# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

**Jnana Sangama, Belagavi – 590018**

**Project Synopsis**

**on**

# "MACHINE LEARNING-BASED EARLY DETECTION OF AUTISM IN CHILDREN"

Submitted in partial fulfillment of the requirements for the award of the degree of

**BACHELOR OF ENGINEERING**

**in**

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**by**


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# ABSTRACT

This project aims to analyze and predict autism spectrum disorder (ASD) diagnosis using machine learning techniques. ASD is a developmental disorder that affects communication, behavior, and social interactions. Early diagnosis is crucial to provide the necessary interventions for individuals with autism. The dataset used in this study contains various features, such as age, gender, and behavioral traits, which are analyzed to identify patterns associated with ASD. Convolutional Neural Networks (CNN) is utilized for image-based data analysis, particularly for facial feature extraction, which enhances the predictive accuracy of the models. The performance of these models is evaluated based on accuracy, precision, recall, and other metrics to determine their effectiveness in real-world scenarios. Additionally, data preprocessing techniques like handling missing values and feature selection are applied to improve model performance. The project also explores the ethical considerations of using machine learning in healthcare, ensuring that the models are interpretable and reliable for medical applications. Overall, the project demonstrates the potential of AI in aiding early autism diagnosis and contributing to better healthcare outcomes.

# CHAPTER 1

## INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that affects an individual's ability to communicate, interact socially, and engage in repetitive behaviours. It presents in early childhood, with symptoms varying in severity, making early diagnosis essential for effective intervention and support. Traditional methods for diagnosing autism are often time-consuming, subjective, and resource-intensive, which can delay treatment for children who need early interventions.

In recent years, advancements in machine learning have provided promising opportunities to enhance the early detection of ASD. By analysing behavioural, demographic, and other clinical data, machine learning algorithms can identify patterns that may not be immediately evident to healthcare professionals. This project leverages data from Kaggle, featuring a dataset containing various attributes linked to ASD traits, to build predictive models for identifying children at risk of autism.

Through this research, we aim to create a reliable, efficient, and scalable diagnostic tool using machine learning techniques such as Decision Trees, Support Vector Machines (SVM), and Logistic Regression. These models are trained to assess the likelihood of ASD based on key indicators from the dataset. The goal is to assist healthcare providers in making informed decisions about potential ASD diagnoses, thus improving early intervention outcomes for children affected by the disorder.

This project not only demonstrates the practical application of AI in healthcare but also emphasizes the importance of accuracy, interpretability, and ethical considerations when using machine learning in sensitive medical contexts.

### 1.1Rationale

Early detection of Autism Spectrum Disorder (ASD) in children centers on the urgent need for timely diagnosis and intervention. ASD is a complex developmental disorder that can significantly hinder a child's communication, social interaction, and overall development. Early identification is vital, as it allows for early intervention strategies that can greatly improve long-term outcomes for children with autism. However, traditional diagnostic methods can be resource-intensive and may not be accessible in all regions. By developing a more efficient approach to diagnosis, this project aims to enhance the availability of diagnostic tools, ultimately contributing to better healthcare outcomes for children at risk of ASD. Addressing these challenges is essential to ensuring that affected children receive the support and resources they need as early as possible.

### 1.2 Problem Statement

ASD can significantly affect a child's development and quality of life, but traditional diagnostic methods are often lengthy, subjective, and require specialized expertise that may not be readily available. This delay in diagnosis can lead to missed opportunities for early intervention, which is crucial for improving

developmental outcomes. By leveraging machine learning techniques, the project aims to develop a more efficient and accessible diagnostic tool that can help identify children at risk for ASD earlier in their development, ultimately enhancing their chances for effective treatment and support.

## 1.3 Objectives

- **Model Development**: Build a machine learning model using Convolutional Neural Networks (CNN) to detect autism (ASD) accurately through image analysis and diverse data features.
- **Enhance Accuracy:** Improve the model's accuracy and robustness by incorporating advanced preprocessing and data augmentation techniques to handle varied datasets effectively.
- **Chatbot Integration:** Integrate a chatbot to provide real-time interaction and guidance, making the system more interactive and supportive for users.
- **User-Friendly Application:** Develop an intuitive and accessible application, ensuring seamless usage for parents and healthcare professionals.

# CHAPTER 2

## LITERATURE REVIEW

[1] Garg et al. (2024) discuss the critical need for early detection of autism spectrum disorder (ASD) to enable timely interventions and improve developmental outcomes for children. Their study explores various machine learning algorithms and methodologies employed to analyse ASD-related data, enhancing the accuracy and efficiency of diagnosis when compared to traditional methods. The research demonstrates promising results through machine learning models, suggesting their potential integration into healthcare systems to support early autism diagnosis and provide timely assistance to at-risk children.

[2] Abdelwahab et al. (2024) emphasizes the importance of early prediction of ASD in children for effective intervention and improved outcomes. The paper investigates the use of multiple machine learning algorithms and techniques to analyse data and identify patterns associated with ASD, thereby enhancing diagnostic accuracy. The authors highlight how machine learning models could transform autism diagnosis by improving accessibility to early intervention services within healthcare systems, especially benefiting children at risk.

[3] Farooq et al. (2023) propose a federated learning (FL) approach for detecting ASD in both children and adults using machine learning models. Their study achieves an accuracy rate of 98% in children and 81% in adults by processing data from four different datasets locally using Support Vector Machine (SVM) and Logistic Regression (LR) classifiers. The results are transmitted to a central server to train a meta-classifier. This FL-based model ensures data security and privacy by keeping data decentralized and transmitting only small-sized local models, making it a promising and secure approach for ASD detection.

[4] Yaneva et al. (2020) present a novel, non-invasive method to detect high-functioning autism in adults using eye-tracking technology. The study analyses visual processing differences during web page browsing tasks and applies machine learning classifiers to the collected data, achieving a 74% accuracy in identifying individuals with autism. The paper highlights the potential of eye-tracking technology as a cost-effective and scalable tool for autism detection in adults, underscoring its promise for broad application in clinical and non-clinical settings.

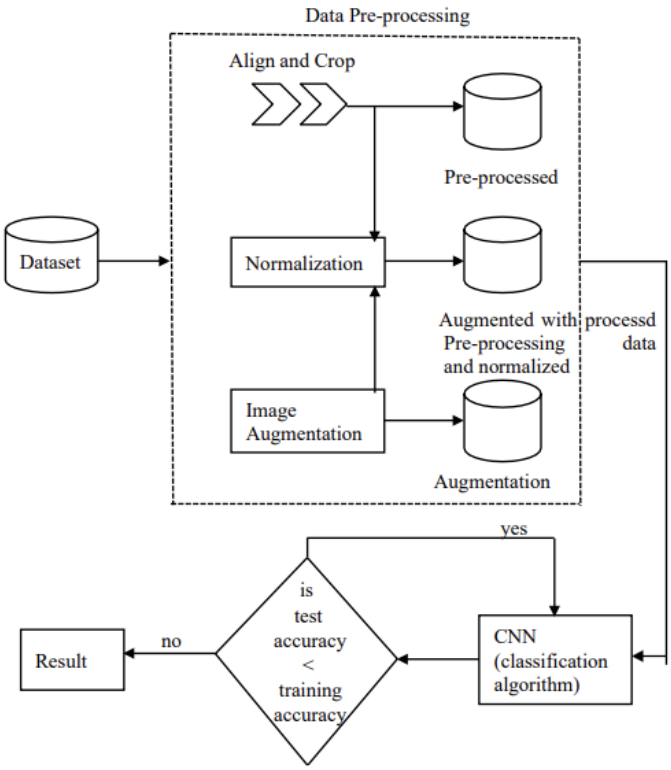
[5] Manushi Srivastav et al. (2023) This review highlights Autism spectrum disorder (ASD) is becoming increasingly common in India, bringing unique challenges for families. Many struggle with societal stigma, limited awareness, and a lack of resources, which delays diagnosis and support. Factors like advanced parental age, neonatal complications, and consanguinity increase the risk. The review emphasizes the need for inclusive

education, employment opportunities, and stronger support systems. Raising awareness and addressing these issues can greatly improve the lives of individuals with ASD and their families.

# CHAPTER 3

## METHODOLOGY

### 3.1 Proposed System




This flowchart outlines a machine learning workflow for classification. It starts with a dataset, which undergoes preprocessing to handle missing values, remove noise, encode data, and normalize features. Optional feature engineering can enhance the data. The processed data is fed into a classification algorithm that predicts classes (e.g., ASD or others). If test accuracy is lower than training accuracy, the model is adjusted and retrained. Once the model performs well, results are obtained and deployed.

## 3.2 Hardware Requirements

1. Laptop or PC

## 3.3 Software Requirements

1. Python
2. Machine Learning(TensorFlow for implementing the CNN model)
3. Frontend Development (HTML, CSS, JavaScript, and Bootstrap)
4. Data Extraction(OpenCV and PIL)
5. Flask Framework(backend operations)
6. SQLite(Database)
7. Bcrypt(hashing passwords to ensure user security)

# CHAPTER 4

## OUTCOMES

The project aims to develop a machine learning model capable of accurately predicting autism spectrum disorder (ASD) in children by analysing behavioural data and images. This will assist healthcare professionals in detecting ASD at an early stage, facilitating timely intervention and personalized support. By automating the diagnostic process, the project seeks to enhance the speed, reliability, and accessibility of ASD detection, addressing the limitations of traditional manual diagnosis methods that often require expert involvement and can be time-consuming.

Additionally, the project explores patterns in children's behaviour and facial features, providing valuable insights into key indicators of ASD. This not only supports current diagnostic practices but also contributes to future research. Through evaluating multiple machine learning algorithms based on metrics such as accuracy, precision, and recall, the project identifies an optimized model for effective prediction. Integrating such models into healthcare systems could transform routine screenings, particularly benefiting underserved communities by making early diagnosis more accessible and improving healthcare outcomes for children at risk of ASD.

# CHAPTER 5

## REFERENCES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