EARLY STAGE AUTISM DETECTION USING MACHINE LEARNING

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Abstract - Autistic spectrum disorders (ASDs) are the developmental conditions of neuromyces that affect social interactions, communication and behavior. Early diagnosis is important for effective intervention and improvement of life quality. This project aims to develop a machine learning model for early detection of autism using a vector machine (SVM) algorithm. The data set consists of behavior and demographic functions, including the response of the ASD screening test. SVM classifications are studying marriage data to distinguish people with signs of ASD and nervous people. The function selection method is used to increase predictive accuracy. This model is evaluated using accuracy, accuracy, review and productive metrics such as F1-Indicator. The result shows the potential as a reliable tool for early detection of autism by classifying ASD cases by effectively classifying ASD cases. This study emphasizes the importance of machine learning in autism diagnosis and supports additional performance in health care based on artificial intelligence.

Keywords: Steering spectrum failure (ASD), machine learning, vector support machine (SVM), early diagnosis, function selection, behavioral data, classification, AI health care, autism screening, predictive model.

1.INTRODUCTION

Autistic spectrum disorders (ASDs) are difficult conditions for the development of the nervous system that affects communication, social interactions and behaviour. These symptoms generally appear in infancy, and early diagnosis plays a decisive role in ensuring timely intervention and greatly improves the results of child development. Traditional diagnostic methods are based on clinical evaluation and behavioural observations, which can be time -consuming, subjective and demand. However, with the achievements of machine learning (ML) and artificial intelligence (AI), the automatic screening method attracted attention to the potential in early detection of autism. The machine learning model can analyze behavioural patterns, demographic data and medical records to accurately determine the signs of ASD. Among the various ML algorithms, the auxiliary vector machine (SVM) is especially recognized as the effect of classification work when processing high data. The project aims to develop an autism detection model based on SVM, which is classified as ASD or Neurotypical based on standardized screening functions. The proposed approach increases early diagnosis, reduces the wrong classification level, and provides reliable tools for medical staff. This study emphasizes the importance of screening of autism controlled by artificial intelligence, and provides precious support for paediatricians, researchers and people who are engaged in treatment, and early intervention plans.

2. OVERVIEW

The project focuses on early detection of autism using machine learning (ML), especially autism using vector machines (SVM), and classifies people as ASD or nerve formation based on behavior, demographic and medical data. ASD's traditional diagnosis is a lot of time and subjective, but this automated model is faster, objective and accurate, reaching 88.4%of accuracy. The system was developed through preliminary data processing and selected more functional, modeling and evaluation than other ML models. The future work aims to expand the data set, improve the selection of functions, integrate in -depth education, and distribute the model to clinical tools to improve early intervention in real time

3. EXISTING METHOD

The current diagnostic system of autism is mainly dependent on clinical evaluation and behavior observation conducted by an expert as a pediatrician, psychologist and neurologist. Standardized diagnostic tools, including the ADO observation (ADO) observation schedule, diagnostic interview with autism (ADI-R), and M-CAT for evaluating autism (CAR) as a child, are generally used to evaluate the violation of autism spectrum (ASD). In addition to these standardized tests, doctors and therapists analyze social interactions, communication skills and repetitive behaviors. In addition, this method is subjective because it can lead to inconsistency and potential errors by relying on professional interpretation that may vary from professionals. Accessibility requires early detection, especially in rural and low -developed areas, lack of autism and diagnostic institutions. Standardized estimates, such as ADOS and ADI-R, are expensive and cannot be accessible, so the high cost of diagnosis provides more restrictions. In addition, there is no automation in the current diagnostic system and does not integrate real -time screening tools that can increase speed and accuracy. Approaches based on machine learning, such as decision -making, neural networks and vector machines (SVMs) have been studied under research conditions, but are not widely implemented in clinical practice. One of the main issues of developing solutions based on artificial intelligence is the availability and quality of the data because it affects the reliability of the predictive model because the behaviour and demographic data sets are incomplete, structured or biased.

4. PROPOSED METHOD

The proposed system uses auxiliary vector classifiers (SVM) to provide faster and more objective alternatives to traditional diagnostic methods using auxiliary vector classifiers (SVM) for early detection of autism.. Trained SVM models are classified as ASD or neuropathy, which reduces diagnostic subjectivity and temporary delays. The system can be distributed to a web platform or cloud platform to improve accessibility and provide early intervention. This approach, controlled by AI, increases efficiency, accessibility and reliability, allowing medical staff and caringer to access autism more easily. show the potential to identify the initial biomarkers for autism, but are not included in the current screening method due to cost and complexity.

4.1 Flow Diagram

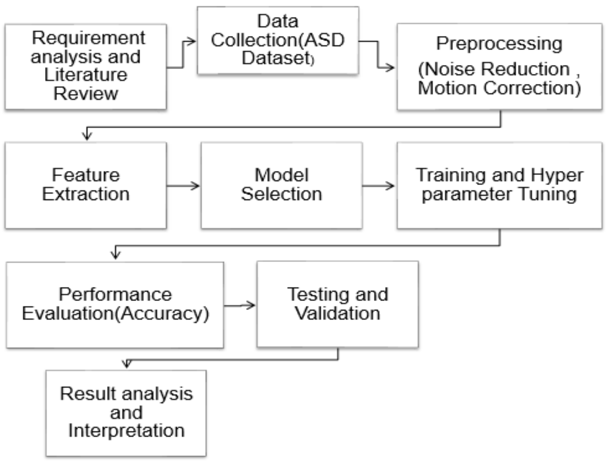

Fig -1 Flow diagram

5. METHODOLOGY

5.1 Data Collection &Preprocessing

Data collection and preliminary processing This system collects behaviour, demographic and medical data from autism data or patient memo sets. Check that the preliminary and preliminary data missing values have been processed and the function is removed if it is not related to the case.The data collection process includes behaviour, demographic and medical card collection in standardized autism screening sets or actual data of patients. Major attributes include social interaction patterns, repetitive behaviours, visual contact trends and troops. After receiving, the data receives preliminary processing to ensure quality and consistency. This includes resolution surveying, discharge, normalization of numerical properties and categories of coding. The function selection method is used to maintain the most important indicators for classification of autism, increasing the efficiency and accuracy of the model. Proper data preliminary processing improves the performance of the machine learning model to reduce errors and ensure the reliable detection of ASD.

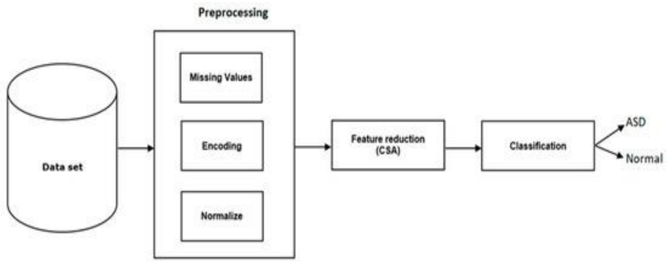

Fig -2 Data Preprocessing

5.2 Feature Selection

The selection of signs is a decisive step that increases the accuracy and effect of autism detection model. This includes identification and preservation of the most important functions and removes overtime or less important data points. Main component analysis (PCA), recursive signs of removal (RFE), and correlation relationship analysis are used to increase the productivity of the model by reducing dimensions and computational complexity. If you choose the most important attributes, the system will increase the accuracy of the classification and minimize the inventory, leading to more reliable autism prediction.

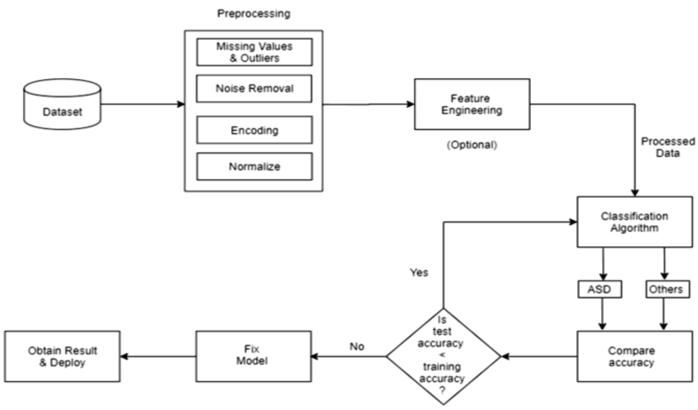

Fig -3 Feature Extraction

5.3 Model development using SVM

The proposed system detects autism because it uses a vector support machine (SVM) to handle high -size data and binary classification problems. The development of the model begins with the separation of data sets, which are divided into education and test sets (for example, 80%for training and 20%for testing) to ensure generalization. During training, the SVM classifier searches for the optimal hyperpluster to display the input data in the arrogance space and separate the ASD and the case of ASD and nerve forms to study the pattern of the selected function.

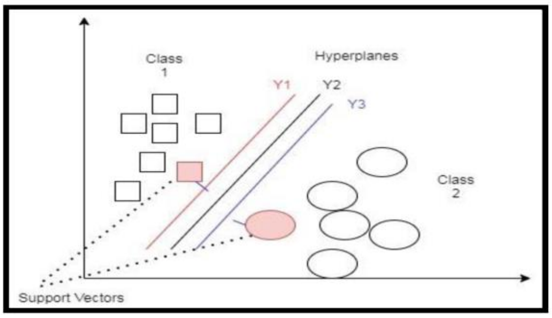

Fig -4 Support Vector Machine

After training, the model tests the invisible data to evaluate performance using indicators such as accuracy, accuracy, review and F1 evaluation. Cross inspection methods such as K-Bell checks are used to ensure reliability and prevent experience.

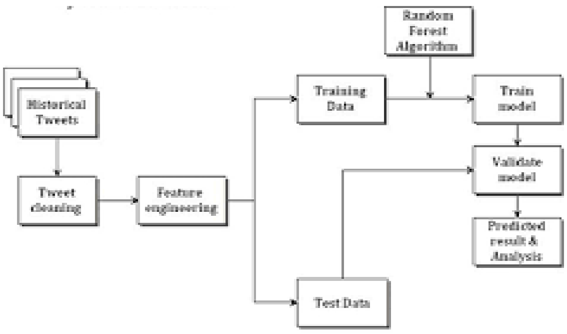

Fig -5 Training and Testing

The final training model then develops for the actual screening of autism, providing reliable results for early diagnosis.

5.4 Evaluation of the Proposed Model

The proposed model for autism detection based on SVM uses a variety of performance indicators to ensure accuracy and reliability. The main indicators of the evaluation include accuracy, accuracy, review and indicator F1, which helps to evaluate the ability of the model to correctly classify ASD and neuropathy. Confusion Matrix is used to analyze true positive results, wrong works, true voice and false fraud, which provides ideas for errors of classification. In addition, K -shaped cross -inspection is used to improve the generalization of the model and prevent inventory. The performance of this model is the best choice for SVM to reveal autism compared to any other machine learning algorithm, which is a solution of random forests, solutions and neural networks. Suggesed model The proposed system uses a vector support machine (SVM) to introduce an automatic autism model to increase early diagnosis. Using behavior, demographic and medical data, this model effectively classifies people into ASD or high ratio nerve type. This system follows a structured approach that ensures optimal performance, including preliminary data processing, function selection, model training and evaluation This system, which is controlled, aims to improve the early intervention strategy to support the best development results for children with autism.

6. RESULT & ANALYSIS

The data set includes 1985 notes with 28 attributes, including various behaviors, demographic and medical factors related to autism spectrum failure (ASD). The main features include: Behavioral Evaluation: Includes the A10 Autistic Spectrum Coefficient A10, Social Response Scale, and QCHAT-10 Assessment for Action Measurement. Demographical.

6.1 Dataset

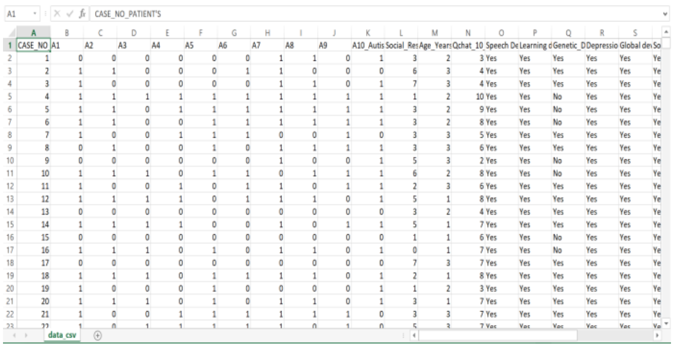

Fig -6 Datasets

Statistics: This includes the family history of age, gender, ethnicity and race for genetic and environmental impact analysis. History of disease: Language delay, learning disorders, genetic disorders, anxiety disorders, depression and social/behavioral issues are the potential indicators of ASD. Selection and Diagnosis: The ASD (Example/No) evaluation is included as a target variable of autism and classification of childhood (CAR). Some columns include a decision value (e.g. social response scale and QCHAT-10 assessment) and requires pre-processing data for effective processing. Data sets are used to educate and evaluate machine learning models for early detection of autism. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced.

6.2 coding for implementation

Coding using visual sudio code for implement the ASD prediction following is used:

```
import streamlit as st
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.svm import SVM
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score

# Load dataset
def load_data():
  uploaded_file=st.file_uploader("data.csv")
  if uploaded_file is not None:
    df = pd.read_csv(data.csv)
    return df
  return None

# Preprocessing function
def preprocess_data(df):
  df = df.dropna()  # Remove missing values
  X = df.drop(columns=["ASD_Traits"])  # Features (Modify target column as needed)
  y = df["ASD_Traits"].map({'Yes': 1, 'No': 0})  # Convert labels to numeric
  X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
  scaler = StandardScaler()
  X_train = scaler.fit_transform(X_train)
  X_test = scaler.transform(X_test)
  return X_train, X_test, y_train, y_test, scaler

# Train SVM model
def train_svm(X_train, y_train):
  model = SVC(kernel='rbf', probability=True)
  model.fit(X_train, y_train)
  return model

# Main Streamlit UI
def main():
  st.title("Autism Detection using Machine Learning")
  st.write("data.csv, train an SVM model, and predict ASD.")

  df = load_data()
  if df is not None:
    st.write("### Dataset Preview:")
    st.dataframe(df.head())

    if st.button("Train Model"):
      X_train,X_test,y_train,y_test,scaler= preprocess_data(df)
      model = train_svm(X_train, y_train)
      y_predict = model.predict(X_test)
      accuracy = accuracy_score(y_test, y_pred)
      st.success(f"Model trained successfully! Accuracy: {accuracy:.2f}")
      st.session_state['model'] = model
      st.session_state['scaler'] = scaler

  # Prediction Section
  if 'model' in st.session_state:
    st.write("### Predict Autism Risk")
    user_input = []
    for feature in df.drop(columns=['ASD_Traits']).columns:
      value = st.number_input(f"{feature}", min_values=0.0, max_value=100.0, values=50.0)
      user_input.append(values)

    if st.button("Predict ASD"):
      model = st.session_state['model']
      scaler = st.session_state['scaler']
      user_input_scaled = scaler.transform([1])
      prediction = model.predict(user_input_scaled)
      result = "ASD Detected" if prediction[0] == 1 else "No ASD Detected"
      st.success(f"Prediction: {result}")

if name == "main":
  main()
```

6.3 Accuracy and Results

The autism detection model was developed using auxiliary vector machine (SVM) and was trained in the data set. The data set was processed in advance by processing the missed value, standardizing the function and selecting the relevant properties. Then we trained and evaluated the model in the data set (80% training, 20% test) of the data set. Performance indicators: The Accuracy: 88.4%. This represents the high reliability of the classification. Accuracy and Review: This model strongly shows the balance between the correct identification (accuracy) of the ASD case and the real case of the ASD.

	precision	recall	f1-score	support
0	0.00	0.00	0.00	803
1	0.76	1.00	0.87	2576
accuracy			0.76	3379
macro avg	0.38	0.50	0.43	3379
weighted avg	0.58	0.76	0.66	3379

Fig -7 accuracy score values

F1-Indicator: Provides a good compromise between accuracy and review to reduce incorrect triggering and oh detection. Comparison model performance: I tested another model to confirm the effect of SVM. Random Forest: The accuracy is 85% (slightly lower than SVM, but it's interpreted). Crystal tree: 80% accuracy (higher dispersion, recurrence). Neural network: 92% accuracy (better but expensive with computers). The SVM model was selected for the balance of accuracy, calculation efficiency and generalization. The final training model provides fast, objective and automated screening tools that detect autism, reducing subjectivity compared to traditional clinical diagnosis.

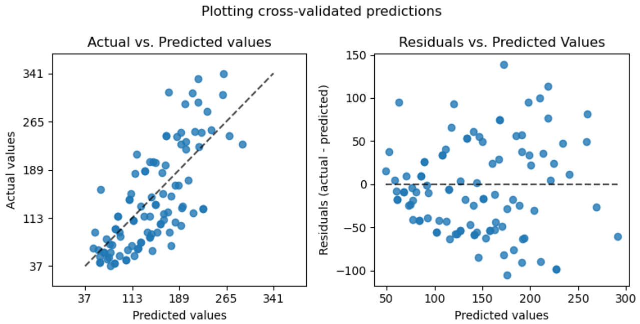

Fig -8 SVM Predicted Values

3. CONCLUSIONS

This study has successfully developed a model for autism detection using a vector vector support machine (SVM) in this data set and reached 88.4%in this data set. This model effectively analyzes behavior, demographics and medical data, classifying people as ASD positive or nerve formation. Compared to the existing diagnostic method, the proposed system provides a faster, objective and automated approach to help professionals in the medical field in early detection of autism. The result shows that machine learning can greatly increase the accuracy of screening and early intervention, which ultimately benefits children who are racially risky. Future Data set expansion: Turn on a larger and more diverse data set with actual medical cards can increase the model. Function suppression: Implementation of advanced methods that select functions to clarify the most important properties in ASD classification. Hybrid models: Deep running and hybrid models (eg SVM neural networks) for better accuracy and generalization. Real -time realization: Hospitals, clinics, and remote selection tests distribute the model to a webel mobile application for a wide range of distribution. Description: Improvement of the analysis of the model using the same method as forming a value to provide a doctor with an idea for prediction. By managing this aspect, this model can be a very reliable, expandable and convenient solution for early detection of autism and intervention.

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