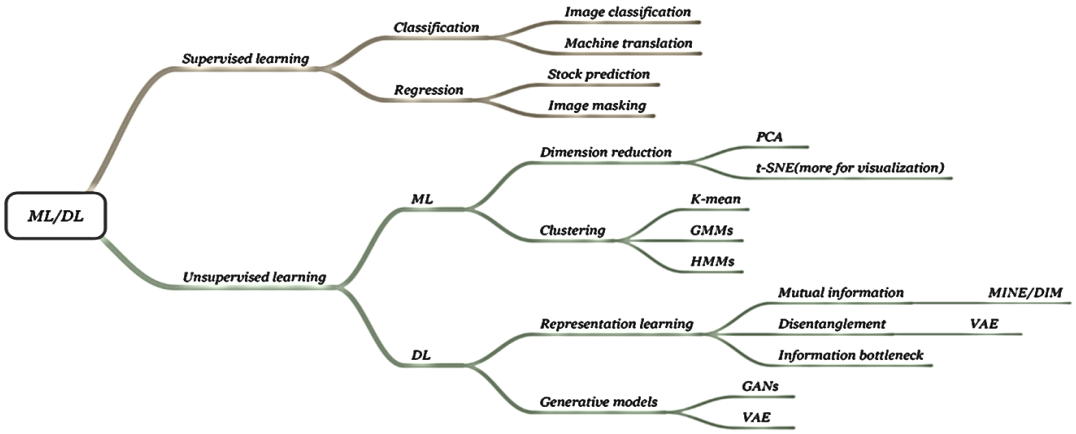


Figure 3: Machine and Deep Learning

3.2 Artificial Neural Network

A conceptual system or mathematical model based on biological neural networks, or a replication of a biological neural system, is known as an Artificial Neural Network (ANN). It uses a connectionist method of computation to handle information and is made up of a network of artificial neurons. An ANN is often an adaptive system that modifies its structure in response to information coming from the outside or inside the network [14] during the learning phase. Neural networks are non-linear statistical data modeling tools, to put it more simply. They can be applied to identify patterns in data or to model intricate relationships between inputs and outputs. Similar to the extensive network of neurons in the human brain, a neural network is a linked collection of nodes [15].

The simplest ANNs imitate the function of the brain by using a layered structure of interconnected ANs. This type of architecture is also referred to as a Dense or Fully Connected Network since each neuron in an ANN receives the activation of every AN of the preceding layer as input parameters (Figure 2). A Feed-Forward Network would be another term for this architecture, which only connects layers in order. Deep ANNs are ANNs having multiple layers between the input and output layer (also known as hidden layers), and training such networks is referred to as deep learning. Typically, supervised learning is used for training, which involves manually annotating the data before to training and using backpropagation to change the weights for each input [16].

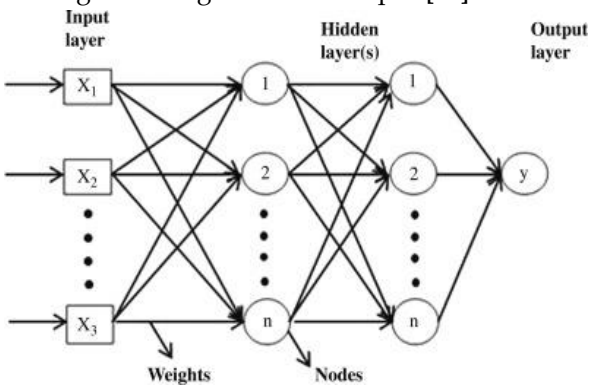


Figure 4: Basic Structure of ANN

4. Support Vector Machine

The main application of SVM in medical data processing is identification. In a multidimensional setting, SVM functions as a separator of distinct data sets. It has the ability to classify data into binary and multiclass categories. Clinical coding, which converts medical data into standardized statistical code, depends on identification. To assess crucial data, identification, for instance, splits the data into diagnostic or process codes. The identification is based on different health assessment-related characteristics [17]. The main objective of this strategy, as shown in Figure 3, is to project nonlinearly identifiable samples to a higher-

dimensional space using various kernel functions. Recently, the popularity of SVM has drawn a lot of attention to kernel techniques. The connection between linearity and nonlinearity mainly relies on kernel functions. SVM employs the idea of transforming the input domain into a space with many dimensions to enhance the identification function [18].

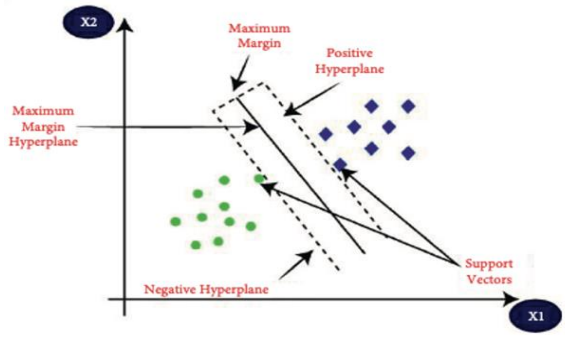


Figure 5: Support Vector Machine [17]

A task that can be divided into two categories is binary categorization. SVM can be effectively employed when the data contains exactly two categories. SVM begins by categorizing data by locating hyperplanes and dividing data points according to a few characteristics. There are numerous hyperplanes; the best has the largest margins and more interdependent data [19].

4.1 Training Method

Our method is trained using the dataset to make reliable output predictions. By extracting information from this dataset, we concentrate on categorizing the iris class. The processed data includes an analysis of each parameter. Data preparation is necessary for the machine learning process in order to transform the data into a format that the machine can interpret. We may say that the algorithm can now quickly analyze the data features. The data is transformed into binary format for our project. The algorithm now performs the necessary calculations. In order for us to understand the output, it is converted from binary to hexadecimal format. Hexadecimal codes are used to identify colors. The aim is to categorize the data according to their data characteristics [20].

4.2 Iris Clustering

This example shows how a self-organizing map neural network can topologically cluster iris into classes, revealing the types of data and offering a helpful tool for additional analysis.

4.2.1 The Problem: Cluster Iris

In this example, we're going to try to create a neural network that classifies iris into natural categories and then groups related categories together. Four characteristics of each iris are listed [21]:

- Sepal length in cm
- Sepal width in cm
- Petal length in cm
- Petal width in cm

This is an illustration of a clustering issue, where the goal is to classify data into groups depending on how similar they are. We want to build a neural network that not only defines classes for known inputs but also enables us to classify unknown inputs in accordance with those classes.

4.2.2 Self-Organizing Map Neural Networks

Classifications may be made extremely well using self-organizing maps (SOMs). The classifications also keep track of topological information on the classes that relate to one another the most. You may design self-organizing maps with any level of detail you choose. They work particularly effectively for clustering data with several dimensions and feature spaces with intricate connections. They work nicely for iris clusters. The SOM will take the four characteristics as inputs and map them onto a layer of neurons in two dimensions.

4.2.3 Preparing the Data

The data are organized into an input matrix X when setting up the data for clustering issues for a SOM. Each ith column of the input matrix will contain four items, each of which represents one of the four measurements that were performed on a single set of data.

4.2.4 Clustering with a Neural Network

Selforgmap creates self-organizing maps for classifying samples in as much depth as needed by selecting the number of neurons in each dimension of the layer. The 2-dimensional layer in this illustration comprises 64 neurons that are arranged in an 8x8 hexagonal grid. In general, more neurons yield more information, and more dimensions allow for the topology of more complex feature spaces to be modelled. The input size is 0 since the network has not yet been configured to match our input data. This will happen after the network has been trained.

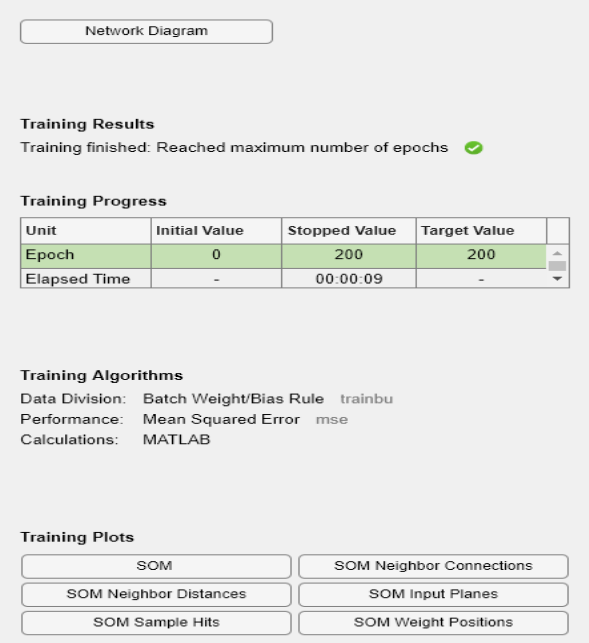
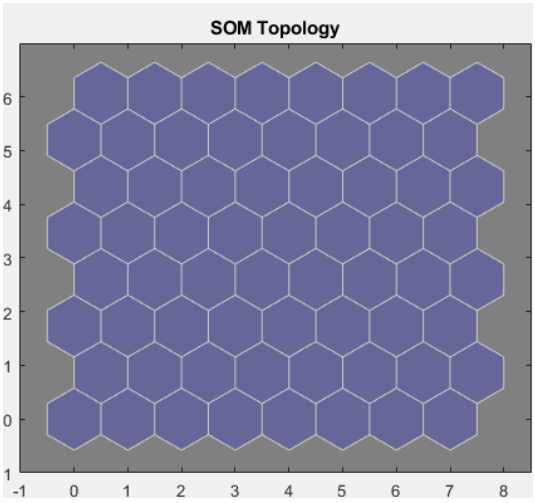
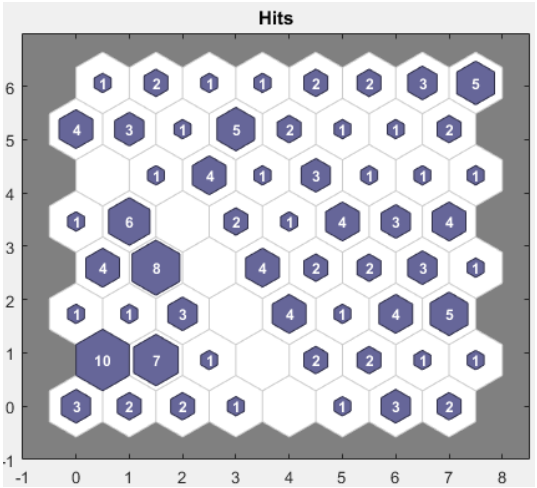
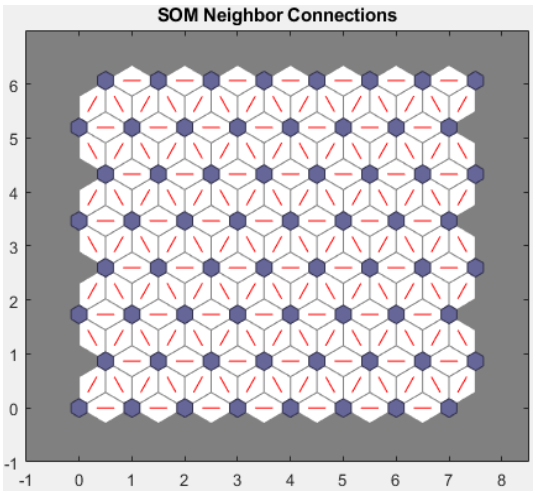


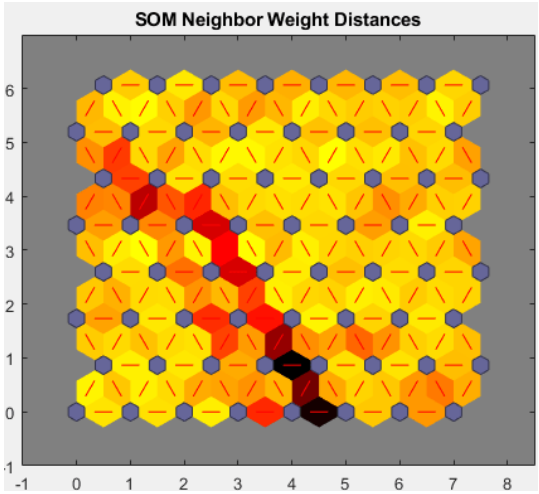
Figure 6: Matlab Neural Network Training

Here, the class vectors for each of the training inputs are calculated using the self-organizing map. These categories encompass the feature space that contains the known data, and they may now be applied to categorize new data in the same manner. A 64x150 matrix representing the j^{th} cluster for each i^{th} input vector with a 1 in its j^{th} member will be the network output.









5. Conclusion

The essay uses machine learning's tasks and applications to explain the idea. The various forms of learning, including supervised learning, unsupervised learning, and reinforcement learning, are also highlighted in the article. This article also discusses a step-by-step process for applying supervised learning to solve an issue. There are two types of machine learning: supervised and unsupervised. For huge data sets, unsupervised learning typically produces superior performance and outcomes. Consider using deep learning techniques if you have a sizable data set that is readily available. You have also studied Deep Reinforcement Learning and Reinforcement Learning. Neural networks, their uses, and their drawbacks are now clear to you. This study examines various machine learning algorithms. Today, whether consciously or unconsciously, every single person uses machine learning. posting images on social networking sites to receiving product recommendations when purchasing online. The majority of the well-known machine learning methods are introduced in this publication.

References

[1] Bhutada, S., K. Tejaswi and S. Vineela. Flower Recognition Using Machine Learning. *International Journal Of Researches In Biosciences, Agriculture And Technology*, 4(2), 67-73, 2021.

[2] Poojitha V, Shilpi Jain, "A Collecation of IRIS Flower Using Neural Network Clusterimg tool in MATLAB", International Journal on Computer Science and Engineering (IJCSE).

[3] P. Galdi and R. Tagliaferri, "Data mining: accuracy and error measures for classification and prediction," *Encycl. Bioinforma. Comput. Biol.*, pp. 431–6, 2018.

[4] Asaad, R. R. (2021). Penetration Testing: Wireless Network Attacks Method on Kali Linux OS. Academic Journal of Nawroz University, 10(1), 7–12. https://doi.org/10.25007/ajnu.v10n1a998

[5] Almufti, S., Marqas, R., & Asaad, R. (2019). Comparative study between elephant herding optimization (EHO) and U-turning ant colony optimization (U-TACO) in solving symmetric traveling salesman problem (STSP). Journal Of Advanced Computer Science & Technology, 8(2), 32.

[6] Asaad, R. R., & Abdulnabi, N. L. (2018). Using Local Searches Algorithms with Ant Colony Optimization for the Solution of TSP Problems. Academic Journal of Nawroz University, 7(3), 1–6. https://doi.org/10.25007/ajnu.v7n3a193

[7] Almufti, S., Asaad, R., & Salim, B. (2018). Review on elephant herding optimization algorithm performance in solving optimization problems. International Journal of Engineering & Technology, 7, 6109-6114.

[8] Asaad, R. R., Ahmad, H. B., & Ali, R. I. (2020). A Review: Big Data Technologies with Hadoop Distributed Filesystem and Implementing M/R. Academic Journal of Nawroz University, 9(1), 25–33. https://doi.org/10.25007/ajnu.v9n1a530

[9] Asaad, R. R. (2019). Güler and Linaro et al Model in an Investigation of the Neuronal Dynamics using noise Comparative Study. Academic Journal of Nawroz University, 8(3), 10–16. https://doi.org/10.25007/ajnu.v8n3a360

[10] D. Decoste, E. Mjolsness. 2001. "State of the art and future prospects by using Machine Learning", vol. 320, 2013.

[11] Y. Lakhdoura and R. Elayachi, "Comparative Analysis of Random Forest and J48 Classifiers for 'IRIS' Variety Prediction," *Glob. J. Comput. Sci. Technol.*, 2020

[12] L. Dhanabal and S. P. Shantharajah, "A study on NSL-KDD dataset for intrusion detection system based on classification algorithms," *Int. J. Adv. Res. Comput. Commun. Eng.*, vol. 4, no. 6, pp. 446–452, 2015.

[13] Hassan, C. A. U., Khan, M. S., & Shah, M. A. (2018, September). Comparison of machine learning algorithms in data classification. In *2018 24th International Conference on Automation and Computing (ICAC)* (pp. 1-6). IEEE.

[14] Asaad, R. R., Abdurahman, S. M., & Hani, A. A. (2017). Partial Image Encryption using RC4 Stream Cipher Approach and Embedded in an Image. Academic Journal of Nawroz University, 6(3), 40–45. https://doi.org/10.25007/ajnu.v6n3a76

[15] Rajab Asaad, R., & Masoud Abdulhakim, R. (2021). The Concept of Data Mining and Knowledge Extraction Techniques. Qubahan Academic Journal, 1(2), 17–20. https://doi.org/10.48161/qaj.v1n2a43

[16] Zebari, D. A., Ibrahim, D. A., Zeebaree, D. Q., Mohammed, M. A., Haron, H., Zebari, N. A., ... & Maskeliūnas, R. (2021). Breast cancer detection using mammogram images with improved multi-fractal dimension approach and feature fusion. *Applied Sciences*, *11*(24), 12122.

[17] Abdulqadir, H. R., Abdulazeez, A. M., & Zebari, D. A. (2021). Data mining classification techniques for diabetes prediction. Qubahan Academic Journal, 1(2), 125-133.

[18] Naser, W. A. K., Kadim, E. A., & Abbas, S. H. (**2021**). SVM Kernels comparison for brain tumor diagnosis using MRI. *Global Journal of Engineering and Technology Advances*, *7*(2), 026-036.

[19] Asaad, R. R., & Ali, R. I. (2019). Back Propagation Neural Network(BPNN) and Sigmoid Activation Function in Multi-Layer Networks. Academic Journal of Nawroz University, 8(4), 216–221. https://doi.org/10.25007/ajnu.v8n4a464

[20] Rajab Asaad, R. (2021). Review on Deep Learning and Neural Network Implementation for Emotions Recognition . Qubahan Academic Journal, 1(1), 1–4. https://doi.org/10.48161/qaj.v1n1a25

[21] Asaad, R. R., Abdulrahman, S. M., & Hani, A. A. (2017). Advanced Encryption Standard Enhancement with Output Feedback Block Mode Operation. Academic Journal of Nawroz University, 6(3), 1–10. https://doi.org/10.25007/ajnu.v6n3a70

[22] Y. Lakhdoura and R. Elayachi, "Comparative Analysis of Random Forest and J48 Classifiers for 'IRIS' Variety Prediction," *Glob. J. Comput. Sci. Technol.*, 2020.

[23] D. Rana, S. P. Jena, and S. K. Pradhan, "Performance Comparison of PCA and LDA with Linear Regression and Random Forest for IRIS Flower Classification," *PalArchs J. Archaeol. EgyptEgyptology*, vol. 17, no. 9, pp. 2353–2360, 2020.

[24] K. Sarpatwar et al., "Privacy Enhanced Decision Tree Inference," in Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops, 2020, pp. 34–35.

[25] Abdulfattah, G. M., Ahmad, M. N., & Asaad, R. R. (2018). A reliable binarization method for offline signature system based on unique signer's profile. INTERNATIONAL JOURNAL OF INNOVATIVE COMPUTING INFORMATION AND CONTROL, 14(2), 573-586.

[26] Almufti, S. M., Ahmad, H. B., Marqas, R. B., & Asaad, R. R. (2021). Grey wolf optimizer: Overview, modifications and applications. International Research Journal of Science, Technology, Education,and Management, 1(1),1-1.

[27] Boya Marqas, R., M. Almufti, S., & Rajab Asaad, R. (2022). FIREBASE EFFICIENCY IN CSV DATA EXCHANGE THROUGH PHP-BASED WEBSITES. Academic Journal of Nawroz University, 11(3), 410–414. https://doi.org/10.25007/ajnu.v11n3a1480

[28] Ihsan, R. R., Almufti, S. M., Ormani, B. M., Asaad, R. R., & Marqas, R. B. (2021). A survey on Cat Swarm Optimization algorithm. Asian J. Res. Comput. Sci, 10, 22-32.