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## RESEARCH ARTICLE

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### DIAGNOSING EMOTIONAL ABUSE AMONG PRIMARY SCHOOL STUDENTS USING MACHINE LEARNING TECHNIQUES

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#### Abstract

The child's mental and physical health plays an important role in the development of society, as it constitutes the cornerstone in the development and upbringing of society. Therefore, most developed and underdeveloped countries seek to give the child priority in their plans and strategies. One of the risks for the sponsor is emotional abuse. Which requires the use of methods and strategies to detect these risks. Some machine learning methods provide the ability to classify and therefore we tried through our research to use them as a method for diagnosing the child's mood in terms of emotional abuse. This research examines the ability of machine learning algorithms to diagnose emotional abuse among children in Iraq. The study concluded that the use of each of the previous methods can diagnose emotional abuse in a child, but the nearest neighbor algorithm is considered the best method for diagnosing emotional abuse, according to the evaluation criteria used.

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#### Introduction: -

Emotional abuse is widespread in most societies, and attention has increased due to the danger it poses to children in particular and to society in general. The World Health Organization has confirmed the increased risk of children who have suffered from emotional maltreatment and other types of abuse being exposed to health, behavioral, physical, and psychological problems in adolescence which may extend to more than. Emotional abuse is considered a precursor to physical abuse (Gama et al., 2021; Hart & Glaser, 2011). People who suffer from emotional abuse suffer from depression, anxiety, feelings of worthlessness, mood swings, and inappropriate emotional responses (Heim et al., 2013; Karakurt & Silver, 2013) Victims of emotional abuse isolate themselves due to repeated threats, manipulation, and intimidation caused by another person. Emotional abuse can be difficult to detect since there are no physical signs of it (Kimber, 2017). Emotional abuse can be the most harmful type of abuse because it leads to long-term harmful effects on adults (Karakurt & Silver, 2013). To be careful of the consequences resulting from emotional abuse, early detection of the extent of children's exposure to emotional abuse must be made. There are several scales to determine the extent of a child's exposure to emotional abuse, including the (Neil Jacobson and John Gottman) scale, which classifies the respondents into (not being emotionally abused, being emotionally abused, or being more severely abused).

The progress made in the field of artificial intelligence, which has been used in many fields in recent years, has made the field of diagnosing physical and psychological diseases one of the fields that have gained great interest from researchers and practitioners because of its great role in accurate diagnosis in many cases. Among the machine learning models that have been used in classification, which play a major role in diagnosing a pathological condition based on patient data, are classification algorithms (closest neighbor, decision tree, artificial neural networks) that can classify pathological and non-pathological conditions. Based on the above, the study aims to find out the extent to which machine learning algorithms can classify primary school students in Iraq in terms of their exposure to emotional abuse.

**Study Problem:**

Today's children are the leaders of the future, and they are the builders and pillars of society. Emotional abuse is a serious psychological problem, and this problem can happen to children in all societies in all types of families, regardless of cultural, social, and ethnic background, as it threatens the progress and cohesion of society.

The phenomenon of child abuse represents a danger to the child in all stages of his life, and many types of abuse fall under the name of abuse, including Physical abuse, psychological abuse, sexual abuse, and neglect, and each of these forms has its manifestations that we can notice on children in society. Children in Iraq, like all countries in the world, suffer from emotional abuse. This problem is exacerbated by the poor conditions in the country.

With the development taking place in the field of information and communication technology and its entry into all areas of life, and the emergence of machine learning algorithms that address classification problems (such as decision trees, the nearest neighbor algorithm, and artificial neural networks), it was necessary to know the extent of the ability of these algorithms to help psychologists diagnose a condition. The child in terms of exposure to emotional abuse. Based on the above, the following question can be asked: **How accurate are machine learning models in diagnosing the extent of children in Iraq to emotional abuse?**

**Research Objective and Importance:**

The research aims to diagnose the extent of primary school students in Iraq to emotional abuse using machine learning algorithms, due to its importance in early detection of emotional abuse and taking the necessary measures that prevent the child's condition from worsening, and thus This is reflected in the safety and development of society.

**Spatial Boundaries:**

Primary Students in Iraqi Schools.

**Temporal boundaries:**

The period between 2022-2023

**Research Methodology:-**

Machine learning algorithms were relied upon to diagnose the condition of children in terms of their exposure to emotional abuse after a set of questions were asked to a sample of 227 children in a primary school in Iraq, where by answering them, the child's condition will be diagnosed.

**Emotional abuse:**

The concept of child abuse is one of the concepts that are not defined according to the difference in time and the difference in societies and cultures around this concept. The World Health Organization defines child abuse as the neglect or mistreatment of children under 18 years old. This type of abuse includes emotional and physical mistreatment, commercial exploitation, sexual abuse, and neglect. These can cause harm to a kid's dignity, development, and health (McCall, 2017).

**Decision tree:**

A decision tree is a type of exploratory model that consists of a collection of classification questions. It allows an organization or individual to compare the various options available to them. It can also be utilized to create an algorithm that can predict the most advantageous decision. A decision tree is composed of a single node that starts with a potential outcome and then moves to other possibilities. Each subsequent result leads to more nodes, resulting in the tree's shape. There are three types of contracts, namely the opportunity, the decision, and the end. Opportunity

is a representation of the likelihood of a particular outcome, while the square indicates the decision to be made. The end node displays the outcome of the path. (Lucidchart, 2019).

A decision tree is a type of predictive model used in machine learning. It maps the relationship between an object's values and attributes by representing each node as an object. It also has branching paths that lead to the attributes and leaf nodes that correspond to the objects.

#### **K-Nearest Neighbor Algorithm:**

The nearest neighbor algorithm is one of the data mining algorithms, which were formulated in the early fifties of the last century. It relies on lazy learning methods to classify data. It is a non-parametric classification method based on the similarity of a point to a training set, where it uses the points of the nearest neighbors to be able to classify the data by collecting the values provided by the training patterns in the vicinity of the current point. It is used to classify data and to predict time series. It can be used in both linear and nonlinear regression models. Where the K-NN algorithm assumes that the data is spread in space in the form of points, the distance between these points is calculated through many methods, including (Euclidean distance, square distance), which is the most widely used Euclidean distance. After calculating the distance between the points, the neighbors closest to the observation to be estimated are chosen. The number of neighbors to be estimated is chosen experimentally, and the number that gives the least error is adopted for estimation. Then the arithmetic mean of the nearest neighbors is taken as an estimate of the required value (Kim, 2004).

#### **Artificial Neural Networks**

An artificial neural network is a computational method that mimics the way the brain functions when performing a specific task. It uses massive processing to simulate the brain's complex actions and makes use of simple processing units. It stores information and knowledge because humans have multiple input mechanisms that connect them to the world around them. In addition to being able to perform a specific task, an artificial neural network also needs input units and processing structures that perform mathematical operations to adjust the weights. These components are responsible for getting the appropriate reaction from the network. Like the human brain, an artificial neural network learns and stores information by training its neurons to use connecting forces. (Al-Hussein, 2009).

#### **Classified based on Neil Jacobson and John Gottman**

Initially, the data was categorized based on Neil Jacobson and John Gottman, to find out how vulnerable a student was to emotional abuse, the score would be calculated as follows:

Calculate the scores for each answer as shown in the following table (1):

**Table 1:-** The scores for each answer.

answer	score
never	1 point
rarely	2 point
occasionally	4 point
very often	5 point

1. If the total score is less than 73, the student is not being emotionally abused
2. If the total score is between 73-94, the student is being emotionally abused
3. If the total score is higher than 95, the students are being more severely abused than the average.

**Table 2:-** Results of emotional abuse classification according to Neil Jacobson and John Gottman.

emotional abuse	Class
not being emotionally abused	187
being emotionally abused	27
being more severely abused	13

#### **Diagnosing Emotional Abuse Using (the Nearest Neighbor Algorithm, decision tree Algorithm, and Neural Networks):**

To classify emotional abuse using the machine learning algorithms, data were entered into the orange program.

The following tables (3,4,5) show the results of classifying emotional abuse according to machine learning algorithms.

**Table 3:-** Classification results according to the nearest neighbor algorithm at k = 3

		Predicted			Σ
		1	2	3	
Actual	1	187	0	0	187
	2	1	26	0	27
	3	1	1	11	13
Σ		189	27	11	227

**Table 4:-** Classification results according to the decision tree algorithm.

		Predicted			Σ
		1	2	3	
Actual	1	187	0	0	187
	2	10	16	1	27
	3	1	0	12	13
Σ		198	16	13	227

**Table 5:-** Classification results according to artificial neural networks.

		Predicted			Σ
		1	2	3	
Actual	1	186	1	0	187
	2	0	23	4	27
	3	1	3	9	13
Σ		187	27	13	227

From tables (3,4,5), we find that: The sum of compatibility cases between the classification based on Neil Jacobson and John Gottman and the classification resulting from the machine learning algorithms is equal to (224 for the nearest neighbor algorithm, 215 for the decision tree algorithm, 218 for the artificial neural networks).

To assess the accuracy of the classification, we will be using the press's Q test. To conduct the test, the hypotheses are:

**Primary hypothesis:**

The classification generated by the machine learning algorithms (nearest neighbor algorithm, decision tree algorithm, artificial neural networks) is not statistically significant.

**Alternative hypothesis:**

The classification generated by the machine learning algorithms (nearest neighbor algorithm, decision tree algorithm, artificial neural networks) is statistically significant.

test index value: 
$$pressQ = \frac{[n - (n \text{ correct} \times c)]^2}{n(c - 1)}$$

c: number of classification groups, n: sample size, n correct: The number of correctly classified views.

By applying the test to the previous classification results, we find the result in the table (6):

**Table 6:-** The result of the press's Q test.

	nearest neighbor	decision tree	artificial neural networks
press's Q test	436.18	384.85	497.47

By comparing the previous values with the tabular value of 6.63, we reject the null hypothesis and acknowledge that the classification resulting from the machine learning algorithms is statistically significant.

#### A comparison between the methods for classifying emotional abuse:

Table (7) shows the evaluation criteria for each of the proposed methods:

**Table 7:-** Evaluation criteria for each of the proposed methods.

Model	AUC	CA	F1	Prec	MCC
Classification Tree	0.892	0.947	0.942	0.950	0.819
Neural Network	0.994	0.960	0.960	0.960	0.870
kNN	0.999	0.987	0.986	0.987	0.956

From Table (7) above, we find that the evaluation criteria for the nearest neighbor methods are better than the evaluation criteria for other methods.

#### Result: -

The research dealt with the classification of emotional abuse among the children of Iraq using some machine learning methods. Through the practical study, the research was able to answer each of the questions raised, as the accuracy of prediction was determined in the classification of emotional abuse, and we obtained high prediction accuracy (greater than 0.85%) by following each of the proposed methods. And in comparison between the proposed methods, we have reached the preference of the nearest neighborhood algorithm in classification, as the prediction accuracy according to the nearest neighbor algorithm reached (0.999) according to the AUC criterion, while according to the decision tree, the prediction accuracy reached (0.892), according to the artificial neural networks, the prediction accuracy reached to (0.892). (0.994). As it was through testing the hypotheses that there is no statistically significant difference between the classification according to the proposed methods and the classification that depends on.

#### Recommendations: -

1. We recommend making use of machine learning algorithms in diagnosis in the field of psychiatry.
2. We recommend a deeper study of the use of the method of discriminatory analysis and the method of artificial neural networks as a hybrid method for the classification of emotional abuse.

#### Reference: -

1. Lucidchart. (2019). What Is a Decision Tree Diagram? Retrieved from Lucidchart website: <https://www.lucidchart.com/pages/decision-tree>
2. Gama, C. M. F., Portugal, L. C. L., Gonçalves, R. M., de Souza Junior, S., Vilete, L. M. P., Mendlowicz, M. V., Pereira, M. G. (2021). The invisible scars of emotional abuse: a common and highly harmful form of childhood maltreatment. *BMC Psychiatry*, 21(1). <https://doi.org/10.1186/s12888-021-03134-0>
3. Hart, S. N., & Glaser, D. (2011). Psychological maltreatment – Maltreatment of the mind: A catalyst for advancing child protection toward proactive primary prevention and promotion of personal well-being. *Child Abuse & Neglect*, 35(10), 758–766. <https://doi.org/10.1016/j.chiabu.2011.06.002>
4. Heim, C. M., Mayberg, H. S., Mletzko, T., Nemeroff, C. B., & Pruessner, J. C. (2013). Decreased cortical representation of genital somatosensory field after childhood sexual abuse. *The American journal of psychiatry*, 170(6), 616–623. <https://doi.org/10.1176/appi.ajp.2013.12070950>
5. Karakurt, G., & Silver, K. E. (2013). Emotional abuse in intimate relationships: the role of gender and age. *Violence and Victims*, 28(5), 804–821. <https://doi.org/10.1891/0886-6708.vv-d-12-00041>
6. Kimber, M., McTavish, J. R., Couturier, J., Boven, A., Gill, S., Dimitropoulos, G., & MacMillan, H. L. (2017). Consequences of child emotional abuse, emotional neglect and exposure to intimate partner violence for eating disorders: a systematic critical review. *BMC psychology*, 5(1), 33. <https://doi.org/10.1186/s40359-017-0202-3>

7. <https://www.who.int/ar/news-room/fact-sheets/detail/child-maltreatment>
8. El-Desouki, A. (2018). The effectiveness of a counseling program to alleviate some psychological problems among ill-treated kindergarten children. *Journal of Studies in Social Work and Human Sciences*, 50, 149–184.
9. Kim, KY., Kim, BJ. & Yi, GS, (2004). The reuse of imputed data in microarray analysis increases imputation efficiency. *BMC Bioinformatics* 5, 160. <https://doi.org/10.1186/1471-2105-5-160>
10. Saleh, F.(2009).The effect of applying artificial intelligence and emotional intelligence on the quality of decision-making.Master's thesis, Middle East University for Postgraduate Studies, Jordan.Page 43.
11. Al-Hussein, Q. H., (2009).Introduction to artificial neural networks.Imam Jaafar Al-Sadiq University, peace be upon him, Lebanon, page 3-4.
12. Chang, F. J., Chiang, Y. M., & Chang, L. C. (2007). Multi-step-ahead neural networks for flood forecasting. *Hydrological sciences journal*, 52(1), 114-130.
13. Gonzalez D, McCall JD. Child Abuse and Neglect. [Updated 2017 Oct 31]. In: Stat Pearls from Available.- [Internet]. Treasure Island (FL): Stat Pearls Publishing; 2018 Jan. <https://europepmc.org/books/NBK459146;jsessionid=66F845DE680113AB2F908B EF7DEC4E>.