International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue: 05 | May 2024 www.irjet.net p-ISSN: 2395-0072

PREDICTION OF CHILDREN BLOOD GROUP USING PARENTS BLOOD GROUP

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Abstract - Abstract - *Many medical applications, such as genetic counselling and transfusion therapy, depend on an understanding of the inheritance patterns of ABO blood groups. We looked at how well parents' blood types predict the possible blood group of their children in this study. We examined all potential pairings of alleles inherited from each parent using a computational method based on Punnett squares in order to predict the blood type of the child. The amalgamation of the parents' blood types offers significant information on the probable blood types of the progeny, as our findings indicate. We discovered that a child's probable blood types can vary depending on the blood group combinations of its parents; some combinations result in a smaller range of possible outcomes.* Furthermore, the significance of taking into account genetic heterogeneity within populations and the possibility of uncommon blood group phenotypes is underscored by our findings. Our findings have consequences for clinical practice and advance our understanding of ABO blood group inheritance. They are especially relevant when discussing blood transfusions, organ transplantation, and genetic counselling. The accuracy of predicting a child's blood group based on their parents' blood types may be improved by additional study using bigger sample sizes and genetic markers.

Key Words: *Blood Groupings Based on ABO,parental connection,* ABO antigens, Rh antigens, Random Forest Classifier

1.INTRODUCTION

Knowing the blood group inheritance patterns is a key component in the complex field of healthcare. Predicting a child's blood group based on their parent's blood type is extremely important, since it can help with everything from safe blood transfusions to identifying genetic links through paternity testing. Our effort aims to provide insight into the genetic basis of blood type inheritance by creating a predictive model. Blood group inheritance is based on well-established genetic theories, most notably Mendelian inheritance. According to this theory, blood groups—which are divided into systems like Rh and ABO—are passed down in predictable ways from parents to their children. But determining a child's precise blood type from their parents' blood types necessitates statistical analysis and a sophisticated grasp of genetic relationships. This is where our research enters the picture. We use cutting edge machine learning algorithms to accurately forecast outcomes and decipher the complexity of blood group inheritance. Repercussions from precise blood group prediction are extensive and extend across several healthcare sectors. To avoid negative responses during blood transfusions, it is crucial to make sure the blood types of the donor and the recipient are compatible. Healthcare practitioners can improve patient safety and maximise the effectiveness of transfusion treatments by anticipating a child's blood type with accuracy and taking pre-emptive measures to identify potential compatibility concerns.

1.1 Scope

Investigating the ability of parental blood groups to predict the probable blood group of their kids is the goal of this study. The study specifically intends to use computational techniques, including Punnett squares, to examine potential allele combinations inherited from each parent and forecast the blood group of the offspring. The study also intends to evaluate the variation in expected results depending on various parental blood group combinations and investigate the clinical practice implications of these results, encompassing genetic counseling, organ transplantation, and transfusion therapy.

1.2 Objective

Our project's goal is to create a reliable predictive model that can reliably identify a child's blood group from their parents' blood types. Our objective is to give medical professionals a trustworthy tool for predicting the possible blood group results for offspring by utilizing machine learning algorithms and genetic inheritance patterns. Planning blood transfusions, paternity tests, and other medical situations where understanding blood group inheritance is essential are intended to be made easier with the use of this predictive model. Our ultimate goal is to improve patient care and healthcare decision-making by

offering a reliable and effective technique for determining a child's blood type.

2. LITERATURE SURVEY

Finding previous studies, research papers, and publications on the subject would be necessary for a literature review on the subject of predicting a child's blood group using parental blood groups. Here is a quick summary of what might be included in such a literature survey:

- Examining research articles:

Look for pertinent research articles on the subject of predicting a child's blood group based on their parents' blood group by searching academic databases (such as PubMed and Google Scholar). Seek publications that address inheritance patterns, the genetics of blood types, and computational techniques for predicting the blood groups of offspring.

- An Historical Perspective

Examine early research that established the groundwork for comprehending the genetics of ABO blood types as well as historical literature on blood group heredity.

- Hereditary and Genetic:

Examine the research on the genetics of ABO blood types, including Mendelian inheritance theory, population allele frequencies, and parent-to-child inheritance patterns of ABO blood types.

- Authenticity and Precision:

Review the literature to determine the reliability and accuracy of forecasts based on parental blood types. Seek research papers that compare predictive algorithms and computer models to real-world data.

- Difficulties and Prospects:

Elucidate the obstacles and constraints associated with forecasting a child's blood group based on the blood groups of their parents, along with possible directions for further investigation to enhance precision and pragmatic applications.

Researchers can better comprehend the status of knowledge today, spot gaps in the literature, and gather information for the design and methods of their own studies by undertaking an extensive literature review.

Table -1: Determination of Blood Group

Genotype (DNA)	Blood Type
AO or AA	A blood type
AB	AB blood type
BO or BB	B blood type
OO	O blood

ABO alleles are inherited by children from each biological parent. A mother with blood type O can only give birth to a child who carries an O allele. Given his blood type (AB),

3. METHODOLOGY:

3.1Information Gathering: Make sure the sample is diverse and covers a range of cultures and ethnicities by collecting information on the blood types of the parents and their children.

```
[7]  data.info()

     <class 'pandas.core.frame.DataFrame'>
     RangeIndex: 534 entries, 0 to 533
     Data columns (total 7 columns):
      #   Column                              Non-Null Count  Dtype
     ---  ------                              --------------  -----
      0   Timestamp                           534 non-null    object
      1   Username                            534 non-null    object
      2   Blood_Group                         534 non-null    object
      3   Mother's_Blood_Group                534 non-null    object
      4   Father's_Blood_Group                534 non-null    object
      5   Do you have any sibling/siblings?   534 non-null    object
      6   Sibling/siblings' Blood Group       499 non-null    object
     dtypes: object(7)
     memory usage: 29.3+ KB
```

Fig3.1:collection blood data

3.2ComputerisedInstruments:

Analyze the inheritance patterns of ABO blood groups and forecast the probable blood types of offspring based on parental blood groups by using computational techniques like Punnett squares or probability calculations.

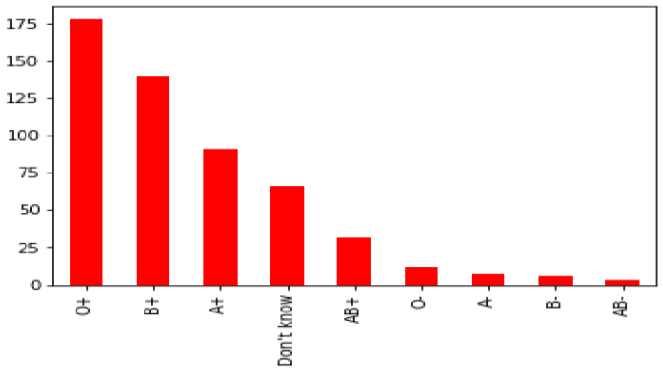

Fig3.2: graphical representation blood

3.3MoralAspects:
Assure that ethical standards are followed, and get the necessary consent before using participant data for the study.

3.4Reporting and Documentation
Thoroughly record the research's methodology, findings, and conclusions. Write a research report or paper that complies with academic requirements and provides concise justificationsfortheresults.

3.5AssessingtheModel
Assess the performance measures of the trained model (s0accuracy, precision, recall, and using the testing data. Moreover, rigorous evaluation may be achieved by using cross-validation approaches.

3.6Prognosis
Based on the blood groups of their parents, apply the trained and assessed model to predict the blood type of their kids. In order to determine the blood group of the kid, you may design an intuitive user interface that allows users to enter the blood groups of their parents.

4. ALGORITHM

Step 1: Enter the blood types (such as A, B, AB, or O) of both parents.

Step 2: Based on their blood types, ascertain what potential alleles each parent might pass on to the child.

Step 3: Produce every conceivable pairing of all levels that the offspring might inherit from their parents.

Step 4: Determine the child's blood group by combining the available allele combinations.

Step5: The child's potential blood groups* should be displayed

5. Schematic of architecture:

There are multiple steps involved in designing an architecture diagram that uses the blood groups of the parents to forecast the blood group of the child. This is a more basic diagram: The input data, which comprises the blood types of both parents, is represented by this layer. Module of Preprocessing The input data is preprocessed by this module to make sure it is in the right format for the prediction model. One-hot encoding or translating blood group types into numerical representations may be required for this. Model of Prediction The centre of the system is this. A machine learning model developed on a dataset of known parent-child blood group associations might be the source of the issue. Based on the blood groups of the parents, the model may predict the child's blood group using algorithms like logistic regression, decision trees, or neural networks.

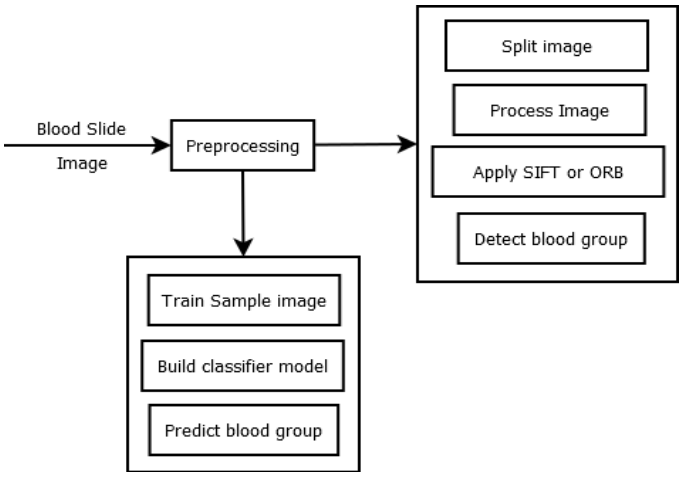

Fig5.1.Architecture Diagram

6.RESULT AND ANALYSIS

When determining the blood type of a kid, 16 potential combinations must be taken into account, as there are 4 distinct mother blood types and 4 possible paternal blood types. All 16 of the potential combinations are displayed in the tables that follow. It is feasible to find the potential blood types of a parent's offspring if you are aware of their blood types.

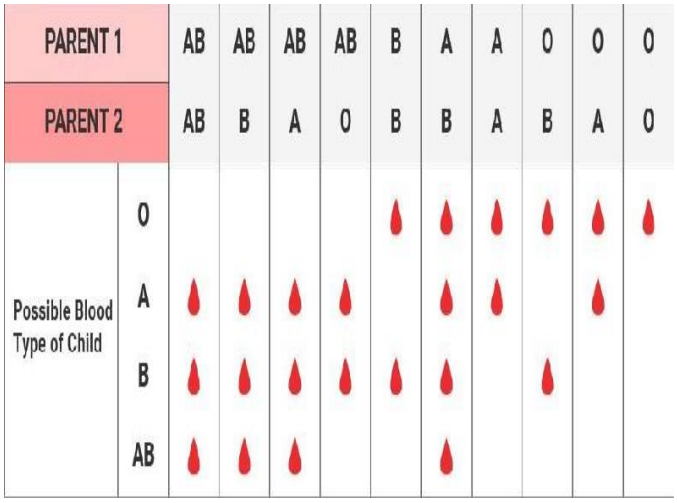

Fig6.1 -: ***Blood Group Typing***

Create a confusion matrix to see how well your model is performing. The confusion matrix will provide the total distribution of forecasts as well as the number of accurate and inaccurate predictions for each blood type category (such as A, B, AB, and O).

```
data.head()
```

	Blood_Group	Mother's_Blood_Group	Father's_Blood_Group
0	4	6	4
2	6	6	4
3	4	5	0
4	6	6	7
6	0	0	0

Fig 6.2:Pre-processed information

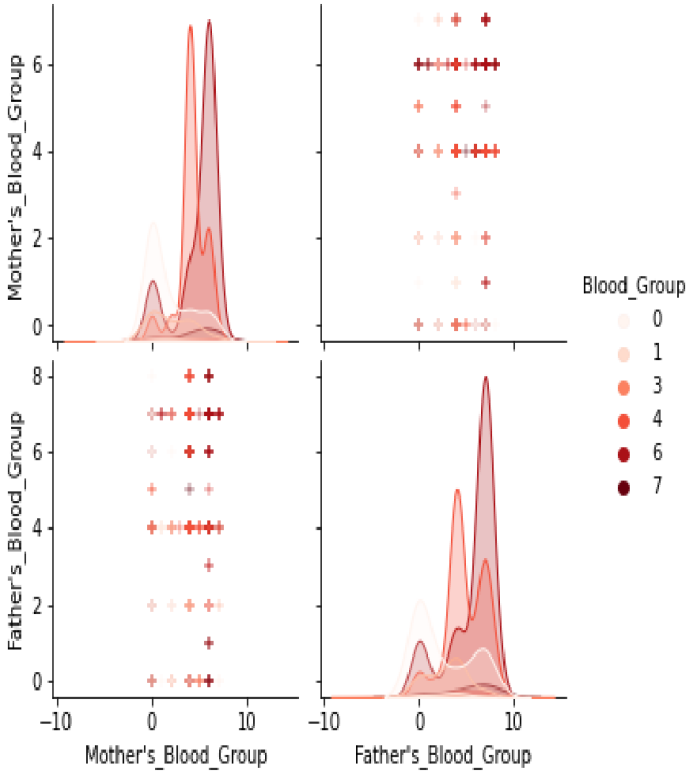

Fig 6.3: Distinguish between blood groups of mother and father

Pair plot illustrating the link between the blood groups of the mother and father. A person's codominant all levees determine their blood type. A chromosome's precise location in our DNA contains many forms of genetic information, one of which is called an allele. The human blood type, also referred to as IA, IB, and i, has three distinct alleles. For ease of communication, we can refer to these alleles as A, B, and O, respectively, for IA, IBBecause we each receive one blood type allele from our biological father and one from our biological mother, we each have two ABO blood type alleles. The genotype is a term used to describe the pair of alleles that make up our DNA. The human ABO system has six distinct genotypes in total because there are three distinct all levels.

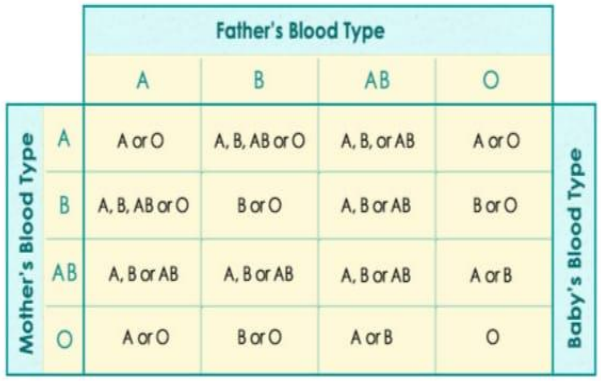

Fig 6.4:Blood types of DNA

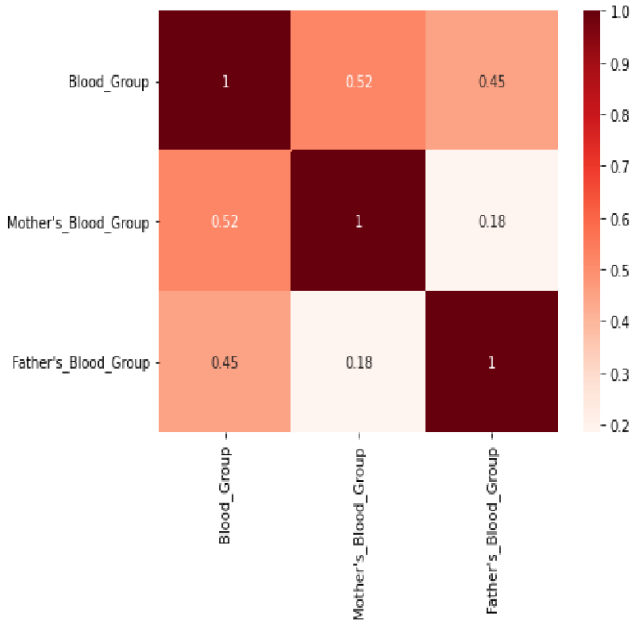

Fig 6.5:relationship between the blood group of the child and the mothers and fathers

7. CONCLUSIONS

With implications for clinical practice and genetic counselling, this research shows the potential of parental blood groups as a predictor of offspring blood type. We identified the potential blood types of children based on the blood groups of their parents by analyzing the inheritance patterns of ABO blood groups using computational techniques such as Punnett squares. In therapeutic settings, personalized assessment is crucial, as evidenced by our findings that show diversity in expected outcomes based on combinations of parental blood groups. We also emphasize the applicability of these predictions to other medical contexts, where knowledge of the prospective offspring's blood type can guide decisions and enhance patient outcomes, such as organ transplantation, genetic counselling, and blood transfusions.

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