

Need of Machine Learning to Predict Happiness: A Systematic Review

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Abstract

Happiness is a current important subject of study in psychology and social science because it affects people's day-to-day lives, thoughts and feelings, work habits, and interactions with society and family. There are a number of challenges in Computer Science and Machine Learning to predict happiness index using prediction techniques. This study presents a systematic review using PRISMA style for happiness prediction. During the Literature survey, it was found that many predictive models whether statistical or Machine Learning was designed to predict happiness index but a major emphasis on research remains focused on the factors that are listed in World Happiness Report, i.e., real Gross Domestic Product per capita, social support, healthy life expectancy, freedom to make life choices, generosity and perceptions of corruption. The factor influencing happiness varies due to personal differences, age group and location variation. According to Gallup Poll, the general annual sample for each country is 1,000 people i.e., approximately 0.007% population participated in happiness index measurement. The purpose of this study is to discover and describe new factors related to psychology like stress and emotions, location-based and age group. It is observed that there is a requirement to develop a Machine Learning predictive model which works on psychological factors like mental health, depression, stress, physical well-being, safety, leisure time available and suicidal ideation in addition to economic factors used in World Happiness Index and by targeting a large sample size of populations.

Keywords: *Factors Affecting Happiness, Happiness Index, Machine Learning, Prediction Techniques.*

1. Introduction

Depression is one of the overseeing causes of inability. Mental health conditions like anxiety, stress and depression are very common nowadays. As per World Health Organization

(WHO) Report in 2017, Depression is a constant mental illness around the world, with an estimated 4.4% of the population affected by it. More women are depressed than men and it can lead to suicide. As per “*World Mental Health Report: Transforming Mental Health for All*”, the world comes to learn from and live with the impacts of the COVID-19 pandemic, and the tremendous impact it has tolled on people’s mental well-being and mental health[1]. The rate of anxiety, sadness and depression went up by more than 25 percent within the first year of the pandemic. Because of COVID-19, mental health disorders have sped up[2]– [5]. Therefore, Happiness is a dream desire to be acquired by individuals and governments and it can be contemplated as an apt measure of social development progress[6].

Nowadays happiness is a very important research issue in social sciences and psychology. Acquiring happiness is a global leisure pursuit. An increasing composition of scientific data hooks up happiness with physical health and overall well-being. People worldwide are continuously yearning for happiness, which is a never-ending journey. The researchers have made the term Happiness Index (HI) to better show vague happiness in data. The Happiness Index is used to measure an individual’s feelings and experiences of their development and survival. Each and every person has unique experiences of happiness. So, HI is the best way to calculate individuals’ happiness. The primary data for World Happiness Report (WHR) is given by Gallup World Poll, using survey methods to collect data. Although the number of people and the number of nations examined fluctuates from year to year, the Gallup World Poll usually includes more than 100,000 participants from 130 countries. It is exceptionally difficult to design public policy for happiness and well-being without a solid understanding of the factors contributing to individuals’ happiness and how they interact with policies[7]. Happiness affects people's daily lifestyle, thinking patterns, and work habits. So, to improve the lifestyle of an individual or a country, there is a need to predict HI using Predictive Analytical techniques by considering all the essential attributes.

Machine Learning (ML) plays a leading role in the prediction of future performance and outcomes. Therefore, both Machine Learning and predictive analytics go hand in hand. “**Predictive Analytics**” implies analytical methods and statistical methods[8]. Predictive analytics is a branch of Data Science and advanced analytics that produces predictions about future results using

historical data combined with data mining methods, statistical modelling, and Machine Learning. Essentially, it is the field of statisticians, data scientists and skilled data analysts. Organizations employ predictive analytics to discover patterns in the data to recognize opportunities and risks.

In the field of medical and clinical psychology, evaluations of the literature review and research surveys that pay attention to ML applications for Happiness Index and mental health have started to emerge in the past few years. There are a large number of ongoing studies, in the field of Computer Science and Machine Learning to predict happiness index and mental disorders, in the broader literature, predictive models to predict happiness index is examined[4], [7], [9]– [23], but most research is conducted on the factors that are listed in World Happiness Report, i.e., real GDP per capita, social support, healthy life expectancy, freedom to make life choices, generosity and perceptions of corruption. These researches focus on the accuracy of predictive models which use different ML approaches to predict happiness index only whereas psychological factors i.e., emotions and stress-related factors have been excluded. The factors influencing happiness vary due to personal differences, age group and location variation.

1.1. Happiness Index

The Happiness Index is a system that examines an individual's, an organization's, geographic area, a nation's, and the world's collective happiness, life satisfaction, and well-being. It is also known as a comprehensive measure of well-being. HI is a comprehensive survey tool that evaluates happiness, well-being, as well as aspects of resilience and sustainability. The Happiness Alliance was established by the Happiness Index to present as a survey tool for researchers, community organizers, and others interested in using a subjective well-being index and data. It is the only tool of its type that is freely available throughout the world and has been translated into over ten languages. This instrument can be used to measure life satisfaction and life quality. It can also be used to define income inequality, a sense of community, trust in government, and other aspects of well-being within a population's specific demographics. The Global Happiness Council, a group of independent academic happiness specialists, developed the Happiness Index first[24].

HI was inspired by the Bhutanese Gross National Happiness Index. The Kingdom of Bhutan developed the concept of Gross National Happiness in response to influences to use Gross National

Product as the primary goal and measurement of effectiveness for the government. Bhutan began prioritizing happiness over other factors such as wealth, comfort, and economic growth in 1972. They developed a happiness index based on multiple measurable factors and have been tracking it ever since. The UN General Assembly passed the resolution Happiness: Towards a Holistic Definition of Development in July 2011. Members of the countries were invited to measure their people's happiness and used the data to help guide public policy[25].

The first UN high-level meeting on Well-being and Happiness: Defining a New Economic Paradigm, chaired by the UN Secretary-General Ban Ki-moon and Bhutan's Prime Minister, took place in April 2012. Furthermore, Bhutan has chosen Gross National Happiness as its primary development indicator rather than Gross Domestic Product. In 2012, the first World Happiness Report was released and 20th March was declared as the International Day of Happiness[25].

1.2. Requirement of Happiness Index

Being happy doesn't always depict that everything is perfect. It means you've chosen to look beyond the imperfections. Happiness is not only about happy faces; internal happiness and peace are major components. Everyone wants to be happy in life, but the requirements for happiness differ from person to person. This is the main reason why defining happiness is difficult.

WHR includes the following factors that affect the happiness of a nation and the effect of these factors on Happiness are listed below in Table 1.

Table 1: Effect of Six Factors Included in WHI on Happiness[26]

Attribute Name	Effects on Happiness
Real GDP per capita	This variable allows researchers to examine the state of the economy because it estimates the value of all products and services produced by a company. GDP levels have a significant impact on people's lives and, as a result, impact World Happiness Index. The higher the log GDP per capita, the better the country's economy.

<p>Social Support</p>	<p>Another important factor influencing people's happiness is social support. This factor indicates that social ties or having relatives and friends to turn to in times of need, are among the factors that influence happiness. When a person does not have anyone to count on in difficulties, they are more likely to become depressed and frustrated. The researcher's goal is to evaluate the impact of social ties on a country's WHI performance.</p>
<p>Healthy life expectancy</p>	<p>Significantly greater life expectancy implies healthier populations, more accessible healthcare, and a higher overall quality of life. This variable introduces physical well-being and health as factors influencing a country's happiness index. The WHI assigns higher ratings to nations with higher lifespans in good health.</p>
<p>Freedom to make life choices</p>	<p>Freedom entails opportunity: the chance to go places, cast votes and be voted, take part in protests, select a career, etc. The level of happiness increases as opportunities improve.</p>
<p>Generosity</p>	<p>Generosity is one of the characteristics that can be used to measure people's happiness because it is strongly linked to prosperity. The WHI, charity and prosperity are related to each other.</p>

WHI does not discuss emotion, stress, safety and other psychological factors. The weightage of GDP or economic factors is considered on the higher side than psychological factors to find out the happiness index. But there are more facts about happiness which can be considered:

1. Money can only make us happy up to a certain limit (say about \$75,000) after that it has no effect on emotional well-being[25]. The requirement of livelihood, well-being, entertainment, and so on is affected by money. Beyond that significance of money reduces its impact on happiness. Money can't purchase happiness; however, a happy person can earn money efficiently.

2. Most religions around the world have long advised that individuals should focus on other people first and then themselves. Such behaviour is referred to as prosocial behaviour by psychologists and many past surveys have discovered when folks have prosocial behaviour, doing kind actions for others, their own happiness increases[25].
3. Bhutan decided to adopt a Happiness Policy rather than one focused on economic growth as measured by GDP (Gross Domestic Product). As a result, this small country has been one of the happiest among countries with far greater wealth[25].
4. The presence of positive emotions, life satisfaction and the absence of negative emotions are three factors that contribute to happiness[25].
5. Adopting happiness via social means (for example, spending more time with family and friends) is more likely to be successful than other methods[25].

By considering the above-mentioned key points, there is a need to improve happiness index by including these factors because happiness of an individual or a nation affects the society as well as nears and dear. Fig. 1 shows that people who are happy, tend to make others happy, and vice-versa, those who do good feel good about themselves.

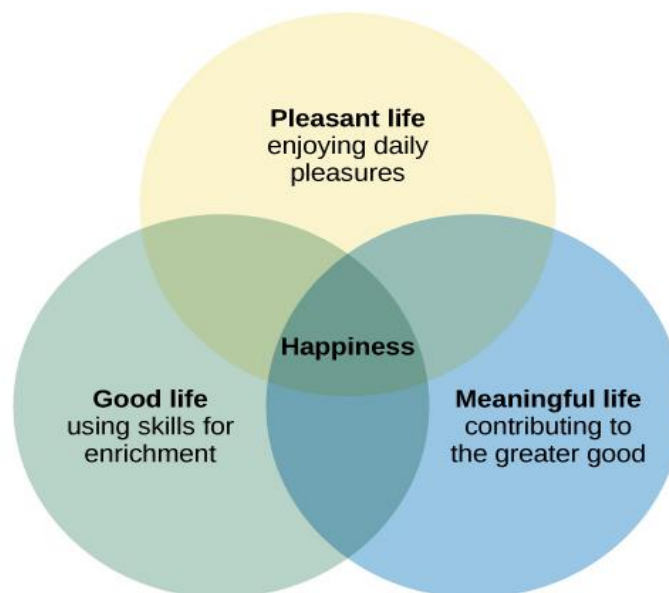


Fig. 1. The Pursuit of Happiness [27]

Happiness affects people's daily lifestyle, thinking patterns, and work habits. So, to improve the lifestyle of an individual or a country, there is a need to predict happiness index using Predictive Analytical techniques by considering all the essential attributes.

1.3 Motivation

The main motivation behind this study is to discover and describe new factors related to psychology like stress and emotions, location-based, age group, personal safety, family, leisure time, faith, and many more[7], [18], [28]– [34]. Furthermore, this study presents a systematic review and analysis of Machine Learning predictive approaches employed for happiness index and depression. Past researches focus on the accuracy of predictive models which use different ML approaches to predict happiness index only whereas psychological factors i.e., emotions and stress-related factors have been excluded. The factor influencing happiness varies due to personal differences, age group and location variation.

Gallup World Poll usually includes more than 100,000 participants from 130 distinct countries. The general annual sample for each country is 1,000 people. If a country had surveys each year, then the sample size would be 3,000[35]. The sample size of the population of countries is described in Table 2 along with the percentage distribution over the total population of India. In this table, 1 to 5 ranked countries in WHR of 2023 i.e., Finland, Denmark, Iceland, Switzerland, Netherlands and India are included[36].

Table 2: Sample size of the Population of 6 countries taken by Gallup Poll to find out Happiness Index [36]– [39]

Country	Years	Sample Size taken by Gallup	Population (Approx.)	Percentage (%)
India	2020	9453	1,380,004,385	0.00068
	2021	3000	1,407,563,842	0.00021
	2022	1000	1,417,173,172	0.00007
	2023	1000	1,428,627,663	0.00006
Finland	2020	1000	5529468	0.01808
	2021	1005	5535992	0.01815

	2022	1000	5540745	0.01804
	2023	1000	5545475	0.01803
Denmark	2020	1009	5825641	0.01731
	2021	1011	5854240	0.01726
	2022	1007	5882261	0.01711
	2023	1000	5910913	0.01691
Iceland	2020	501	366669	0.1366
	2021	500	370335	0.1350
	2022	500	372899	0.1340
	2023	500	375318	0.1332
Switzerland	2020	1000	8638613	0.01157
	2021	1000	8691406	0.01150
	2022	1000	8740472	0.01144
	2023	1000	8796669	0.01136
Netherlands	2020	1006	17434557	0.00577
	2021	1000	17501696	0.00571
	2022	1006	17564014	0.00572
	2023	1000	17618299	0.00567

World Happiness Report 2023 was published on 20th March 2023 in which Gallup Poll conducted a survey by taking 1000 sample size out of 142 crore population of India i.e., only 0.00006% participated in the survey and India at 136th place[36]. So, there is a need to increase sample size to improve HI.

2 Theoretical Framework

2.1 Search Methodology

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) tool was used in the systematic review to examine research that used various Machine Learning predictive algorithms to tackle various problems related to depression and happiness index. The methodology applied in the search comprised several publications dealing with the application of ML algorithms as methods of prediction of happiness index that were published between 2018 and 2023[40], [41]. The peer-reviewed, scholarly, full-text, and year of publication criteria were used to identify and then include or exclude the papers from the review that ranged from 2018 to 2023. The following

databases were taken into consideration when choosing the papers: IEEE Explore, Springer, Science Direct, Nature, MDPI, and Wiley.

A total of 750 papers on predictive algorithms on happiness index and factors affecting happiness published between 2018 and 2023 were considered, and 60 papers were ultimately chosen for the

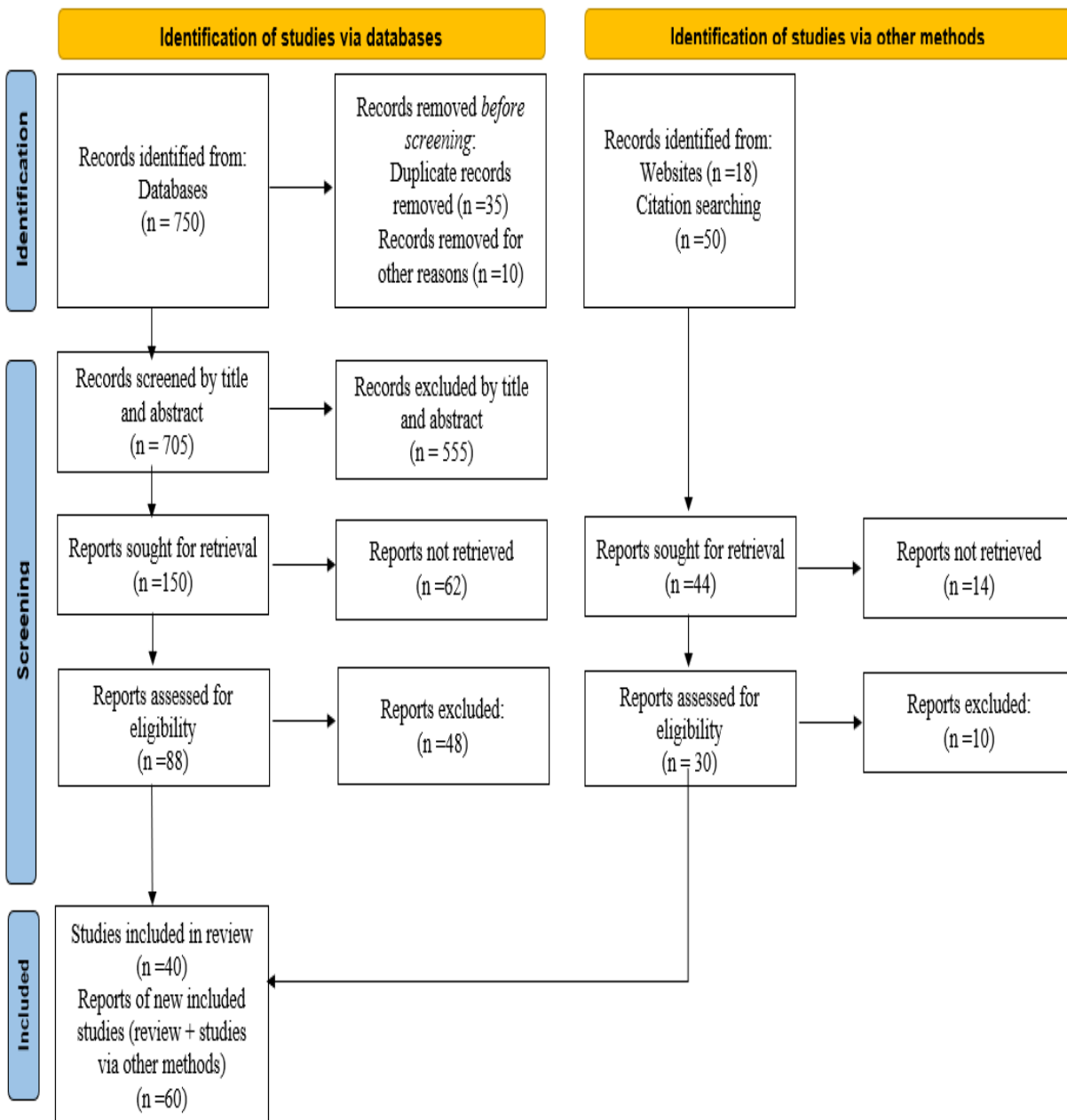


Fig 2: The PRISMA flow diagram for the search conducted on Databases and via other methods

purpose of this study. After excluding duplicate records (N = 35) and records with some other reasons(N=10) from the papers (N = 750), only 705 papers remained for screening. After the screening of the papers by title and abstract, only 150 records were left. Figure 2 shows the PRISMA style of representation adopted for paper selection in this study. Based on the inclusion and exclusion criteria, only 60 papers were selected for the final study. The inclusion and exclusion criteria are shown in Table 3.

For the study, a total of 750 papers are filtered out from various publishers such as Springer, Science Direct, IEEE Xplore, MDPI, Wiley, and PubMed. For population sample size WHR is also considered from 2020 to 2023. The paper distribution in terms of publishers is presented in Table 4.

Table 3 Inclusion and exclusion criteria

Inclusion Criteria (IC)	
IC1	Articles published after 2017
IC2	Presenting a systematic review of Machine Learning predictive algorithm and happiness index
IC3	The articles addressed factors of Happiness as a challenge.
IC4	Papers from the psychological factors affecting happiness based on machine intelligence approaches were considered.
Exclusion Criteria (EC)	
EC1	Articles published before 2017.
EC2	The title does not include happiness, Machine Learning, psychological factors and prediction techniques.
EC3	Excluded the papers which are not available electronically.
EC4	Articles are presented at several sources.

Table 4 Distribution of papers based on different publishers

Sr. No.	Publication	No. of Papers	Percentage (%)	Databases
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1	IEEE Conference & IEEE Journal	06	10	IEEE Xplore
2	Springer Journal	10	16.6	Springer
3	Elsevier Conference & Elsevier Journal	04	6.6	ScienceDirect
4	Others (MDPI, Wiley etc. and web pages)	40	66.6	MDPI, Wiley, PubMed, Google Scholar, etc.
Total		60	100	

The number of papers considered for each year along with the percentage distribution is presented in Table 5. In this study, 4 papers from the year 2023, 8 papers from 2022, and 11 papers from 2021 are considered, whereas from the years 2020, 2019 and 2018, 15, 7 and 8 papers, are included respectively. 2 papers from 2015 are also included just to show the use of PRISMA statements and flowcharts.

Table 5 Number of papers considered for each year along with the percentage distribution

Sr. No.	Years	Number of Papers	Percentage (%)
1	2023	4	7.5
2	2022	8	15.1
3	2021	11	20.7
4	2020	15	28.3
5	2019	7	13.2
6	2018	8	15.1

2.2 Machine Learning Predictive Techniques and Happiness

Machine Learning plays a leading role in the prediction of future performance and outcomes. Therefore, both Machine Learning and Predictive Analytics go hand in hand. Predictive Analytics implies analytical methods and statistical methods[8]. Predictive Analytics is a branch of Data Science and advanced analytics that produces predictions about future results using historical data combined with data mining methods, statistical modelling, and ML. Essentially, it is the field of statisticians, data scientists and skilled data analysts. Organizations employ predictive analytics to discover patterns in the data to recognize opportunities and risks.

Today, whether intentionally or not, everyone uses Machine Learning. There are a number of reviews or systematic reviews done on most of the popular ML algorithms[3], [42]– [47]. Machine Learning techniques are broadly classified into 3 learning techniques or methods – Supervised Learning, Unsupervised Learning and Reinforcement Learning. The taxonomy of Machine Learning methods is shown in Figure 3 given below.

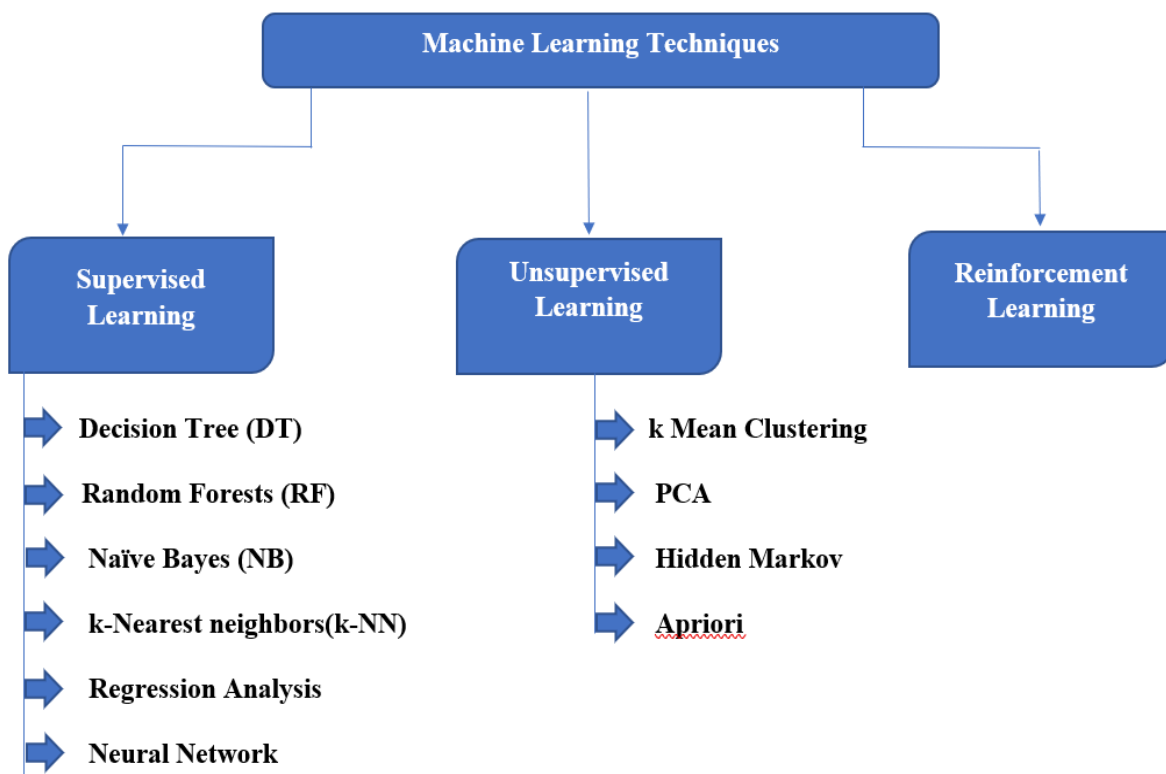


Fig 3: Taxonomy of Machine Learning Approaches

This systematic review focuses on the ML algorithms which are used to predict the insights so that these algorithms will be applied to predict happiness index. From past studies of predictive analytical techniques to predict happiness, depression, mental health issues, etc., the most popular techniques are fetched based on their performances. These Predictive Analytical algorithms are shown in Figure 4.

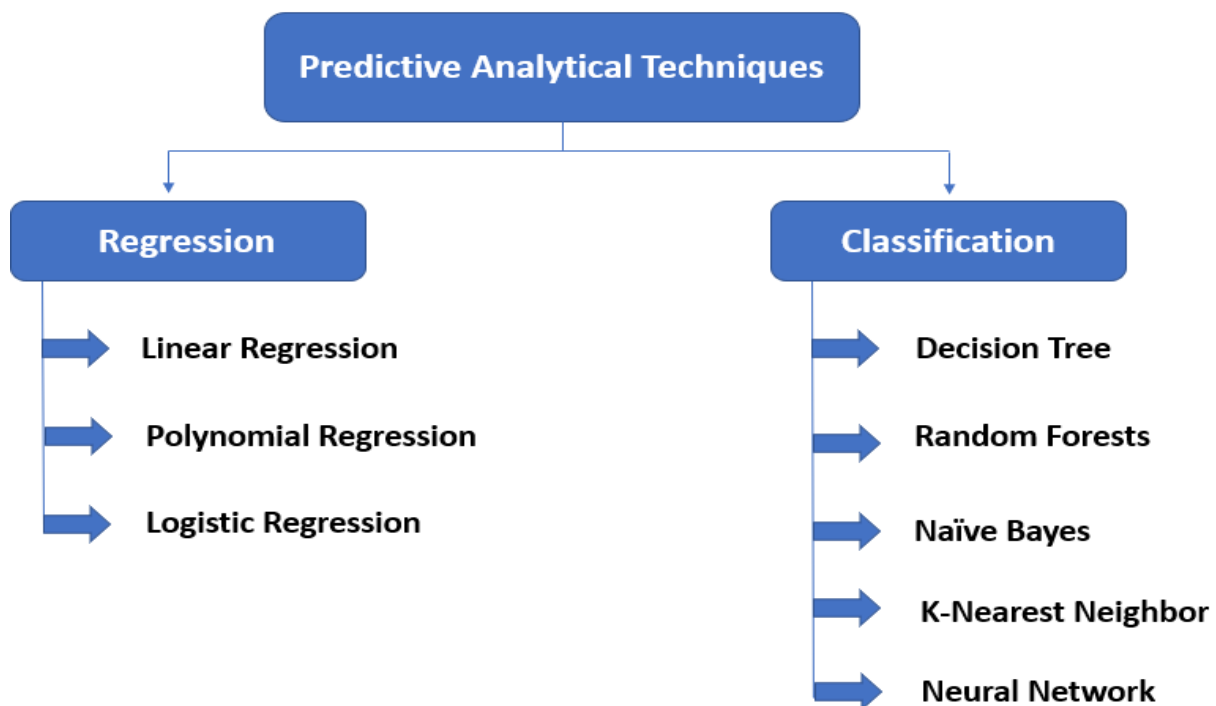


Fig 4: Predictive Analytics Techniques that are mostly used in Prediction

In 2021, Abdul Azim et al. analyzed the WHR 2019 with the aim to use Machine Learning approaches. Google Colab and Weka Machine Learning tools were used to model the report. After that, the authors used ML techniques i.e., Decision Table, Random Forest and SMOreg to predict happiness of a country. On the basis of the findings, Random Forest performed the best among all regressors and based on the ranking given by ML techniques, the most crucial factor for measuring happiness was generosity[21]. In addition to the ML approaches, S. Nikam added more approaches to predict HI of the world. The author made use of WHR from 2015 to 2021. She utilized Decision

Tree, Random Forest, KNN and Linear Regression. On the basis of R Square and RMSE (Root Mean Square Error), the Linear Regression fitted the data well and the model performed better than another model used[16]. To continue the research in this field Z. Yifei presented a Linear Regression model to predict happiness score of countries in 2022. The author utilized WHR from 2015 to 2021 to analyze data and the accuracy of model was tested by comparing it with the output values of WHR 2022. He concluded on the basis of the results that GDP is the best attribute to predict happiness score using linear regression[12].

S. Arora et al proposed a model working with 156 countries of WHR 2018 and 2019 using Unsupervised K-mean learning to find out the correlation between various factors adapted to find out happiness index. The importance of factors included in WHR with the help of Unsupervised K-mean learning method was also discussed by the authors[22]. Furthermore, while discussing ML and HI, K.D. Mahato et al conducted research on Decision Tree, XGBoost, Gradient Boosting and Linear Regression predictive algorithms to predict happiness score. The authors concluded that among the six factors in WHR, Health and GDP were considered best to predict HI. The best result was obtained by Linear Regression with an accuracy of 97.56% [4].

Focusing on the accuracy of predictive techniques, Takorn P. and Piyanuch C. constructed a happiness prediction model for employees in an organization based on the information gathered from the survey. The authors put into service four Machine Learning approaches, viz. Decision Tree, Multi-layer Perceptron, K-Nearest Neighbor (KNN), and Naïve Bayes. The dataset collected by the authors was imbalanced so to solve this issue they used two primal techniques, under-sampling and over-sampling techniques. The experiments demonstrated that Decision Tree approach with random over-sampling technique is the best happiness prediction algorithm. The accuracy of the proposed prediction model was nearly equal to 87.66 percent[23]. P.K. Sharma et al. proposed a supervised two-tier ML analytical model to predict the BLI (Better Life Index) of a country by considering a dataset from the Organization for Economic Corporation and Development (OECD) regional statistics. The proposed model was a stacked generalization based on a novel method that combined different ML methods to produce a Meta-Machine Learning model to maximize the prediction accuracy. The authors evaluated the model using accuracy

performance evaluators, R, r, and RMSE (Root Mean Squared Error). The experiments showed that the proposed model was approximately 90 percent accurate and more precise for predicting the life satisfaction score of a country[18].

A. Chakraborty and C. P. Tsokos in “A Real Data-Driven Analytical Model to Predict Happiness” established a non-linear analytical model that accurately predicts the average Happiness Score (HS) and score is based on eleven risk factors. The authors compared the proposed analytical model to three other statistical models, and the proposed model performed better in terms of RMSE (Root Mean Square Error) and MAE (Mean Absolute Error) than the others. Five major findings are included in the analytical model. The proposed model's response is the average happiness score of individuals in developed countries. In addition to predicting happiness, the proposed model identifies individual risk factors and their interactions that have a significant impact on happiness. These risk factors are ranked according to their percentage contribution to the HS. A rank is given to the developed countries based on their predicted HS from the developed model. The authors concluded that based on the research, Finland ranks first, Denmark is on the second rank and United States is ranked fifth[14].

Fan Z. et al proposed a hierarchy-based ML model with a 2-layer structure using particle swarm optimization to predict happiness. On the basis of experiments, the authors concluded that the proposed model had the best accuracy i.e., 61.43% and an F1 score of 66.03%. So, this indicated that this model was effective in improving happiness prediction[15]. Table 6 summarizes the predictive algorithms applied to WHR and their performance and accuracy are noted as findings.

Table 6: Summary of Research Papers for Happiness Prediction Using Machine Learning

References	Authors	Techniques used	Dataset	Findings
[4]	K.D. Mahato et al	Decision Tree, XGBoost, Gradient boosting and Linear Regression	World Happiness Report 2020	Health and GDP were considered best to predict HI. The best result was obtained by Linear Regression with an accuracy of 97.56%.
		Decision Tree,		

[9]	P.V. Narayanrao and L.S. Kumari	Support Vector Machine, Naïve Bayes, KNN and Logistic Regression	Collected from Data Driven Inventory (DDI)	Different Algorithms were analysed and proposed the mechanism to predict depression through text on Twitter.
[12]	Z. Yifei	Linear Regression	World Happiness Report from 2015 to 2021	GDP was the best attribute to predict happiness score using linear regression.
[16]	S. Nikam	Decision Tree, Random Forest, KNN and Linear Regression	World Happiness Report from 2015 to 2021	Linear Regression fitted the data well and the model performed better than other models used.
[18]	P.K. Sharma et al.	Decision Tree, Random Forest, Neural Network, Linear Model and Support Vector Machine	OECD regional statistics	The proposed ensemble model based on stack organisation was a better predictor of life satisfaction with an accuracy of 90%.
[21]	Abdul Azim et al	Decision Table, Random Forest and SMOreg	World Happiness Report 2019	Random Forest performed the best. The most crucial factor for measuring happiness was generosity. Will use more ML algorithms in the future.
[22]	S. Arora et al	Unsupervised K-mean learning method	World Happiness Report from 2018 to 2020	Discussed current factors affecting happiness. No work is done on factors affecting happiness in the field of ML.
[23]	Takorn P. and Piyanuch C	Decision Tree, Multi-layer Perceptron, KNN and Naïve Bayes	A questionnaire conducted in 2017	Decision Tree performed the best prediction with RandomOverSampler technique and the accuracy was 87.66%.

Several theories have been proposed in the field of ML to predict factors that affect HI, some focusing on economic factors, others on social factors but only a few works in literature demonstrate psychological factors as primary.

2.3 Happiness and Economic Factors

Z. Wang established a Mars social evaluation model of happiness. The author used many parameters to evaluate happiness, such as working hours, hourly wage, compulsory education, professional skills, social security and maternity leave. BP (Back Propagation) neural network was used to analyze the impact of GDP on happiness. The author concluded that based on personal perspective happiness is more important than the GDP but the social point is more important than the personal so according to the social perspective GDP is a more important factor than happiness and other factors discussed in this paper. Therefore, it was reported in the literature that GDP is more favorable to encouraging the development and progress of Mars's society, as well as maintaining Mars' social stability[48]. In addition, to justify the importance of GDP, M. A. Sayfi et al. conducted research on World happiness report datasets to categorize the most precarious variables related to the life happiness score. The authors used supervised Machine Learning approaches to reveal insights from the data and Neural Network Classifier to define the variable's importance. They used several variables that affect world happiness score and the variables are regional indicators, social support, GDP per capita, freedom, corruption, generosity, and healthy life expectancy. The results showed that GDP per capita is the precarious variable of life happiness score and the second primary variable is the healthy life expectancy[6].

L. You made use of ML to make some predictions and to analyze features linked to the happiness index. The author collected a random number of happiness index of Chinese people and asked some relevant questions. Furthermore, the author used linear models and tree models to analyze the attributes related to HI and to make predictions. By using tree models, the authors ranked the feature's importance, showing which feature is closely related to HI. The experiments showed that the most relevant features are income, education and health[7].

2.4 Happiness and Social vs. Individual Level

In previous studies, it is noticed that the social point of view is more important than the personal one. Indian people are more concerned with social status than their well-being[30]. To support social factors F. Mohamadian et al. studied influencing factors on happiness, such as gender, married status, happy parents, informal social participants, formal participants, education, [32] and employment status. The authors concluded that good and cordial relationships with others, including family, relatives, and friends (informal social participation), are the primary sources of life satisfaction and human happiness. Higher-income can increase happiness by increasing access to needs, desires, problem-solving, social support, self-esteem, and opportunities to participate in one's favorite activities. According to this research, social level and interaction are the most important factors of happiness. In order to show the significance of social level and individual level, Y.K Ng stated that there are four important F's for Happiness at an individual level, these are **Family, Friends, Faith and Fitness**. He continued by pointing out that religious faith is likely underestimated in terms of happiness. Despite their lower income, believers are truly happy. As a result, the positive effect of faith on happiness must be large enough to compensate for the negative effect of income. The author added more factors that affect happiness at a social level which include equality, environmental quality, freedom, social capital (including trust), government quality and democracy[30].

H. Sukmana et al. described happiness level of society and the factors that impact happiness. The authors conducted quantitative research in Sidoarjo Regency taking 423 participants as a sample. They used simple random sampling techniques and prepare a questionnaire that includes variables, such as health, education, income, employment, social relations, environmental conditions, domestic harmony, security, happiness, home ownership, transportation and leisure time availability. Regression analysis discovered that the most influencing factors on people's happiness are health, safety, family, leisure time, home and amenities, and affection. The authors further added that income, education, transportation, social relations and environmental conditions do not affect happiness as the influence of these six variables is very small based on t test[29].

In addition, G. Tampubolon et al. examined the contextual and individual factors that influence life satisfaction and happiness in one of the world's happiest countries, Indonesia. The findings

show that factors influencing happiness and life satisfaction go beyond individual differences. Happiness and life satisfaction are also strongly related to factors within a person's household and at the district government level. Individuals who live in better-off households are happier and more satisfied. Unemployment and poor health have a negative impact on happiness and life satisfaction. Individuals who live in districts where governments provide better public services are happier and more satisfied. Those who live in areas of conflict and violence, on the other hand, are less happy and satisfied[49].

2.5 Happiness and Psychological Factors

In terms of psychological contexts, a number of authors have recognized different types of psychological factors on happiness. H. K. Kim et al. conducted a descriptive study to illustrate the factors that affect happiness of people who live in rural areas. The authors concluded that, in Korean rural residents, happiness was found to be influenced by age, social support, depression, and suicidal ideation. Adolescents' happiness score is on the lower side compared to the rest of the sample. The results demonstrate that there is a need for greater focus on teenagers and unmarried or separated citizens in the rural areas of Korea, especially those who have lower educational levels, lower economic status, and low social support, suffer from physical health problems, and history of violence in the past. Further, the authors added that People in rural areas with lower levels of happiness are more likely to commit suicide. As a result, their psychological health must be properly managed[31]. In addition, to justify the significance of mental health, M. Yazdkhasti et al. conducted a study using SEM (Structural Equation Model) by gender differences to examine the factors affecting mental health and happiness in the elderly. The authors provided an empirical model that depicts the relationship between mental health, happiness and related factors in the older population. Mental health problems, which had a negative causal relationship with happiness, are the most important factor affecting elderly happiness. The findings reveal that older women have lower educational levels, more symptoms of mental disorders, and were less happy than men[28]. To include more factors related to psychology, O. N. Medvedev and C. E.

Landhuis examined the relationship between happiness, quality of life and well-being by applying the widely used measures with satisfactory psychometric properties. The results indicated that psychological, social, physical health and environmental health collectively account for 73% of happiness as measured by the OHQ (Oxford Happiness Questionnaire) and 66% of subjective well-being. However, environmental factors only accounted for 14% of the variance in subjective well-being and were found to be insignificant in predicting happiness. In both situations, the psychological domain was the strongest and best predictor. These findings concluded that the environment does not seem to be a significant factor in determining an individual's happiness. In contrast to both environment and social interactions, the psychological domain, however, was found to be the best predictor of both subjective well-being and happiness[50].

2.6 Happiness and Other Factors

Some authors also suggested that there are some other factors that affect happiness like age group, physical activities, safety and physical well-being. Fig 5 depicts some other factors that are not included to measure Happiness Index. A.D. Moghadam et al. conducted a study of young people aged 15 to 29 years. The authors used multistage cluster random sampling to select the respondent. The result concluded that age group, physical activities, type of occupation and place of residence are the factors that are important for a young person's happiness. Furthermore, the authors added that there is no significant relationship between education, gender and marital status with happiness index among young people[34]. In order to add new factors, S. Chopra et al. analyzed the happiness index and its relationship with various factors. The authors opted for a survey by designing a questionnaire. This study is conducted to find out the reasons behind low happiness index of the country. They considered the factors determined by the UN and they also introduced physical well-being and personal safety. Physical well-being was found to be the most influential in determining the happiness of the selected sample through multiple regression, and it was also observed that it was the same factor with the lowest average, implying that a low value of physical well-being among the sample in the area of study undertaken is also causing a low value of happiness index[33].

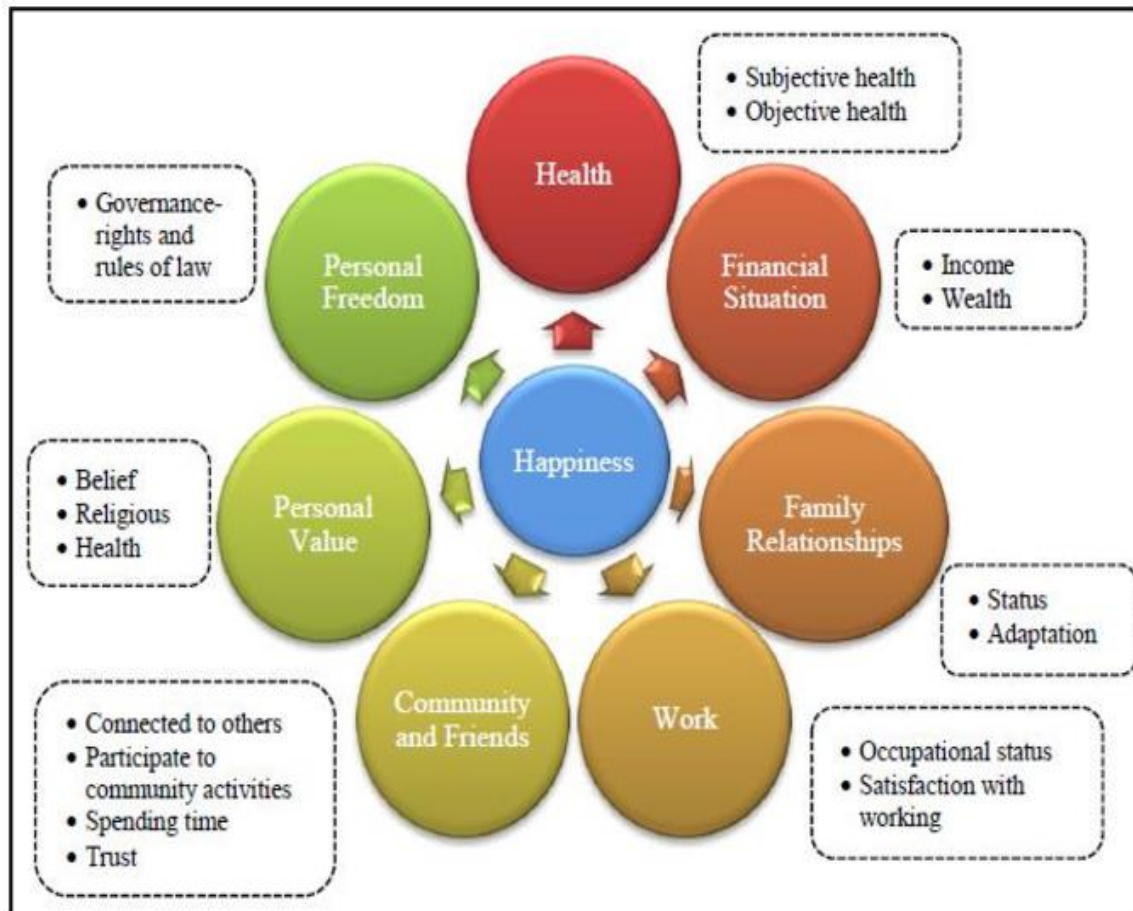


Fig 5: Factors Affecting Happiness [51]

3 How Machine Learning and Happiness Index are related?

Predictive analytics has a wide range of applications in every field. In the medical field predictive techniques are used to predict mental health issues, heartbeats, Diabetes, depression, etc.[9], [19], [52]– [54]. Therefore, past researches show that prediction using predictive analytics techniques is very popular and give good accuracy. There is a vast range of algorithms of ML for prediction[44], [46], [55]– [60]. So, it is a good approach to predict HI using Machine Learning approaches.

4 Lesson Learnt from this study

1. Gallup World Poll usually includes more than 100,000 participants from 130 distinct countries. The general annual sample for each country is 1,000 people. If a country had surveys each year, then the sample size would be 3,000[35]. Therefore, there is a need to increase the sample size so that it becomes more representative.
2. Past researches related to Machine Learning Predictive Techniques focus on the accuracy of predictive models which use different ML approaches to predict happiness index only whereas they never considered the effectiveness of factors so there is a need for the inclusion of new factors to predict Happiness Index.
3. Factors that are not included in predictive models of Happiness and the World Happiness Report are fetched from previous studies of psychology with their importance. Table 7 depicts the factors that can be used to find out the HI of a country with their description. The importance of factors at different geographical locations, environments and work areas, etc. is also required to be analysed. So, there is a need to consider these factors so that HI can be calculated accurately.

Table 7: Attributes fetched from past studies that can be used in the prediction of happiness

Attribute	Description and importance
Personal Safety	The state of being safe or unlikely to present a threat to health or safety[29], [33].
Access to Services	One of the primary indicators of prosperity is the accessibility of services, which affects how people obtain the essentials for fulfilling their requirements[18].
Health	Additionally, there are regional variances in well-being outcomes that are not fully acknowledged as a result of unequal access to health and well-being services[7], [18], [29].
Faith	Faith comprises religious faith. Here, more important than participating in religious rituals are spirituality and hope[13], [30].
Environmental Outcomes	The state of the neighbourhood has an impact on prosperity. Currently, air pollution is included, but other environmental quality factors, such as water and waste, should be included as well[18].

Income	The ability to earn money is crucial to one's personal well-being. It also contributes to life's pleasure by enabling people to meet their fundamental needs[7], [18].
Education	Education can provide multiple private benefits in terms of expertise, employment, and well-being. Furthermore, there is proof that education has absolutely crucial social returns, which influence incremental political cooperation, a location's overall productivity, and crime rates[7], [18].
Life Satisfaction	This determines how individuals experience and perceive their lives[18], [49].
Equality	Equality in wealth, income and status. It minimizes the crime rate and encourages social harmony[30], [32].
Community	Considered to be significant contributors to personal well-being include positive relationships, social network supports and confidence or trust in others[32].
Jobs	Jobs, or employment, are another aspect of well-being that significantly affects people's circumstances. Gaining new skills is made easier by working, and it also affects aspects of well-being like health, social contacts and life satisfaction[18], [34].
Depression Or Mental Disorder	Depression is a mental condition that leads to a constant sense of sadness and dullness. It impacts how you think, and behave and can cause a number of mental and physical issues. It is also known as major depressive disorder or clinical depression[28], [31].
Physical Activities	The term "physical activity" refers to any skeletal muscle-produced motion that involves an energy expenditure[34].
Leisure Time	Leisure, also known as free time or quality time, is time spent away from work, housework, business, and education. It also excludes time spent on essential activities like sleeping. It includes sports, clubs, talking with family and friends, and many more activities that relax your mind[13], [29].
Family	Being with parents and children. The importance given to married life and relatives [29], [32].

5 Conclusion and Future Directions

In this paper, a systematic review of factors affecting happiness, happiness prediction and Machine Learning techniques to predict happiness are analyzed. This study uses a systematic review using the PRISMA style. Despite the fact that the search produced over 750 qualifying papers, 60 articles were left after filtering methods based on title screening, abstract screening, full-text screening and year of publications. To narrow the search results, key search words are used i.e., Machine Learning, Happiness Prediction, Happiness Index and Predictive Techniques.

Without knowing the impact of factors on happiness, the existing models are not useful for Psychologist, psychiatrists, Society and any other stakeholders. The past researches focus on the accuracy of predictive models which use different ML approaches to predict HI. New factors that are related to social, psychological, environmental, etc. are never considered in ML approaches with WHR. The sample size taken by WHR of a country is very small. WHR is used as a dataset only rather than analyzing the factors affecting happiness.

It is observed that there is a requirement to develop a Machine Learning model which works on additional factors like social, psychological, environmental, etc. along with the six factors present in WHR, the model can be able to target a large number of populations and the importance of factors at different geographical location, environment and work area, etc. is also required to be analyzed.

There is a need to develop a Machine Learning model able to analyze maximum factors in a particular situation (geographical, academic, social, psychological, etc.) to predict the HI of a nation or of a targeted group so that society can be benefited.

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