



# APPLICATIONS OF MACHINE LEARNING ALGORITHMS IN EMOTION RECOGNITION AND HEALTHCARE SECTOR

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**Abstract:** In recent years to analyse the data from a large set of database and how data are interrelated with each other are predict by various algorithms. From the algorithms the best and suitable approaches are derived from Machine Learning (ML) techniques. For the faster approach and efficient solution prediction especially in healthcare the machine learning algorithms were used. In healthcare the medical data are derived from various input parameters such as clinical data, data received form sensors and genome data which are processed by various learning like supervised, unsupervised, semi-supervised and reinforcement. In this review, all the essential factors (labelling, input, strategies, performance, influencing factor & deficiencies) which are required for identify the needed data in the healthcare sector. The outcome of this paper will make the researcher or beginner to learn about the various learning algorithms and how effective these algorithms are utilized in the healthcare sector.

**Index Terms:** Machine learning, reinforcement learning, semi-supervised learning, unsupervised learning and supervised learning.

## I. INTRODUCTION

Images and motion videos are major elements in emotion recognition. Emotion Recognition (ER) is defined as the method to identify the human emotions in various situations. Peoples have moderate IQ in understanding others emotion. The major kind of emotions listed as aggression, sad, happy, anxiety, surprise and angry. So, some of the new mechanisms are helped humans to recognize their emotions using the term emotion detection [1]. In various applications the term facial emotional recognition is placing a vital role. The concept facial emotional recognition Figure.1 which includes three main processes namely face detection, facial expression identification and classifying the emotions to predict the right one.

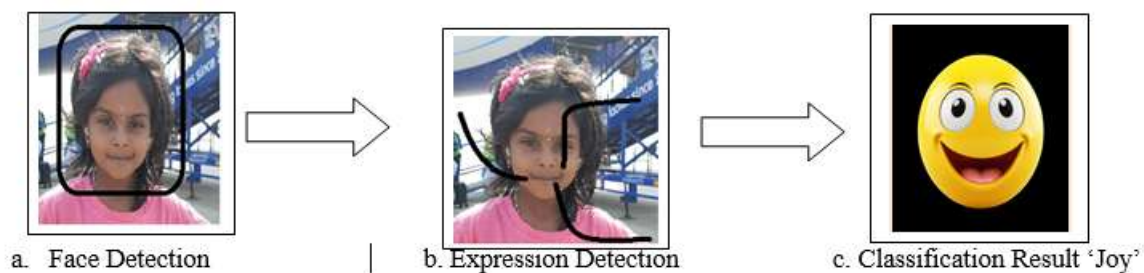


Figure.1 Processing steps of Facial Emotional Recognition

The term emotion detection fully operates with the position of facial landmark which focuses at eyebrows, eyes and nose reactions. By using the advanced algorithms, the facial emotions are analysed from the various emotions with more accuracy. The popular facial algorithms are Convolutional Neural Network (CNN), Histograms and Principal Component Analysis (PCA).

The FER utilized in so many environments like public services, analysis of customer behaviours, advertisements, education sector, healthcare and recruitment. Different algorithms are used to get output with high accuracy in identifying emotions from the classification of emotions. Some of the recently used algorithms are Markov chain models like Hidden Markov Models, Ensemble methods, KNN (K- Nearest Neighbours) and Support Vector Machines (SVM), in machine learning. From the facial landmark the features are extracted using several algorithms like Geometric features, textures features, binary patterns in local landmarks and HOG (Histogram of Oriented Gradients) are used under deep learning models. In this survey summary a randomized algorithms are how effectively used in the facial emotion recognition and the strength/weakness of all the algorithms are discussed in detail.

## II. METHODS

### 2.1 Machine Learning (ML)

The term machine learning was derived in the year of 1950's by Arthur samuel using chess game. Without the involvement of human interventions, the machine itself can play the game automatically.

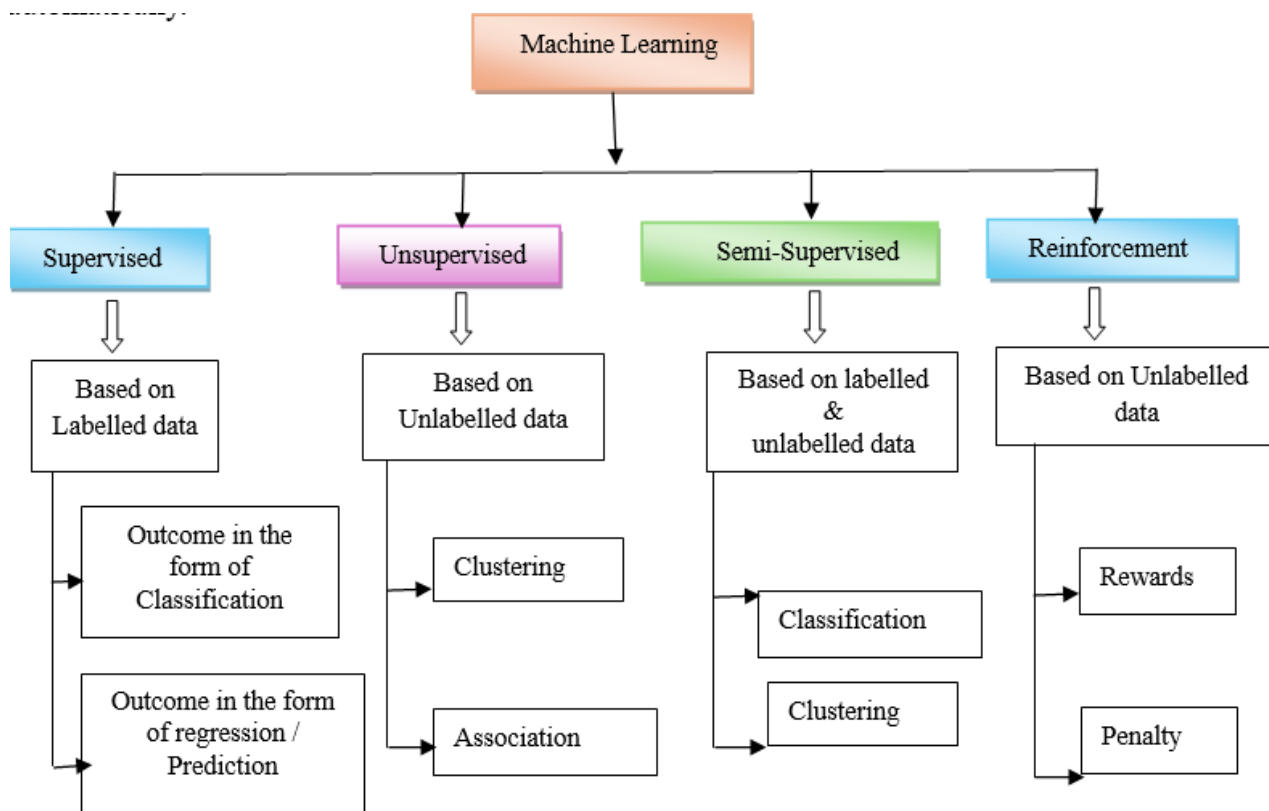


Figure.2. Classification of ML algorithms.

The theme of ML is to make the computer utilise the data by accessing the relevant data for learning itself. 'Data' is a powerful one in machine learning and it is also called as 'backbone' of ML. There are Several models are used to make the system more accurate by prediction the exact output [2]. In all sort of companies/industries and everywhere the ML algorithms are effectively utilised by the peoples for getting exact prediction. There are several approaches are used for the prediction such as supervised machine Learning (SL), Semi-Supervised machine Learning (SSL). Unsupervised machine Learning (UL) and Reinforcement machine Learning (RL). The classification of algorithms are represented in the below Figure. 2 with the attributes such as type of learning, datatypes and outcomes.

#### 2.1.1 Supervised Learning (SL)

In SL the training model is used to learn from the finite number of labelled data to find the new one by applying better prediction mechanisms. There are two partitions generally the machine learning follows: one is for training the data and another one is for testing the data with any new values. Here the prediction is evaluated by sing various parameters. In medical, generally on hospitals the patient case history called as labelled data which means data obtaining the patient samples based on that the outcome will derive as either diagnosis or treatment. Few of the popularized algorithms are applied in this learning mechanism likely Decision Trees, random decision forest, artificial neural networks and maximum margin classifiers [3].

For better clinical data some advanced models are used intentionally by deep learning like Natural Language Processing (NLP), MRIs to diagnose the characteristics and finding the disease accurately [4].

### 2.1.2 Unsupervised Learning (UL)

If the labelled data is not known to train the model, then it belongs to unsupervised learning. By using the concept clustering the similar data are grouped together to know the hidden data. In unsupervised learning the main indent is to identify the exact feature of data from the clusters using feature extraction techniques. The UL applied areas like analysis the data, grouping the data and data reduction part. Some of the popular algorithms are hierarchical clustering (HC), Deep Belief Networks (DBN) and K-medoids also the UL approach is well utilized by the healthcare sectors than the supervised learning.

### 2.1.3 Semi Supervised Learning (SSL)

The together processing of labelled and unlabelled data in a study is termed as semi-supervised learning. Here the mechanisms used in supervised learning as well as unsupervised learning works together for better predictions with more accuracy. By this approach the training model can start training with minimum number of labelled data and maximum number of unlabelled data which yields the result with high accuracy for better prediction. Some of the popular healthcare support algorithms are generative models (GAN), Transductive Support Vector Machine (TSVM) as well as Co-forest used for following operations like self-training, co-training, mapping graphs etc. [5].

### 2.1.4 Reinforcement Learning (RL)

A new type of learning using an agent learns from the environment and take decision itself based on that the agent may granted with either rewards or penalties is termed as reinforcement learning. It is not completely part of supervised or unsupervised learning instead it is fully based on trial error learning approach [5]. In this approach the performance is improved by observing the actions happened in an environment and possible steps to predict the accurate output with better accuracy. In healthcare the application of RL is day by day is getting increased. It provides minimized treatment strategies, better solution finding and improving the patient outcomes. Some of the popular algorithms are Recurrent Neural Network (RNN), Q- learning, MDP etc. There are some wide areas we are applying the mechanisms of various ML algorithms likely finance sector, transportation sectors, manufacturing industries sector, healthcare sector, etc...

### III. APPLICATIONS:

There are finite number of applications in healthcare which is increasing gradually by machine learning and its model's day by day. The outcome of the machine learning approaches is invited by the communities in healthcare industries. Here some of the applications are listed with below Figure 3.

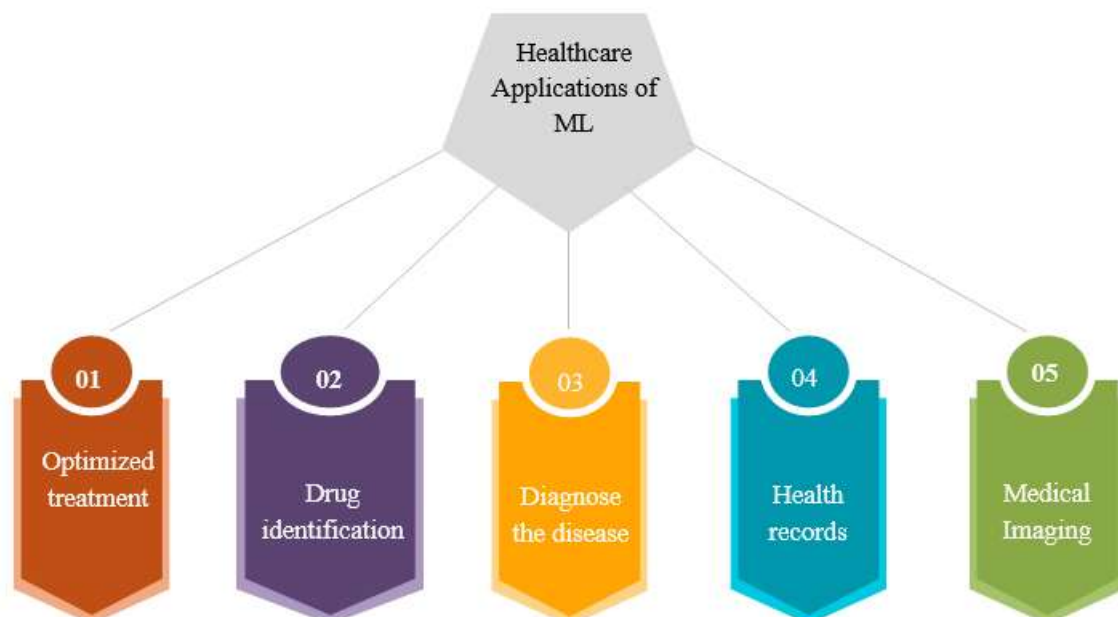


Figure.3. Applications of Machine Learning in Healthcare

The above list of applications is progressive with several types of machine learning techniques which is essential to predict the output with high accuracy. Based on few research papers, the ML techniques across the universe have been listed here in table format with various parameters for reference.

S. No	Feature	Supervised	Unsupervised	Semi Supervised	Reinforcement
1	Labelling	Complete labelled data	Not required any labelled data	Minimum number of Labelled and Maximum number of unlabelled data	Based on feedback like reward or penalty
2	Algorithms	Support Vector Machine (SVM), Concurrent Neural Network (CNN), Recurrent Neural Network (RNN)	Autoencoders, Principal Component Analysis (PCA), SCAN	Training, Self training, Co training, Graph based.	Q- learning, Policy Gradient Methods (PGM), D- queue Networks.
3	Input	Data required with good quality also it is labelled.	Only real time data is required.	Maximum of unlabelled and minimum of few labelled data are input,	Feedback from environment
4	Strategies in Emotional Recognition	Either from facial or textual emotions classified.	Identifying emotion by grouping data or clustering	Use few labelled and many unlabelled data	The agents trained with environment by interaction
5	Performance	Maximum when we use fixed labelled data	Complexities high when deal with unlabelled data also less accuracy	Balanced one when SL is used and better one for UL	Based on the environment metrics and reward/penalty design
6	Influencing factor	Better prediction by exact classification	May use when labelled data cost is high	For better action reducing the cost of labelled data	Instant action by the Emotion aware agent
7	Deficiency	Classification cost is high for labelled data	Difficult to evaluate	For more precise output need some labelled data	Delayed action by the agent
8	Few Examples	Organise the emotions like angry, neutral, surprise from facial actions.	Clustering the facial emotions	Few labelled data used for better classification	Virtual assistant for user interaction

Table 1. Detailed analysis of ML techniques by different parameters

#### IV CONCLUSION

There are various machine learning techniques used in emotion recognition and healthcare sectors. To evaluate the different data set for emotion as well as healthcare related many ML algorithms are used such as SL, UL, SSL & RL algorithms are used for better prediction with high accuracy by applying the parameters like labelling, strategies, input & performance. In this paper, recent technique in machine learning are used and those algorithms are to compare various categories of emotional and clinical data in the healthcare sector using various parameters for better performance and to predict the exact output. From the survey, the final conclusion would be for examining various types of data in different data sets in healthcare, there are several algorithms are used for detection, preprocessing, feature extraction and classification are proposed with the help pf various researchers and health reports.

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