A Prediction Model for studying the Impact of Separated Families on Students using Decision Tree

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Summary

Social studies show that the number of separated families have lately increased due to different reasons. Despite the causes for family rift, many problems are resulted which affected the children physically and psychologically. This effect may cause them fail in their life especially at school. This paper focuses on the negative reaction of the parents' separation with other factors from the computer science prospective. Since the artificial intelligent field is the most common widespread in computer science, a predictive model is built to predict if a specific child whose parents separated, may complete the school successfully or fail to continue his education. This will be done using Decision Tree that have proved their effectiveness on the predication applications. As an experiment, a sample of individuals is randomly chosen and applied on our prediction model. As a result, this model shows that the separation may cause the child success at school if other factors are satisfied; the intelligent of the guardian, the relation between the parents after the separation, his age at the separation time, etc.

Keywords:
Machine learning, Predictive decision tree, Social studies, If-then-else rules.

1. Introduction

Machine learning is considerable a subset of Artificial Intelligent (AI) where it designs algorithms that allow a computer to learn and takes care of any problem after identifying the available data. There are many types of algorithms of machine learning; supervised learning is one of them [1]. Supervised algorithm is used to generate a function that maps inputs to desired outputs. There are many types of it; Decision tree is the most common one.

Decision tree has many applications in real life; classification and prediction are two forms of data analysis that can be used to model a solution of a problem and can use the decision tree algorithm [2]. The problem statement is represented by the tree root, however, a set of solutions are represented by the tree branches which can expand all the possibilities of a problem statement to any length. This way makes the user visualize each step of solution and making a decision becomes much easier depends on regression than most other methods [3].

On the other hand, many statistics have shown that the ratio of divorce has noticeably increased and the children were severely affected since the bad relation between parents makes the parents under pressure and always increases the tension between parents and their children. Consequently, this tension makes them struggle or have conflict in areas such as basic values, education or religion. If the family atmosphere is disturbed and the child suffers from family disintegration, he will have complicated personality, which effects his interaction with the society especially at school. The majority of these children are in need of psychological rehabilitation programs. In other cases as proven in some studies, the divorce can solve problems found between parents and therefore, make them more stable and help their children overcome this time and have good personality.

In this research and regards the reasons for the divorce or separation of the parents, the impact of this social phenomenon on the children is investigated and a model using decision tree is built to predict if the separated children will pass school successfully or fail.

This paper consists of six sections. Section 2 presents the related researches applied to students at schools in different countries to measure either their academic achievement or their social lives. Section 3 represents our model from a social study perspective. Section 4 represents the model using if then else rules depicted by a flow chart. Section 5 applies the model on set of data and discuss the results. Section 6 represents the conclusion.

2. State of the art

Many studies have been conducted on school students for many reasons; one of them for knowing the reason for bullying, others to investigate the most important factor needed to keep the unity of the family, or to predict if the student will graduate at the time or not.

School bullying could be physical, verbal, relational/social aggression and cyber bullying. Children who are exposed to bullying report psycho-social health problems such as emotional trauma, a negative impact on school life, syndromes such as depression and anxiety. A study which applied to students in a city in Turkey showed that boys, older students, and those who have parents living separately were more bullied than other students, and students who were overweight and had a low socio-economic status tended to be exposed to more bullying than their counterparts [4].

Another study was conducted to measure the happiness level among students at school in Jordan. It is mentioned that the level of the mother's education is very important factor to keep family cohesion and make children happy [5]. Another study showed that positive psychotherapy helps children of divorce to have balanced personality and make their life more stable [6]. So if the guardian is smart, he/she can discover characteristic abilities for the divorced children directly or indirectly by conducting psychotherapy. The guardian can find ways to develop them in organized fashion cause to reach final aim of personal growth and prosperity and then get over the divorce problem and being normal children.

Another study made a comparison of academic motivation, social adjustment and happiness among the students with divorced parents and regular ones in primary schools in Iran. The result showed that the academic motivation of students with divorced parents is more than the students with regular parents while the social adjustment and happiness of students with regular parents is more than students with divorced parents [7].

Another study found evidence for a significant positive effect of parental migration and left their children living in transnational families on their school performance, however, the study showed a higher probability of suffering from depression and having health problems more frequently [8].

Understanding the academic success of Black students from single-mothers who know the schooling experiences is investigated in [9]. This study focused on factors that contribute to academic success: a deeply invested mother, and social-relational supports.

All the previous studies are social studies, which depend on having samples of students under investigation and apply social theories until reach the mentioned results. However,

there is a research paper that applies the decision tree algorithm to predict student graduation by generating rules sets that could early predict and identify students who are not having graduation on time. This application consists of six phases, which include understanding the problem and data, data preparation, data mining, evaluation of the discovered knowledge and use of the discovered knowledge [10].

3. The impact of parent's separation on children

Many reasons could make the effect of the separation worse or neglected on the children; bullying, level of the education of the mother, how smart is the guardian,

There are some factors have to be taken under consideration when we make a prediction if the child whose parents are separated will pass school or fail. These factors can affect any child; however, their effect is deeper in the case of separated family. These factors might concern the child himself, the parents, his guardian or his siblings (if there is any). After investigation in all kinds of communities, it was found that after separation, the child (ren) might stay with their mother, father or grandparents. The person who the child stay with is called a guardian.

The factors that affect the status of the child at school are:

- Intelligent and wisdom level of the guardian: it is believe that it is the most important factor. If the guardian is intelligent with wisdom, he/she will care about the child and his future and in this case the child could pass school. If the intelligent of the guardian is in normal range or less, the chance of failure will be high.
- Age of the child: If the separation happened when the child was very young (less 5 years), he is not affected. However, if the separation happens in later age, the child could be affected badly.
- The Social level: if the social level of the guardian is high to medium, the guardian can take care well of the child. The child could have his needs from different School supplies to private tutors to help him scholastic achievement. Otherwise, the chance of failure will be high.
- Sibling's presence: if the child has siblings, they could help each other overcome their circumstances and succeed in the school. If he is alone, the chance of failure will be high.
- Educational level of the siblings: if there are siblings to the child under investigation, their educational level has to be known. If they are doing well at their school, the child will pass school. Otherwise, the chance of failure will be high.

The relation between the parents after the separation and between them with the child: Of course if there is a good relation between his mother and father after separation, they can discuss any issues regard their children with each other

and reach solution and the children can live normally in this case. However, if there is always problem with them, the child could not see the other parent and he will be raised with lots of problems which can affect negatively his achievement at school.

- The health status of the child: health status might be physiologically or psychologically. If he is normal with good health, he could pass school. But if his health is affected with the separation or he has some problem from the beginning, he may fail.

- The child appearance: The appearance of the child in any case can make other students at school bully him. Bullying affect the child from separated family more than other children. If the child is normal, so he could have friends who help him and make him happy at school. If he has something wrong in his appearance (ugly, very tall, very short, fat), he could hate school.
- The personality of the child: If he has a good personality and social skills, he could pass very well.
- His talents: If the child has any talent (drawing, writing, reading, music…), he could spend some times with it unloading his stress if feels with it then he can return to study positively.

4. Applying the prediction model to study the impact of separated family on students

To build a model using decision tree for predict applications, an if then else rule statements from the datasets has to be constructed. The datasets are divided into training and testing data. The training data was used to develop a model using machine learning algorithm. The ISFS model is then tested using testing data to determine the accuracy.

To take a predication about if the child will pass the school years successfully or not, the following rules have to be applied:

TABLE I

THE VARIABLES, THEIR DATA TYPE AND THEIR MEANING

Rule 1: if the intelligent level of the guardian is high, the child will succeed and exit.
Rule 2: If the social level is high or normal, then go to Rule 6.
Rule 3: If the age of the child at the separation time was less than 5 years old, then go to Rule 6.
Rule 4: If the number of siblings > 0 AND they are good at school, the child will succeed and exit.
Rule 5: If the number of siblings > 0 AND they are bad at school, the child could be different than his siblings, more factors have to be studies and go to Rule 7

Rule 6: If the relation between the father and mother is good, the child will succeed and exit.
Rule 7: if his health status > 70%, the child will succeed and exit.
Rule 8: If he has good shape and appearance, he will succeed and exit.
Rule 9: If he has a talent, he will succeed and exit.
Rule 10: Otherwise, The child will fail at school and exit

The previous rules are translated visually to the flowchart shown in Figure 1 using the parameters described in section 5.

5. Experimentations

Our initial database contains a test sample of 101 observations (O), the descriptor variables are shown in the first line of Table 2. An observation consists of a person described by 10 variables:

- Intelligence level defined by $X1$, is a binary variable that takes 1 for high level and 0 for normal or low level;
- Social level, defined by $X2$, is a binary variable that takes 1 for high or normal level and 0 for low level;
- Number of cablings defined by $X3$;
- Education level of cablings defined by $X4$, is a binary variable that takes 1 if siblings have succeed in their education course, 0 otherwise
- Age defined by $X5$;
- Relation between father and mother after separation is defined by $X6$. It takes 1 if the relation is good, 0 otherwise;
- Health status defined by $X7$, indicates the physical condition of the child in percentage (100% for an excellent health condition);
- Appearance defined by $X8$, is an integer from 1 to 6: 1 for normal, 2 for ugly, 3 for tall, 4 for short, 5 for fat and 6 for thin;
- Personality defined by $X9$, is a binary variable where 1 corresponds to a strong to normal personality and 0 for a weak personality;
- Talent defined by $X10$, can take values from 0 to 5 such that 1 corresponds to drawing, 2 for reading, 3 for writing, 4 for music, 5 for other skills and 0 for no skills at all.

The first treatment consists on selecting download the data set (see flowchart in Figure 1.) The predictive target (X) is a bi-valued variable. It is called Impact and can take either yes or no. In a second step the base is randomly cut into two partitions. The first contains 70 individuals (about 2 thirds of the total observations). It corresponds to the learning base or training set. The second set contains the remainder i.e. 31 individuals (a roughly 1 tier of observations). This set

corresponds to the test base. In a third step, we use decision trees for predicting the impact (failure or success of the child in his school process) as a target variable. Considering the number of initial parameters and the number of observations, we have a fairly large tree depicted by Figure 2.

The fourth step consists on applying the decision tree on the training set for the prediction of the impact variable. We then use the same decision variable on the remaining observations, namely on the testing set.

The last step consists on calculating the estimated error of our model. The latter succeeds to estimate the predicted variable with an error rate estimated to 0%. Indeed, all observations of the test sample have been well classified which demonstrates the effectiveness of our model.
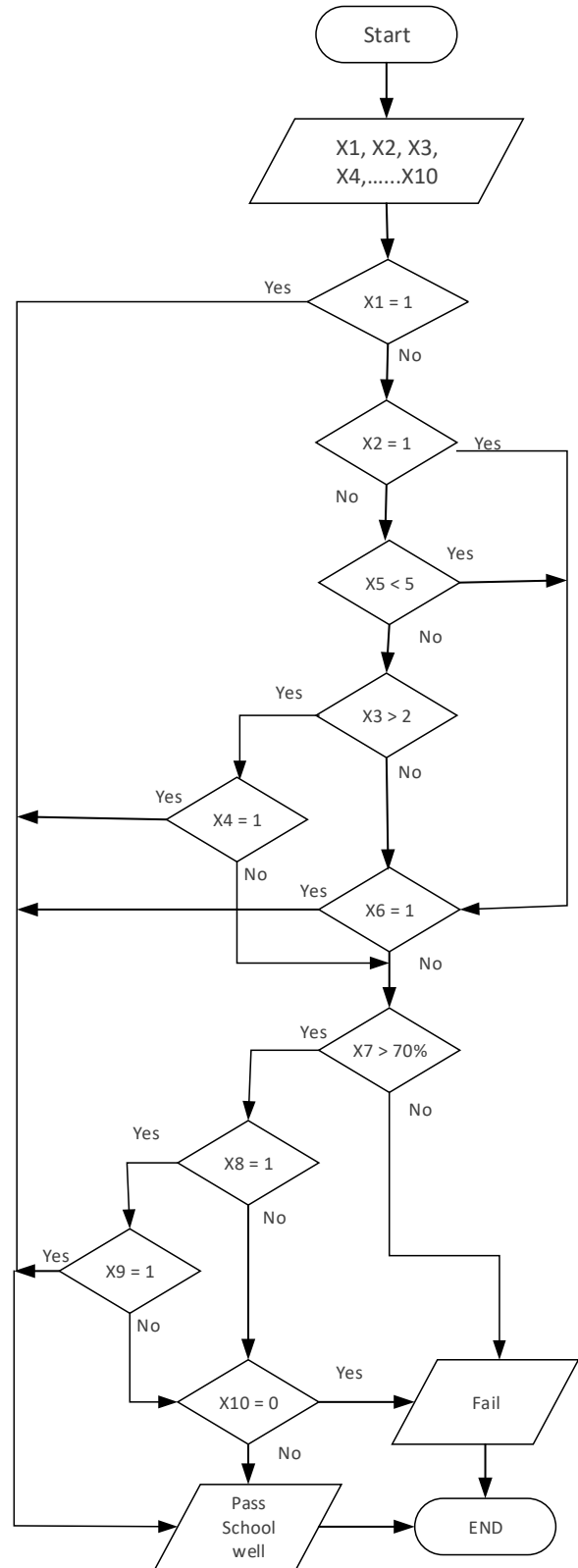

Fig. 1. The flow chart of ISFS prediction model using the variables of Table1.

6. Conclusion

This paper experiments a prediction model that have been used to study the impact of separated families on their children. This paper also studies other factors that may increase or decrease the impact of the separation on the child and considers them all when building the prediction model which depends on one of the machine learning algorithms; decision trees. The "if then else" rules are constructed for the model and applied to a sample of dataset. The model has led to excellent results with a null error rate.
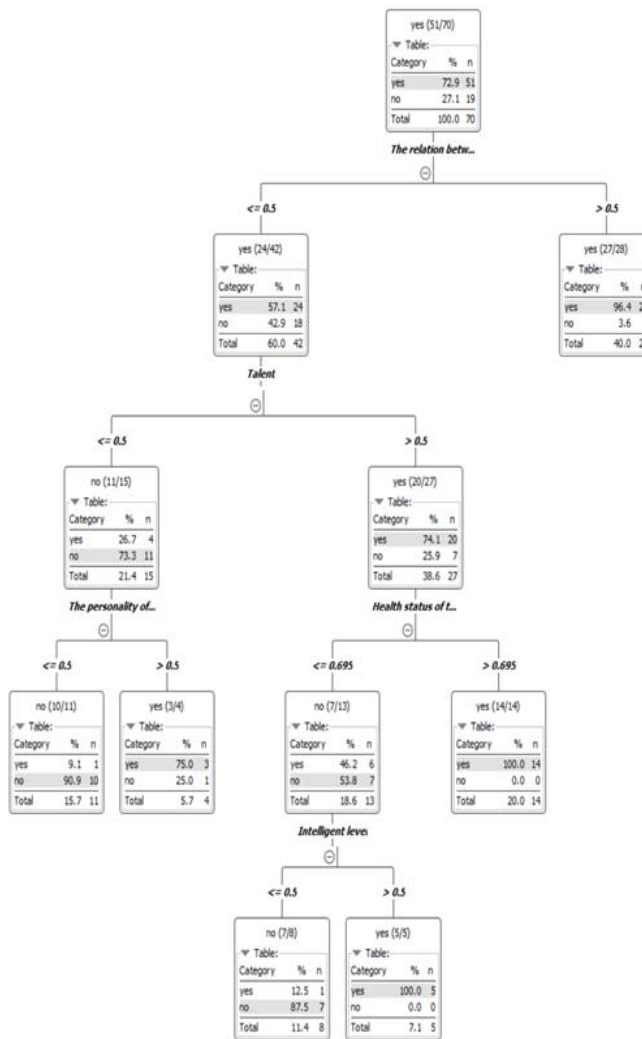

Fig. 2. Decision tree derived from learning examples.

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