DETECTION OF EARLY STAGE OF AUTISM SPECTRUM DISORDER USING MACHINE LEARNING

A PROJECT REPORT

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In partial fulfillment of the requirements

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IN

COMPUTER SCIENCE AND ENGINEERING

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PBR VISVODAYA INSTITUTE OF TECHNOLOGY & SCIENCE : KAVALI (AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that the Project report entitled "DETECTION OF EARLY STAGE OF AUTISM SPECTRUM DISORDER USING MACHINE LEARNING" is the bonafide work done by M.YASASWINI (19731A05A1), K.DEVI (19731A0596), K.SAI LEELA (19731A0597), M.LAVANYA (19731A05A0), who carried out the project under my guidance during the year 2022-23, towards partial fulfilment of the requirements of the Degree of Bachelor of Technology in Computer Science and Engineering, from Jawaharlal Nehru Technological University Anantapur. The results embodied in this project report has not been submitted to any other University or Institution for the award of any degree.

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Project Viva –Voce Conducted on ____________________

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EXTERNAL EXAMINER

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CERTIFICATE OF AUTHENTICATION

We solemnly declare that this project report **DETECTION OF EARLY STAGE OF AUTISM SPECTRUM DESORDER** is the bonafide work done purely by us, carried out under the supervision of **Mr. D.PAVAN KUMAR, Assistant Professor** towards partial fulfillment of the requirements of the Degree of **BACHELOR OF TECHNOLOGY** in **Computer Science & Engineering** from Jawaharlal Nehru Technological University Anantapur, Ananthapur during the year 2022-23

It is further certified that this work has not been submitted, either in part of in full, to any other department of the Jawaharlal Nehru Technological University, or any other University, institution or elsewhere, or for publication in any form.

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ABSTRACT

The Autism spectrum disorder (ASD) is the neuro development disorder. It effects on how the people communicate and interact with others. In this we particularly concerning three domains social functioning, communication and Stereotyped Behaviors. Diagnosis of autism requires significant amount of time and cost. ASD can be cause due to having an immediate family member who's autistics, certain genetic mutations and some mental and physical health condition. Early detection of autism can come to a great help by prescribing patients with proper medication at an early stage. According to the ASD problem starts with childhood and continues to and keep going on into adolescence and adulthood. Based on some machine learning algorithms like Naive bayes, support vector machine, logistic regression, KNN, CNN (Convolution neural networking) for predicting and analysis of ASD problems in child, adolescents and Adults. So, this will try to shed light on characteristics and features of Autistic children and their common language, speech and communication related problems so that it may help to the diagnosis as soon as possible to take effective measures.

keywords: Autism, Neuro Development Disorder, Stereotyped, Diagnosis, Genetic Mutation, Adolescence

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ASD	Autism Spectrum Disorder
ADOS	Autism Diagnostic Observation Schedule
CARS	Childhood Autism Rating Scale
CNN	Convolutional neural network
GARS	Gilliam Autism Rating Scale
ML	Machine Learning

CHAPTER 1

INTRODUCTION

1.1 Problem Statement:

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder generally it can be cause due to having an immediate family member who's autistics, certain genetic mutations and some mental and physical health condition is characterized by deficits in communication and social interaction and restricted, repetitive patterns of behaviors, interests, and activities. The problem of autism spectrum disorder now a days it is mounting swiftly to all ages of Human population. Autism patients face different types of challenges such as difficulties with concentration, learning disabilities, mental health problems. Current explosion rate of autism around word is numerous and it is increasing at the very high rate. Earlier detection of autism can be great help for patients at an early stage.

The doctors will diagnose a child with ASD specific methods for diagnosis of children with Autism are broken down in to two levels: level-1 Initial screening level and it is carried out by general practitioners of children. Level-2:Get the more detailed evaluation from expects and again early detection ASD around 18 months but diagnosis is usually at or after age of three and assignments are conducted using neurodevelopment frame work the frame work includes involving the child's family and doctors .ASD difficult to diagnose because it has such diverse list of symptoms which include delayed in speech, no proper eye contact , lack of response ,poor social skills, Atypical tone behaviors issues, learning delay and more the main causes of ASD.

Autism spectrum disorders (ASDs) describe a group of neurodevelopmental conditions in which the individuals face challenges with social engagement and age-appropriate play and fail to develop appropriate peer relationships according to their developmental level. Although young people are frequently recommended to participate in leisure activities including play, sports, hobbies, and social activities, children with ASD tend to spend time in passive play and maladaptive behaviors and they are less likely to spontaneously participate in organized leisure activities such as sports. It could be attributed to their significant deficits in development of motor development and physical activity (PA) behavior. Social and behavioral impairments in ASD can limit children opportunity to participate in physical activity and recreation programs that eventually end to their inactivity. Physical inactivity predisposes children with ASD to several comorbid conditions such as overweight and obesity. To assess key correlates of physical activity, previous studies frequently addressed social variables as critical factors contribute to ASD children physical activity. For example, Pan showed that children with ASD who had lower social engagement with adults displayed lower levels of physical activity than children had higher social involvement. Indeed although children with ASD receive rehabilitation services from an early age in order to improve daily performance and enhancement of active life, PA and leisure aspects of quality of life (QOL, parents and caregivers have to spend many resources while making a balance between children needs and those of family or guardians is a difficult task. Thus recently, studies examining QOL in a wide range of individuals with ASD indicated that adults with ASD have lower scores in wellbeing measures, and children also show a sub ideal outcome. A recent study on ASD demonstrated a positive connection between cheerfulness and participation in a quality leisure program; authors also indicated that satisfaction is also correlated with leisure activities in individuals with ASD. Although some studies could not show any differences between the physical activity levels of children with and without ASD, there is a general consensus that children with ASD did not participate in enough PA necessary to meet the activity guidelines for wellbeing. Most recent review of literature confirmed that children with ASD fall short of the recommended physical activity levels and experience challenges in physical activity and physical education settings and thus recommended strategies to improve the physical activity statistics and quality of life among children with ASD. Limited research, to date, has looked at the barriers and facilitators of PA among children with ASD.

1.2 About the Project

Autism Spectrum Disorder is a neurobiological disorder. There is no cure for this Disorder and no physical treatment or test to find it. So, the project's objective is to early detecting the autism in children's and adults by gathering some datasets and building ml model to predict disorder and how this disorder occurred and provides the precautions to the disorder.

1.3 Objectives of the Project

The major objective is to Autism Spectrum Disorder Prediction. The scope of the project is to study focuses mind set of the children's and adults and detecting the (AUTISM SPECTRUM DISORDER) ASD in early stage and provide them some suggestions and precautions. It suggests some doctors if the patient is having the diseases.

1.4 Existing System

Different existing data mining procedures and its application were considered or explored. Utilization of machine learning algorithms was connected in various medical data sets. Machine learning strategies have diverse power in different medical data sets. Previously mentioned conventional machine learning techniques gave less exact outcome and results additionally shifts in light of the procedures has been utilized for the prediction. Initially this project has been developed by some research persons they developed machine learning models only. They developed ml models like random forest algorithm and SVR. Those models have the less accuracy.

1.5 Drawbacks of Existing System

- Patients are not aware of the disease. This model is not available to normal people.
- These are just machine learning models, and these are not sufficient to predicts the diseases.
- These models have the less accuracy. So, it comes under the lower fitting.

1.6 Proposed System

Our proposed strategy focuses on a novel machine learning procedures for autism spectrum disorder (ASD) classification and prediction, thus overcoming the existing problem. By utilizing Random Forest (RF), Support Vector Machine (SVM). AdaBooster algorithms and some other algorithms. We have collected the datasets from the Kaggle website and we pre-processed it. In our existing model they have tried with Random Forest Algorithm, but it is having less accuracy. So here tired with same also tried with some accuracy increasing methods to increase the accuracy of existing method. The used methods are GirdSearchCV and pipeline methods. These helps a lot to increase the accuracy from 65% to 98%. Later we generate the pickle file and use that pickle file to develop the web application which makes our application to available 24/7. we will make our model in order to increase the performance and accuracy.

1.7 Advantages of Proposed System

- Eco friendly and 24/7 available.
- More accurate about the results.
- We predict the disease percentage, recommend the doctor's name and contact details for patients.

CHAPTER 2

LITERATURE SURVEY

F Bonnet-Brilhault et al., The ASD are complex neurobehavioral disorder by social and communication deficits and repetitive and stereotyped behaviors. It is now believed that environmental factors may modulate phenotypical expression of ASD that are associated with the genetic predisposition. The diagnosis of ASD can be reliably made in the second year of Life and appears to be relatively stable over time. However, diagnosis of very young children can be quite complex due to their clinical heterogeneity and varying patterns of onset that can differ from the typical autism symptoms of an older child.

Ditza Antebi Zachor et al., This study evaluated the effectiveness of the ESDM for preschool-aged children with ASD using a predominantly group-based intervention in a community child care setting.in this they follow some methods there are taken some participants with some 26 children's with ASD with mean age 49.6 months. Children received 15-20 hours of group-based, and one hour of one-toone, ESDM intervention per week his study suggests community dissemination of the ESDM using predominantly groupbased intervention may be an effective intervention.

Valsamma Eapen et al ., The Behavioral interventions for children with autism spectrum disorders,the intervention behavioral is only treatment for young children with ASD s. This article describes the core features of behavioral treatments, summarizes the evidence base for effectiveness, and provides recommendations.

Patricia Manning-Courtney,Donna Murray, Kristen Currans et al., Children on the Autism Spectrum and the Use of Virtual Reality for Supporting Social Skills Autism spectrum disorders (ASDs) are characterized by differences in socio-pragmatic communication. These conditions are allocated within a ”spectrum” of phenotypic variability with some methods for improving social skills like emotional training and traditional emotional training.

Alessandro Frolli , Giulia Savarese et al.,The Using participant data to extend the evidence base for intensive behavioral intervention for children with autism the gathered individual participants data from 16 group studies with children with autism, most children who are underwent behavioral intervention achieved change in IQ(29.8 percent)compared with 2.6percent and 8.7percent.

Sigmund Eldevik , Richard P Hastings et al., This article summarizes the current literature on social skills training for children and adolescents with autism spectrum disorders. The article describes several different methods of social skills training, along with a summary of research findings on effectiveness. Interventions described include social skills groups, peer mentoring/training, social stories, and video modeling.

Amy J Bohlander,Felice Orlich, Christopher K Varley et al .,The study provides an overview of recent studies on behavioral interventions for children and adolescents with autism spectrum disorder (ASD),Behavioral interventions are effective for improving language, cognitive abilities, adaptive behavior, and social skills, and reducing anxiety and aggression. Medication combined with behavioral intervention appears to be more effective for reducing aggressive behavior than medication alone.

Geraldine Dawson , Karen Burner et al ., The New strategies and findings for behavioral interventions in autism spectrum disorders . Outcomes of these interventions are neither easily assessed nor simple, but are dependent on child characteristics as well as caregiver skills and attitudes.

Catherine Lord , Rebecca M Jones et al .,The Overview of meta-analyses on early intensive behavioral intervention for young children with autism spectrum disorders ,There were many differences between meta-analyses, leading to different estimates of effect and overall conclusions. The weighted mean effect sizes across meta-analyses for IQ and adaptive behavior ranged from g = .38-1.19 and g = .30- 1.09, respectively.

CHAPTER 3

SYSTEM ANALYSIS

3.1 SOFTWARE REQUIREMENTS:

The functional requirements or the overall description documents include the product perspective and features, operating system and operating environment, graphics requirements, design constraints and user documentation.

The appropriation of requirements and implementation constraints gives the general overview of the project in regards to what the areas of strength and deficit are and how to tackle them.

- Python ide 3.7 version (or) above version
- Anaconda 3.7 (or) above version □ Jupiter Notebook. □ Visual Studio

3.2 HARDWARE REQUIREMENTS:

Minimum hardware requirements are very dependent on the particular software being developed by a given Enthought Python / Canopy / VS Code user. Applications that need to store large arrays/objects in memory will require more RAM, whereas applications that need to perform numerous calculations or tasks more quickly will require a faster processor.

- Operating system : Windows, Linux
- Processor : minimum intel i3
- Ram : minimum 4 gb
- Hard disk : minimum 250gb

3.3 FUNCTIONAL REQUIREMENTS

- Data Collection
- Data Preprocessing
- Training and Testing

- Modeling
- Predicting

3.1 NON-FUNCTIONAL REQUIREMENTS

NON-FUNCTIONAL REQUIREMENT (NFR) specifies the quality attribute of a software system. They judge the software system based on Responsiveness, Usability, Security, Portability and other non-functional standards that are critical to the success of the software system. Example of non functional requirement, “how fast does the website load?” Failing to meet non-functional requirements can result in systems that fail to satisfy user needs. Non- functional Requirements allows you to impose constraints or restrictions on the design of the system across the various agile backlogs. Example, the site should load in 3 seconds when the number of simultaneous users are > 10000. Description of non-functional requirements is just as critical as a functional requirement.

- Usability requirement
- Serviceability requirement
- Manageability requirement
- Recoverability requirement
- Security requirement
- Data Integrity requirement
- Capacity requirement
- Availability requirement
- Scalability requirement
- Interoperability requirement
- Reliability requirement
- Maintainability requirement
- Regulatory requirement

- Environmental requirement

3.5 Feasibility Study

Preliminary investigation examine project feasibility, the likelihood the system will be useful to the organization. The main objective of the feasibility study is to test the Technical, Operational and Economical feasibility for adding new modules and debugging old running system. All system is feasible if they are unlimited resources and infinite time. There are aspects in the feasibility study portion of the preliminary investigation:

- Technical Feasibility
- Operational Feasibility
- Economical Feasibility

The main objective of the study of the prospect is just to verify the technical, social as well as operational achievement to include additional features and to investigate the past working structure. Every device will be back to earth in the event that they are infinite energy and unremitting time. Perspectives exist in the concentration of attainability of some portion of the quick evaluation.

3.5.1 Economic Feasibility

Cost-effectiveness analysis is an integral component of HTA. Given the cost of running fully powered RCTs, it is important to establish their feasibility to evaluate whether or not to conduct the trial and how to best to do so. This part of the second phase of the ASSSIST study evaluated the feasibility of collecting data for economic analysis. More specifically, the economic study aimed to establish whether or not 5 it was feasible to collect data on generic measures of health and relevant resource use in this population to allow estimation of costs associated with treatment delivery and associated health-care and societal costs (i.e. how various service usage changes given treatment and the costs associated with that change).

3.5.2 Feasibility of operation

Children with ASD have difficulty with social interaction behaviors, including establishing and maintaining relationships, reciprocating social interaction, and communicating with others.

3.5.3 Technical Feasibility

A Feasibility Study of Autism Behavioral Markers in Spontaneous Facial, Visual, and Hand Movement Response Data. Feasibility of using a humanoid robot for enhancing attention and social skills in adolescents with autism spectrum disorder.

CHAPTER 4

SYSTEM DESIGN

4.1 MODULES DESCRIPTION:

A module is a collection of source files and build settings that let you divide your project into discrete units of functionality. Your project can have one or many modules, and one module can use another module as a dependency. You can independently build, test, and debug each module.

1) Login: This is an online application and user need to login by using username as ‘admin’ and password as ‘admin’ .
2) Train Random Forest Algorithm: We can use this model to train RF model with Autism dataset and after training model we will calculate both models’ accuracy on test data.
3) Upload User Data: using this module we will allow user to upload user data and the application will predict condition of person as healthy or effected with Autism disease.

4.1.1 Modules:

1. Numpy

Python has a strong set of data types and data structures. Yet it wasn’t designed for Machine Learning per say. Enter NumPy (pronounced as num-pee). Numpy is a data handling library, particularly one which allows us to handle large multi-dimensional arrays along with a huge collection of mathematical operations. The following is a quick snippet of NumPy in action.

Numpy isn’t just a data handling library known for its capability to handle multidimensional data. It is also known for its speed of execution and vectorization capabilities. It provides MATLAB style functionality and hence requires some learning before you can get comfortable. It is also a core dependency for other majorly used libraries like pandas, matplotlib and so on. It’s documentation itself is a good starting point.

2. Pandas

Think of relational data, think pandas. Yes, pandas is a python library that provides flexible and expressive data structures (like data frames and series) for data manipulation. Built on top of NumPy, pandas is as fast and yet easier to use.

Pandas provides capabilities to read and write data from different sources like CSVs, Excel, SQL Databases, HDFS and many more. It provides functionality to add, update and delete columns, combine or split data frames/series, handle datetime objects, impute null/missing values, handle time series data, conversion to and from numpy objects and so on. If you are working on a real-world Machine Learning use case, chances are, you would need pandas sooner than later. Similar to numpy, pandas is also an important component of the SciPy or Scientific Python Stack .

3. Scipy

Pronounced as Sigh-Pie, this is one of the most important python libraries of all time. Scipy is a scientific computing library for python. It is also built on top of numpy and is a part of the Scipy Stack.

This is yet another behind the scenes library which does a whole lot of heavy lifting. It provides modules/algorithms for linear algebra, integration, image processing, optimizations, clustering, sparse matrix manipulation and many more.

4 . Matplotlib

Another component of the SciPy stack, matplotlib is essentially a visualization library. It works seamlessly with numpy objects (and its high-level derivatives like pandas). Matplotlib provides a MATLAB like plotting environment to prepare high-quality figures/charts for publications, notebooks, web applications and so on.

Matplolib is a high customizable low-level library that provides a whole lot of controls and knobs to prepare any type of visualization/figure. Given its low-level nature, it requires a bit of getting used to along with plenty of code to get stuff done. Its well documented and extensible design has allowed a whole list ~~o~~f high-level visualization libraries to be built on top. Some of which, we will discuss in the coming sections.

5 . Scikit-Learn

Designed as an extension to the SciPy library, scikit-learn has become the de-facto standard for many of the machine learning tasks. Developed as part of Google Summer of Code project, it has now become a widely contributed open source project with over 1000 contributors.

Scikit-learn provides a simple yet powerful fit-transform and predict paradigm to learn from data, transform the data and finally predict. Using this interface, it provides capabilities to prepare classification, regression, clustering and ensemble models. It also provides a multitude of utilities for preprocessing, metrics, model evaluation techniques, etc.

6. Seaborn

Built on top of matplotlib, seaborn is a high-level visualization library. It provides sophisticated styles straight out of the box (which would take some good amount of effort if done using matplotlib).

Apart from styling prowess and sophisticated color pallets, seaborn provides a range of visualizations and capabilities to work with multivariate analysis. It provides capabilities to perform regression analysis, handling of categorical variables.

4.2 ARCHITECTURE:

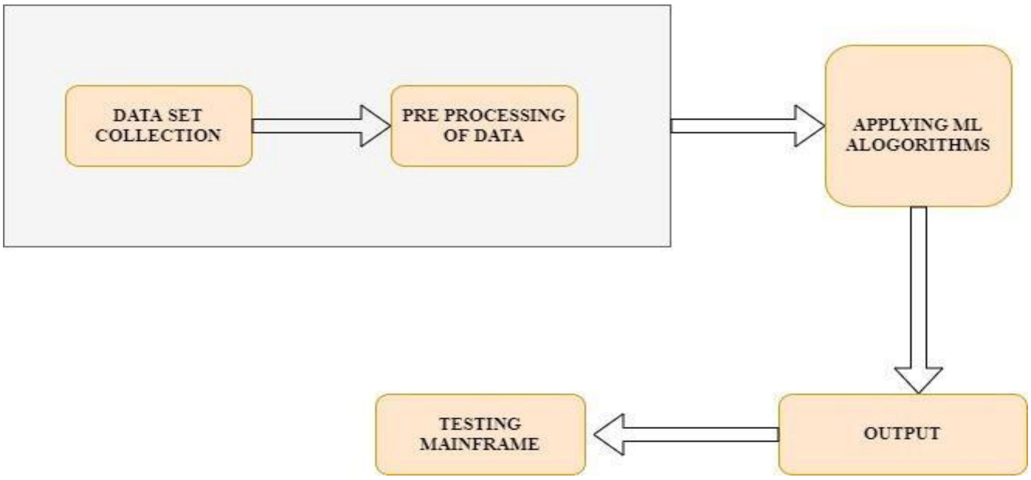


Fig 4.1: Architecture Diagram

4.3 UML DIAGRAMS:

UML is an acronym that stands for Unified Modeling Language. Simply put, UML is a modern approach to modeling and documenting software. In fact, it’s one of the most popular business process modeling techniques.

It is based on diagrammatic representations of software components. As the old proverb says: “a picture is worth a thousand words”. By using visual representations, we are able to better understand possible flaws or errors in software or business processes.

UML was created as a result of the chaos revolving around software development and documentation. In the 1990s, there were several different ways to represent and document software systems. The need arose for a more unified way to visually represent those systems and as a result, in 1994-1996, the UML was developed by three software engineers working at Rational Software. It was later adopted as the standard in 1997 and has remained the standard ever since, receiving only a few updates.

GOALS:

The Primary goals in the design of the UML are as follows:

1. Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.
2. Provide extendibility and specialization mechanisms to extend the core concepts.
3. Be independent of particular programming languages and development process.
4. Provide a formal basis for understanding the modeling language.
5. Encourage the growth of OO tools market.
6. Support higher level development concepts such as collaborations, frameworks, patterns and components.
7. Integrate best practice.

4.3.1 Use Case Diagram:

The UML, use-case diagrams model the behavior of a system and help to capture the requirements of the system. Use-case diagrams describe the high-level functions and scope of a system. These diagrams also identify the interactions between the system and its actors. The use cases and actors in use-case diagrams describe what the system does and how the actors use it, but not how the system operates internally. Collect the dataset from the internet, which has 1055 records to find the Autism. In this dataset, ten behavioral features (Q-Chat-10) plus other individuals characteristics that have proved to be effective in detecting the ASD cases from controls in behavior science are present. This dataset contained some string value parameter

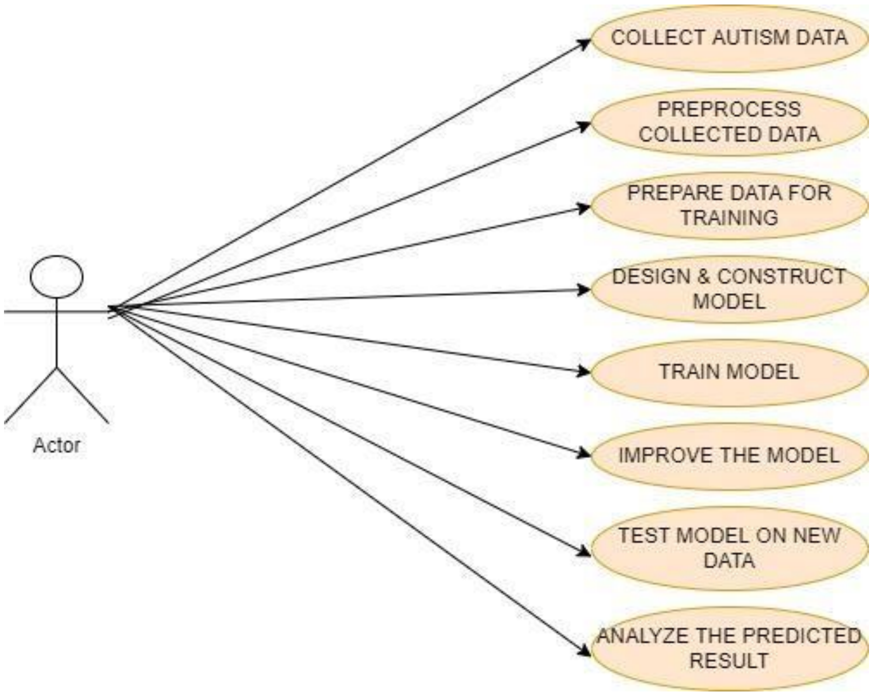


Fig 4.2: Use Case Diagram

4.3.2. Sequence Diagram:

A sequence diagram simply depicts interaction between objects in a sequential order i.e. the order in which these interactions take place. We can also use the terms event diagrams or event scenarios to refer to a sequence diagram. Sequence diagrams describe how and in what order the objects in a system function. In this user, Doctor and ASD Application are main entity firstly user need to approach the doctor then doctor will ask the Questions doctor will enter the user answers. In ASD Application Data prepossessing traing and testing of data done predict the output to doctor then doctor will give precautions Doctor give information regarding the ASD.

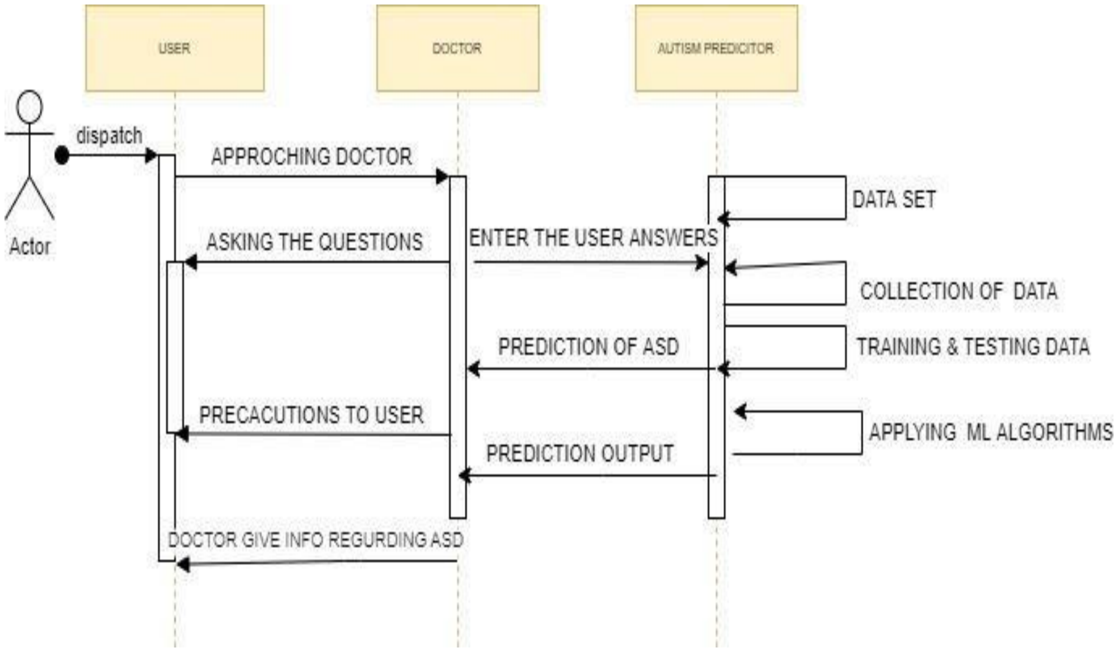


Fig 4.3: Sequence diagram

4.3.3 Class diagram

In software engineering, the Class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application. In this ASD Application is the main class with have the details about the Child and Parent. ASD application can be accessed by the Login ID. From Child parent has the username password they need to get login and get the output.

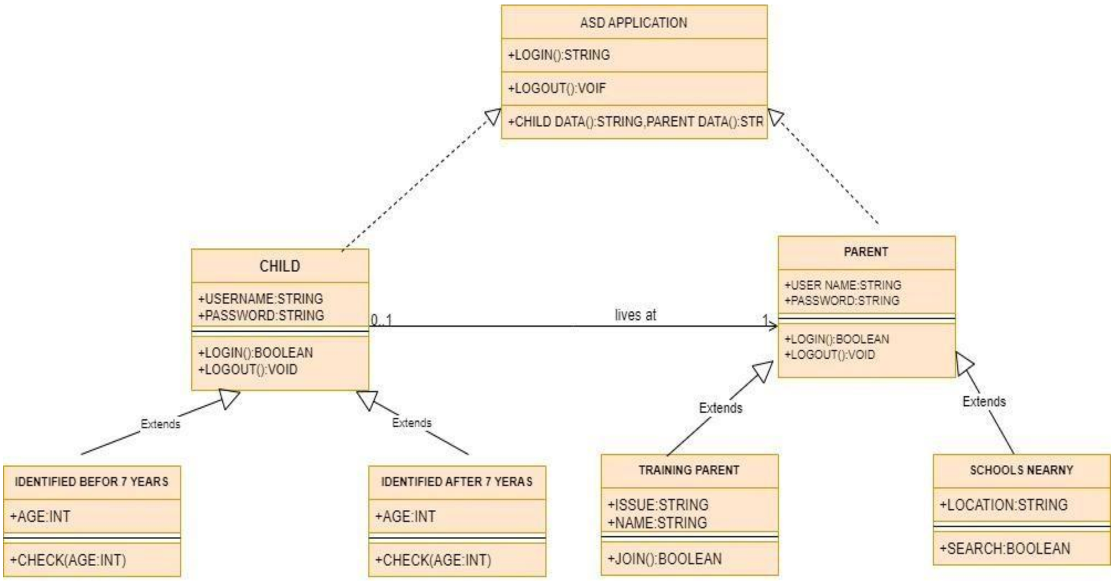


Fig 4.4 class diagram

4.3.4 Data Flow diagram: -

Data flow diagrams are used to graphically represent the flow of data in a business information system. DFD describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation.

Data flow diagrams can be divided into logical and physical. The logical data flow diagram describes flow of data through a system to perform certain functionality of a business. The physical data flow diagram describes the implementation of the logical data flow.

The data flow diagram shows the way information flows through a process or system. It includes data inputs and outputs, data stores, and the various subprocesses the data moves through. DFDs are built using standardized symbols and notation to describe various entities and their relationships. Firstly, we need to collect the data by machine learning technique and then processing of data will be happen then create the perfect data that data has to been trained and tested and then applying the machine learning algorithms then get the output.

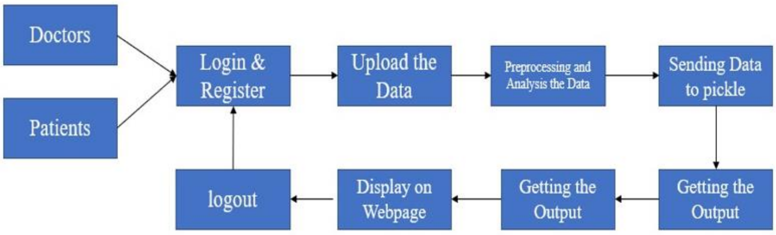


Fig 4.5 Data Flow Diagram

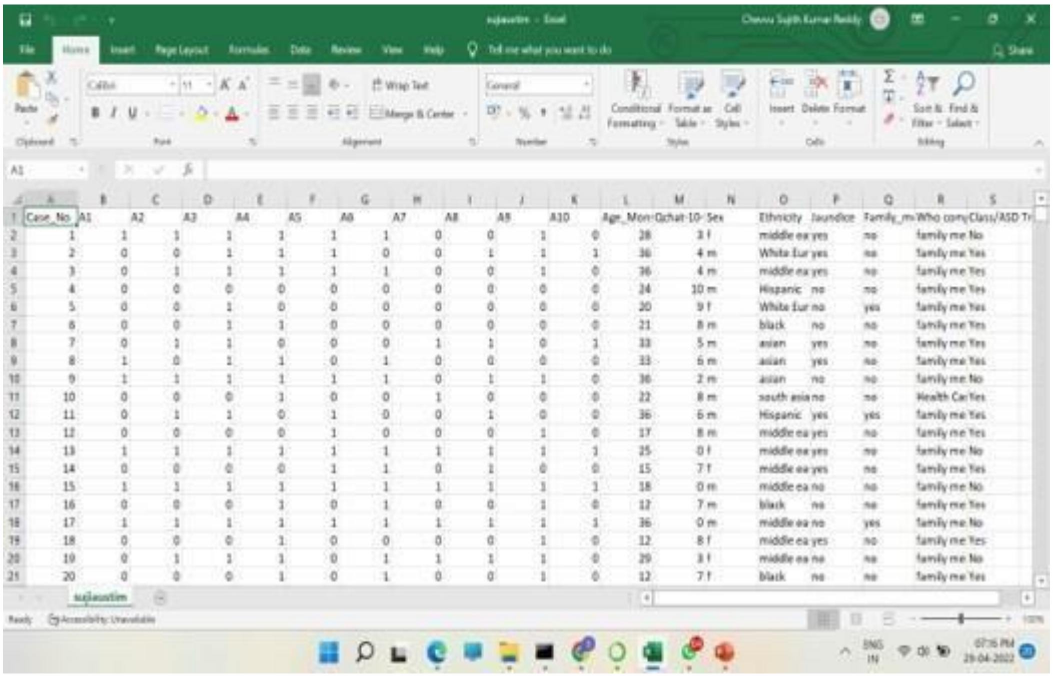
CHAPTER 5

IMPLEMENTATION

5.1 Dataset:

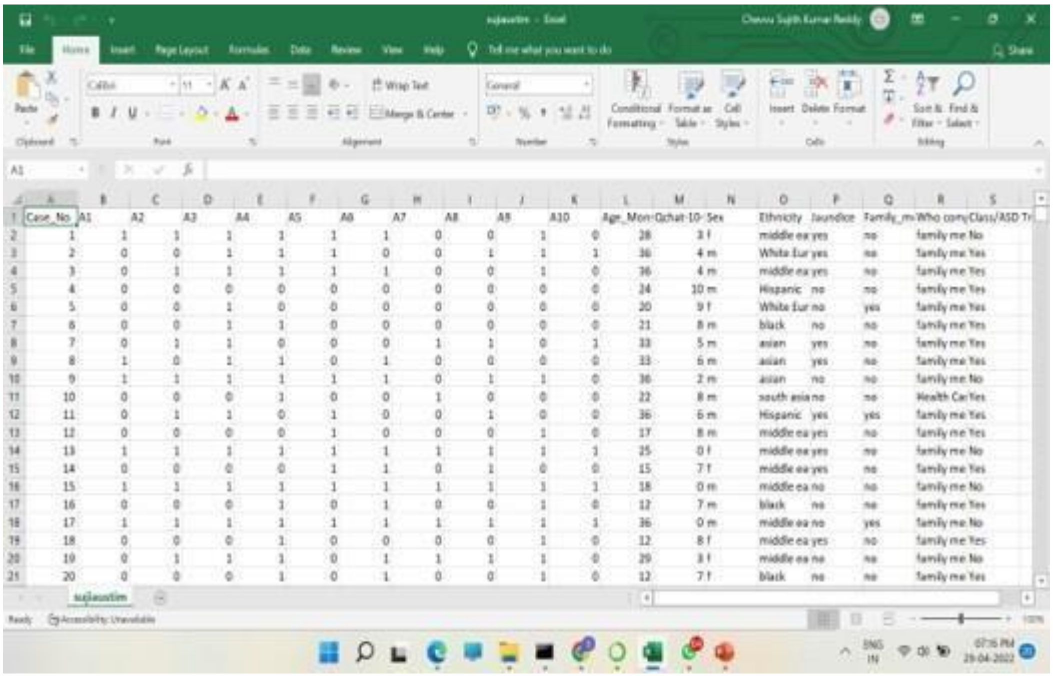
The dataset is collected from the UCI repository and the information about Autism Spectrum Disorder has been collected from the Kaggle website

The link where image dataset collected is: **Autism Spectrum Disorder (ASD) | Kaggle**



Case_No	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	Age_Mon	Qchat-10-	Sex	Ethnicity	Jaundice	Family_m	Who com	Class/ASD Tr
1	1	1	1	1	1	1	0	0	1	0	28	3	f	middle ea	yes	no	family me	No
2	0	0	1	1	1	0	0	1	1	1	36	4	m	White Eur	yes	no	family me	Yes
3	0	1	1	1	1	1	0	0	1	0	36	4	m	middle ea	yes	no	family me	Yes
4	0	0	0	0	0	0	0	0	0	0	24	10	m	Hispanic	no	no	family me	Yes
5	0	0	1	0	0	0	0	0	0	0	20	9	f	White Eur	no	yes	family me	Yes
6	0	0	1	1	0	0	0	0	0	0	21	8	m	black	no	no	family me	Yes
7	0	1	1	0	0	0	1	1	0	1	33	5	m	asian	yes	no	family me	Yes
8	1	0	1	1	0	1	0	0	0	0	33	6	m	asian	yes	no	family me	Yes
9	1	1	1	1	1	1	0	1	1	0	36	2	m	asian	no	no	family me	No
10	0	0	0	1	0	0	1	0	0	0	22	8	m	south asia	no	no	Health Car	Yes
11	0	1	1	0	1	0	0	1	0	0	36	6	m	Hispanic	yes	yes	family me	Yes
12	0	0	0	0	1	0	0	0	1	0	17	8	m	middle ea	yes	no	family me	Yes
13	1	1	1	1	1	1	1	1	1	1	25	0	f	middle ea	yes	no	family me	No
14	0	0	0	0	1	1	0	1	0	0	15	7	f	middle ea	yes	no	family me	Yes
15	1	1	1	1	1	1	1	1	1	1	18	0	m	middle ea	no	no	family me	No
16	0	0	0	1	0	1	0	0	1	0	12	7	m	black	no	no	family me	Yes
17	1	1	1	1	1	1	1	1	1	1	36	0	m	middle ea	no	yes	family me	No
18	0	0	0	1	0	0	0	0	1	0	12	8	f	middle ea	yes	no	family me	Yes
19	0	1	1	1	0	1	1	1	1	0	29	3	f	middle ea	no	no	family me	No
20	0	0	0	1	0	1	0	0	1	0	12	7	f	black	no	no	family me	Yes

Fig 5.1 Dataset part 1



Case_No	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	Age_Mon	Qchat-10-	Sex	Ethnicity	Jaundice	Family_m	Who com	Class/ASD Tr
1	1	1	1	1	1	1	0	0	1	0	28	3	f	middle ea	yes	no	family me	No
2	0	0	1	1	1	0	0	1	1	1	36	4	m	White Eur	yes	no	family me	Yes
3	0	1	1	1	1	1	0	0	1	0	36	4	m	middle ea	yes	no	family me	Yes
4	0	0	0	0	0	0	0	0	0	0	24	10	m	Hispanic	no	no	family me	Yes
5	0	0	1	0	0	0	0	0	0	0	20	9	f	White Eur	no	yes	family me	Yes
6	0	0	1	1	0	0	0	0	0	0	21	8	m	black	no	no	family me	Yes
7	0	1	1	0	0	0	1	1	0	1	33	5	m	asian	yes	no	family me	Yes
8	1	0	1	1	0	1	0	0	0	0	33	6	m	asian	yes	no	family me	Yes
9	1	1	1	1	1	1	0	1	1	0	36	2	m	asian	no	no	family me	No
10	0	0	0	1	0	0	1	0	0	0	22	8	m	south asia	no	no	Health Car	Yes
11	0	1	1	0	1	0	0	1	0	0	36	6	m	Hispanic	yes	yes	family me	Yes
12	0	0	0	0	1	0	0	0	1	0	17	8	m	middle ea	yes	no	family me	Yes
13	1	1	1	1	1	1	1	1	1	1	25	0	f	middle ea	yes	no	family me	No
14	0	0	0	0	1	1	0	1	0	0	15	7	f	middle ea	yes	no	family me	Yes
15	1	1	1	1	1	1	1	1	1	1	18	0	m	middle ea	no	no	family me	No
16	0	0	0	1	0	1	0	0	1	0	12	7	m	black	no	no	family me	Yes
17	1	1	1	1	1	1	1	1	1	1	36	0	m	middle ea	no	yes	family me	No
18	0	0	0	1	0	0	0	0	1	0	12	8	f	middle ea	yes	no	family me	Yes
19	0	1	1	1	0	1	1	1	1	0	29	3	f	middle ea	no	no	family me	No
20	0	0	0	1	0	1	0	0	1	0	12	7	f	black	no	no	family me	Yes

Fig 5.2 Dataset part 2

Based on the capacity of my system I have trained 70% data and tested with 30% data for prediction.

5.2 TECHNOLOGY DESCRIPTION:

We have developed this project using the below technology:

PYTHON:

Python is currently the most widely used multi-purpose, high-level programming language. Python allows programming in Object-Oriented and Procedural paradigms. Python programs generally are smaller than other programming languages like Java. Programmers have to type relatively less and indentation requirement of the language, makes them readable all the time. Python language is being used by almost all tech-giant companies like – Google, Amazon, Facebook, Instagram, Dropbox, Uber… etc.

The biggest strength of Python is huge collection of standard library which can be used for the following –

1. Machine Learning
2. Web frameworks like Flask
3. Web scraping (like Scrapy, BeautifulSoup, Selenium)

4. Test frameworks
5. Multimedia

Advantages of python:

1. **Extensive Libraries**

Python downloads with an extensive library and it contain code for various purposes like regular expressions, documentation-generation, unit-testing, web browsers, threading, databases, CGI, email, image manipulation, and more. So, we don't have to write the complete code for that manually.

2. **Extensible**

As we have seen earlier, Python can be **extended to other languages**. You can write some of your code in languages like C++ or C. This comes in handy, especially in projects.

3. **Embeddable**

Complimentary to extensibility, Python is embeddable as well. You can put your Python code in your source code of a different language, like C++. This lets us add scripting capabilities to our code in the other language.

4. **Improved Productivity**

more productive The language's simplicity and extensive libraries render programmers than languages like Java and C++ do. Also, the fact that you need to write less and get more things done.

5. **IOT Opportunities**

Since Python forms the basis of new platforms like Raspberry Pi, it finds the future bright for the Internet Of Things. This is a way to connect the language with the real world.

6. **Simple and Easy**

When working with Java, you may have to create a class to print ‘Hello World’. But in Python, just a print statement will do. It is also quite easy to learn, understand, and code. This is why when people pick up Python, they have a hard time adjusting to other more verbose languages like Java.

7. **Readable**

Because it is not such a verbose language, reading Python is much like reading English. This is the reason why it is so easy to learn, understand, and code. It also does not need curly braces to define blocks, and indentation is mandatory. This further aids the readability of the code.

8. **Object-Oriented**

This language supports both the procedural and object-oriented programming paradigms. While functions help us with code reusability, classes and objects let us model the real world. A class allows the encapsulation of data and functions into one.

9. **Free and Open-Source**

Like we said earlier, Python is freely available. But not only can you download Python for free, but you can also download its source code, make changes to it, and even distribute it. It downloads with an extensive collection of libraries to help you with your tasks.

10. **Portable**

When you code your project in a language like C++, you may need to make some changes to it if you want to run it on another platform. But it isn’t the same with Python. Here, you need to code only once, and you can run it anywhere. This is called Write

Once Run Anywhere (WORA). However, you need to be careful enough not to include any system-dependent features.

11. **Interpreted**

Lastly, we will say that it is an interpreted language. Since statements are executed one by one, debugging is easier than in compiled languages.

Advantages of python over other languages:

1. **Less Coding**

Almost all of the tasks done in Python requires less coding when the same task is done in other languages. Python also has an awesome standard library support, so you don’t have to search for any third-party libraries to get your job done. This is the reason that many people suggest learning Python to beginners.

2. **Affordable**

Python is free therefore individuals, small companies or big organizations can leverage the free available resources to build applications. Python is popular and widely used so it gives you better community support.

3. **Python is for Everyone**

Python code can run on any machine whether it is Linux, Mac or Windows. Programmers need to learn different languages for different jobs but with Python, you can professionally build web apps, perform data analysis and machine learning, automate things, do web scraping and also build games and powerful visualizations. It is an all-rounder programming language.

Disadvantages of python:

So far, we've seen why Python is a great choice for your project. But if you choose it, you should be aware of its consequences as well. Let's now see the downsides of choosing Python over another language.

1. Speed Limitations

We have seen that Python code is executed line by line. But since Python is interpreted, it often results in slow execution. This, however, isn't a problem unless speed is a focal point for the project. In other words, unless high speed is a requirement, the benefits offered by Python are enough to distract us from its speed limitations.

2. Weak in Mobile Computing and Browsers

While it serves as an excellent server-side language, Python is much rarely seen on the client- side. Besides that, it is rarely ever used to implement smartphone-based applications. One such application is called Carbonnelle.

3.Design Restrictions

As you know, Python is dynamically-typed. This means that you don't need to declare the type of variable while writing the code. It uses duck-typing. But wait, what's that? Well, it just means that if it looks like a duck, it must be a duck. While this is easy on the programmers during coding, it can raise run-time errors.

4.Underdeveloped Database Access Layers

Compared to more widely used technologies like JDBC (Java DataBase Connectivity) and ODBC (Open DataBase Connectivity), Python's database access layers are a bit underdeveloped. Consequently, it is less often applied in huge enterprises. As we have seen earlier, Python can be extended to other languages. You can write some of your code in languages like C++ or C. This comes in handy, espcially in projects

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Compared to more widely used technologies like JDBC (Java DataBase Connectivity) and ODBC (Open DataBase Connectivity), Python's database access layers are a bit underdeveloped. Consequently, it is less often applied in huge enterprises.

5.Simple

No, we're not kidding. Python's simplicity can indeed be a problem. Take my example. I don't do Java, I'm more of a Python person. To me, its syntax is so simple that the verbosity of Java code seems unnecessary.

History of Python: -

That time in a project at the CWI, called Amoeba, a distributed operating system. In an interview with Bill Venners[1], Guido van Rossum said: "In the early 1980s, I worked as an implementer on a team building a language called ABC at Centrum voor Wiskunde en Informatica (CWI). I don't know how well people know ABC's influence on Python What do the alphabet and the programming language Python have in common? Right, both start with ABC. If we are talking about ABC in the Python context, it's clear that the programming language ABC is meant. ABC is a general-purpose programming language and programming environment, which had been developed in the Netherlands, Amsterdam, at the CWI (Centrum Wiskunde & Informatica). The greatest achievement of ABC was to influence the design of Python.Python was conceptualized in the late 1980s. Guido van Rossum worked. I try to mention ABC's influence because I'm indebted to everything I learned during that project and to the people who worked on it."Later on in the same Interview, Guido van Rossum continued: "I remembered all my experience and some of my frustration with ABC. I decided to try to design a simple scripting language that possessed some of ABC's better properties, but without its problems. So I started typing. I created a simple virtual machine, a simple parser, and a simple runtime. I made my own version of the various ABC parts that I liked. I created a basic syntax, used indentation for statement grouping instead of curly braces or begin-end blocks, and developed a small number of powerful data types: a hash table (or dictionary, as we call it), a list, strings, and numbers." Python a versatile programming language doesn’t come pre-installed on your computer devices. Python was first released in the year 1991 and until today it is a very popular high-level programming language. Its style philosophy emphasizes code readability with its notable use of great whitespace.

The object-oriented approach and language construct provided by Python enables programmers to write both clear and logical code for projects. This software does not come pre-packaged with Windows.

How to Install Python on Windows and Mac :

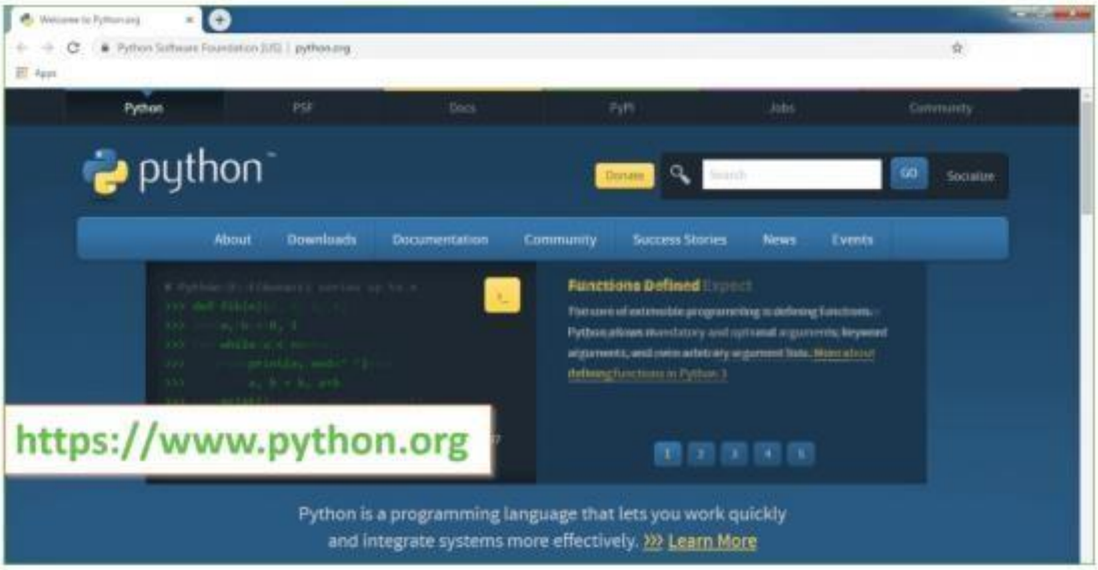
There have been several updates in the Python version over the years. The question is how to install Python? It might be confusing for the beginner who is willing to start learning Python but this tutorial will solve your query. The latest or the newest version of Python is version 3.7.4 or in other words, it is Python 3.

Note: The python version 3.7.4 cannot be used on Windows XP or earlier devices.

Before you start with the installation process of Python. First, you need to know about your System Requirements. Based on your system type i.e. operating system and based processor, you must download the python version. My system type is a Windows 64-bit operating system. So the steps below are to install python version 3.7.4 on Windows 7 device or to install Python 3. Download the Python Cheatsheet here.The steps on how to install Python on Windows 10, 8 and 7 are divided into 4 parts to help understand better.

Download the Correct version into the system

Step 1: Go to the official site to download and install python using Google Chrome or any other web browser. OR Click on the following link: https://www.python.org



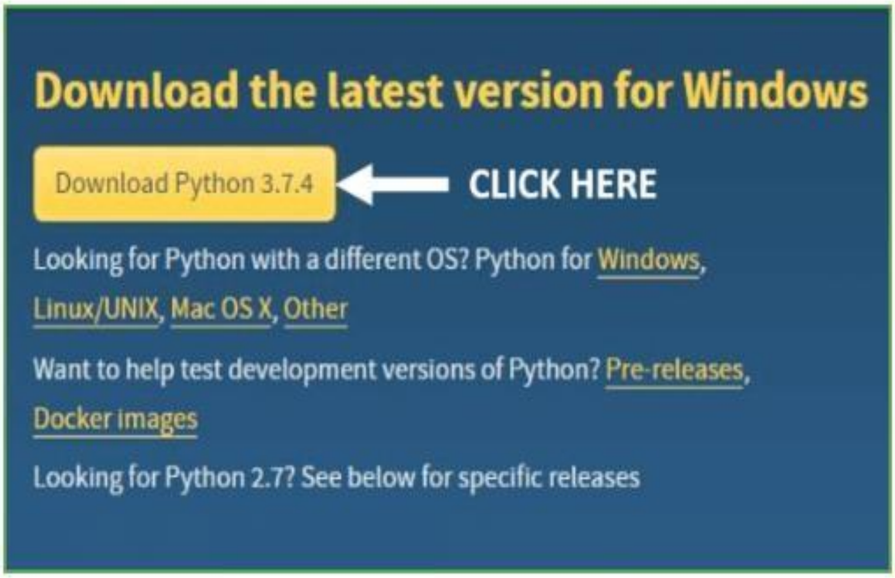
Functions Defined

The core of extensible programming is defining functions. Python allows mandatory and optional arguments, keyword arguments, and even arbitrary argument lists. More about defining functions in Python 3

Python is a programming language that lets you work quickly and integrate systems more effectively. >>> Learn More

Now, check for the latest and the correct version for your operating system.

step 2: Click on the Download Tab.



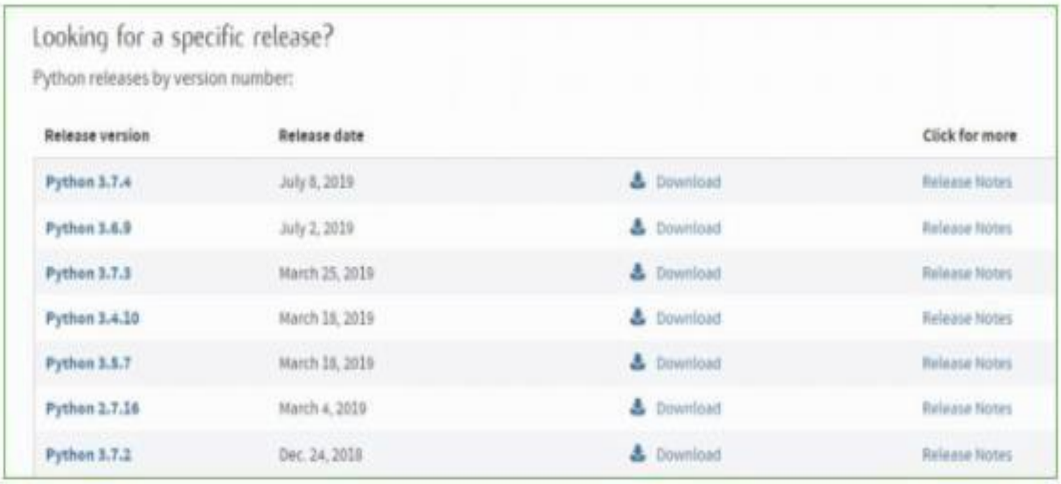
Download the latest version for Windows

Looking for Python with a different OS? Python for Windows, Linux/UNIX, Mac OS X, Other

Want to help test development versions of Python? Pre-releases, Docker images

Looking for Python 2.7? See below for specific releases

Step 3: You can either select the Download Python for windows 3.7.4 button in Yellow Color or you can scroll further down and click on download with respective to their version. Here, we are downloading the most recent python version for windows 3.7.4



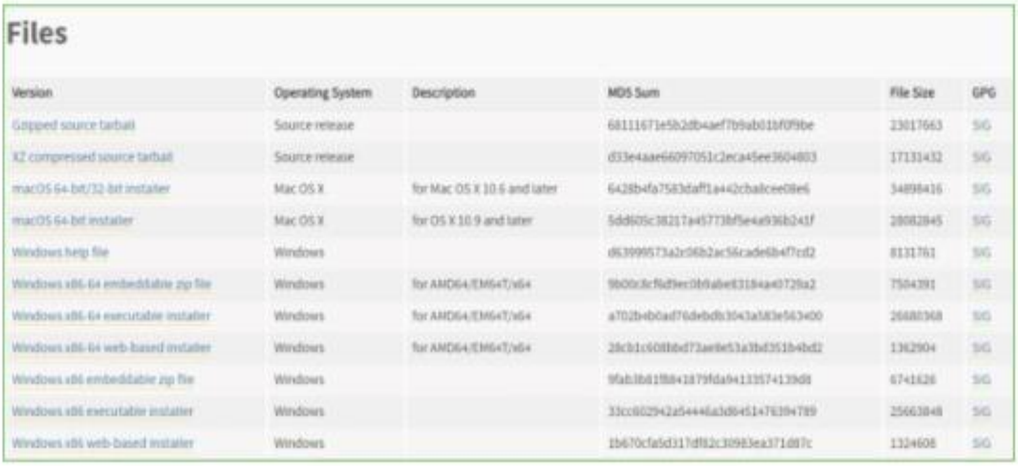
Looking for a specific release?

Python releases by version number:

Release version	Release date		Click for more
Python 3.7.4	July 8, 2019	Download	Release Notes
Python 3.6.9	July 2, 2019	Download	Release Notes
Python 3.7.3	March 25, 2019	Download	Release Notes
Python 3.4.10	March 18, 2019	Download	Release Notes
Python 3.5.7	March 18, 2019	Download	Release Notes
Python 2.7.16	March 4, 2019	Download	Release Notes
Python 3.7.2	Dec. 24, 2018	Download	Release Notes

Step 4: Scroll down the page until you find the Files option.

Step 5: Here you see a different version of python along with the operating system.



Files

Version	Operating System	Description	MD5 Sum	File Size	GPG
Gzipped source tarball	Source release		68111671e5b2db4aef7b9ab01bf0f9be	23017663	SIG
XZ compressed source tarball	Source release		d33e4aae66097051c2eca45ee3604803	17131432	SIG
macOS 64-bit/32-bit installer	Mac OS X	for Mac OS X 10.6 and later	6428b4fa7583daff1a442cba8cee08e6	34898416	SIG
macOS 64-bit installer	Mac OS X	for OS X 10.9 and later	5dd605c38217a45773bf5e4a936b241f	28082845	SIG
Windows help file	Windows		d63999573a2c56b2ac56cade6b4f7cd2	8131761	SIG
Windows x86-64 embeddable zip file	Windows	for AMD64/EM64T/x64	9b00c8cf6d9ec0b9abe83184a40729a2	7504391	SIG
Windows x86-64 executable installer	Windows	for AMD64/EM64T/x64	a702b4b0ad76debdb3043a583e563400	26680368	SIG
Windows x86-64 web-based installer	Windows	for AMD64/EM64T/x64	28cb1c608bbd73ae8e53a3bd351b4bd2	1362904	SIG
Windows x86 embeddable zip file	Windows		9fab3b81f8841879fda94133574139d8	6741626	SIG
Windows x86 executable installer	Windows		33cc602942a54446a3d6451476394789	25663848	SIG
Windows x86 web-based installer	Windows		1b670cfa5d317df82c30983ea371d87c	1324608	SIG

To download **Windows 32-bit python**, you can select any one from the three options: Windows x86 embeddable zip file, Windows x86 executable installer or Windows x86 web-based installer.

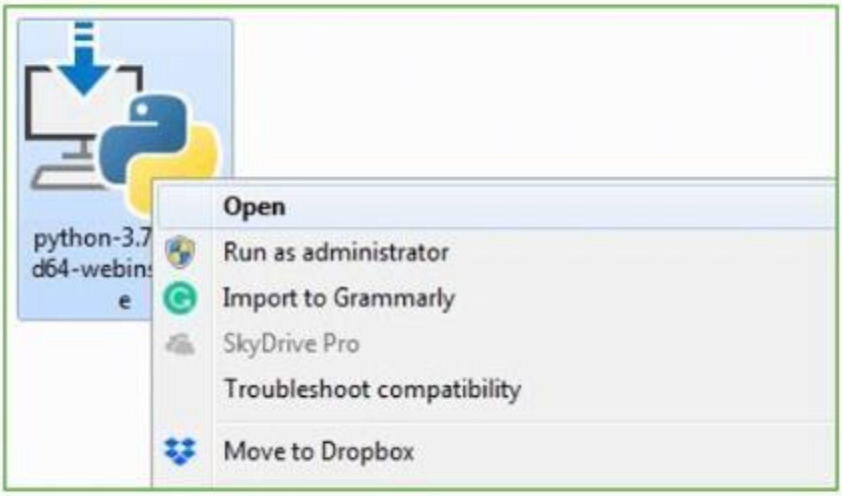
- To download **Windows 64-bit python**, you can select any one from the three options: Windows x86-64 embeddable zip file, Windows x86-64 executable installer or Windows x8664 web-based installer.

Here we will install Windows x86-64 web-based installer. Here your first part regarding which version of python is to be downloaded is completed. Now we move ahead with the second part in installing python i.e. Installation

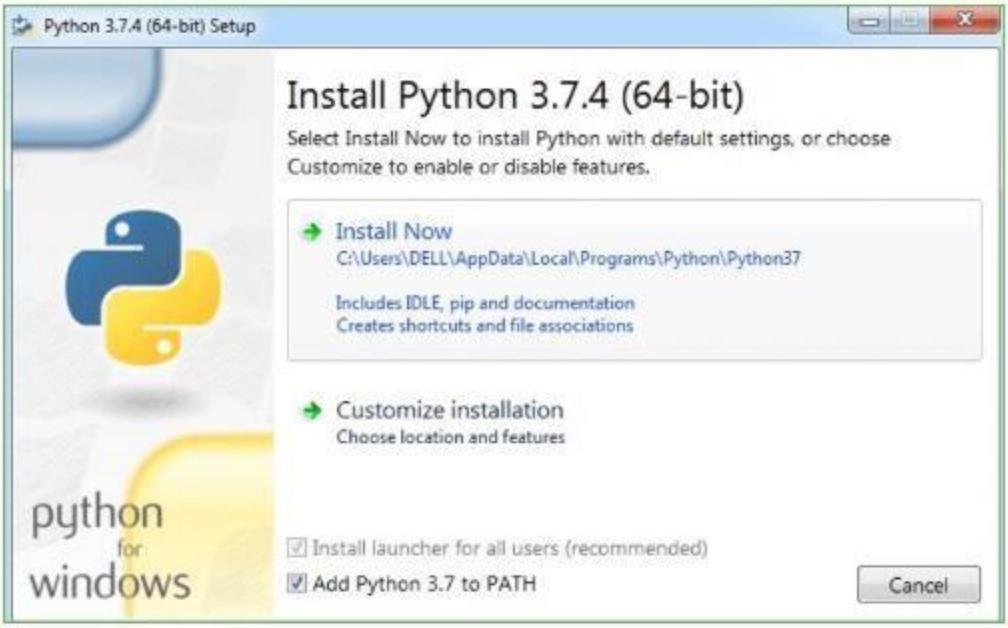
Note: To know the changes or updates that are made in the version you can click on the Release Note Option.

Installation of Python

Step 1: Go to Download and Open the downloaded python version to carry out the installation process.



Step 2: Before you click on Install Now, Make sure to put a tick on Add Python 3.7 to PATH.



Python 3.7.4 (64-bit) Setup

Install Python 3.7.4 (64-bit)

Select Install Now to install Python with default settings, or choose Customize to enable or disable features.

Install Now
C:\Users\DELL\AppData\Local\Programs\Python\Python37

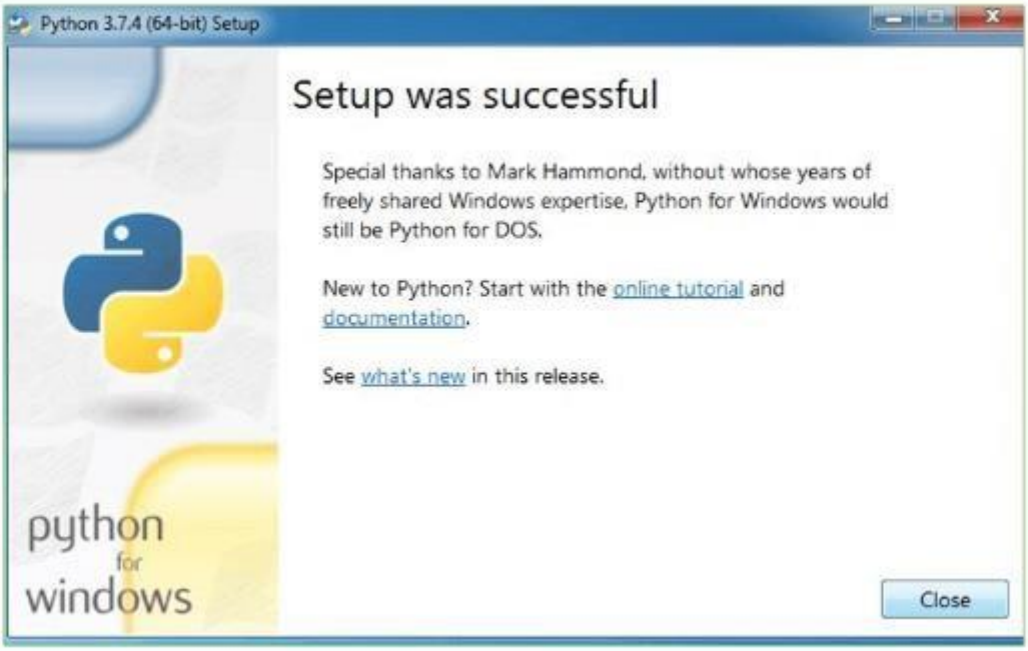
Includes IDLE, pip and documentation
Creates shortcuts and file associations

Customize installation
Choose location and features

☑ Install launcher for all users (recommended)

☑ Add Python 3.7 to PATH

Step 3: Click on Install NOW After the installation is successful. Click on Close.


Python 3.7.4 (64-bit) Setup

Setup was successful

Special thanks to Mark Hammond, without whose years of freely shared Windows expertise, Python for Windows would still be Python for DOS.

New to Python? Start with the online tutorial and documentation.

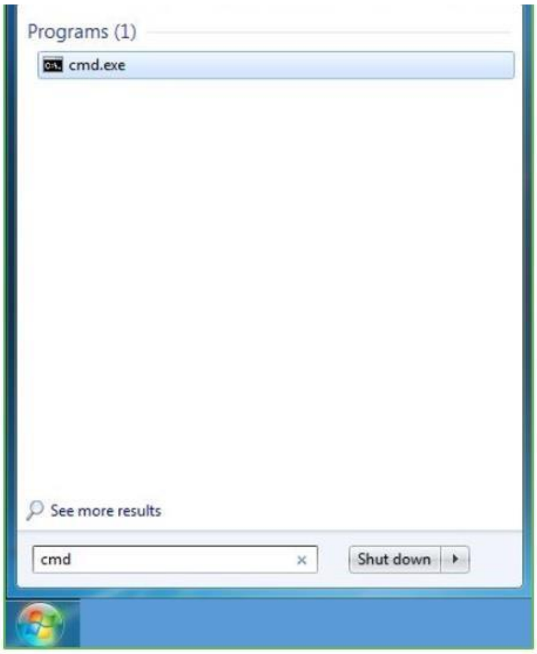
See what's new in this release.

With these above three steps on python installation, you have successfully and correctly installed Python. Now is the time to verify the installation. **Note:** The installation process might take a couple of minutes.

Verify the Python Installation

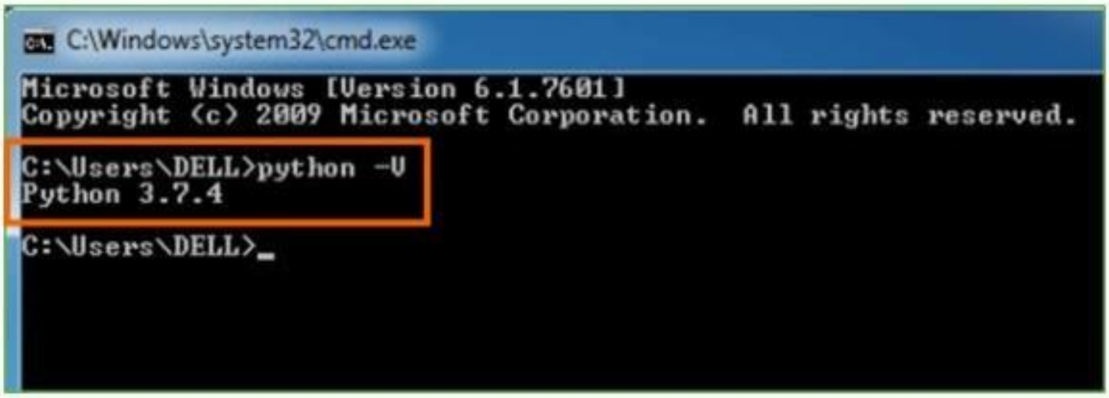
Step 1: Click on Start

Step 2: In the Windows Run Command, type “cmd”



Step 3: Open the Command prompt option.

Step 4: Let us test whether the python is correctly installed. Type **python –V** and press Enter.



```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\DELL>python -V
Python 3.7.4

C:\Users\DELL>_
```

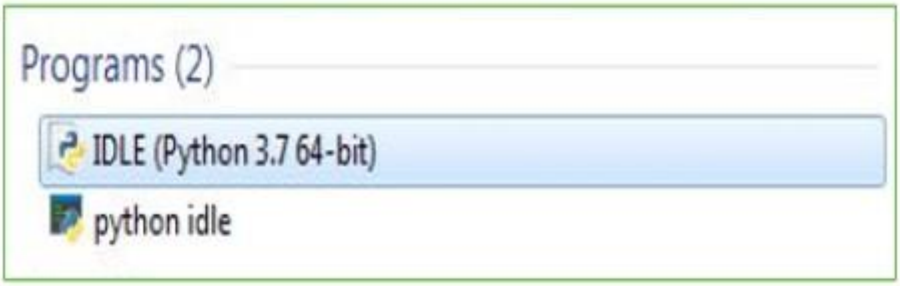
Step 5: You will get the answer as 3.7.4

Note: If you have any of the earlier versions of Python already installed. You must first uninstall the earlier version and then install the new one.

Check how the Python IDLE works

Step 1: Click on Start

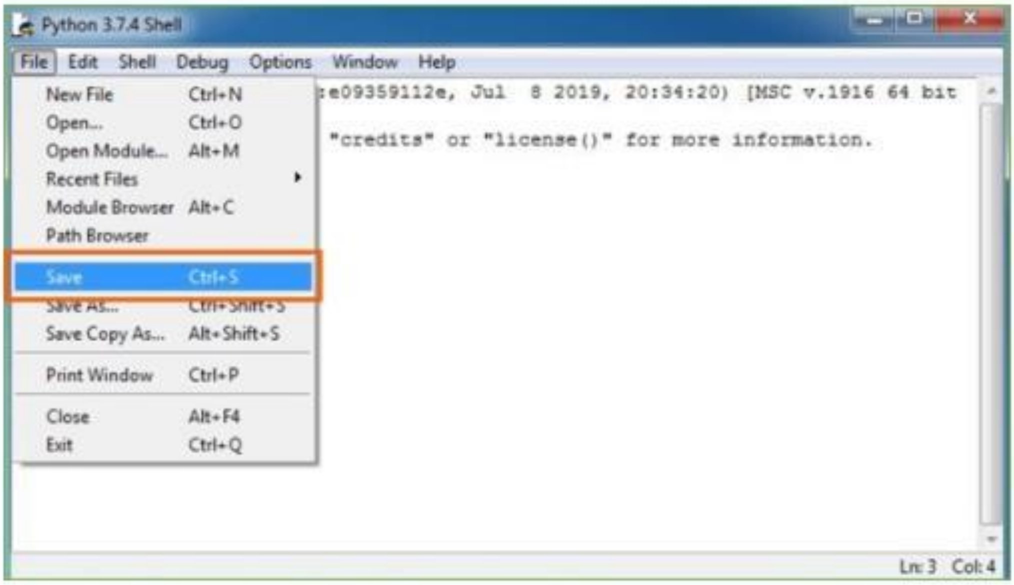
Step 2: In the Windows Run command, type “python idle”



Step 3: Click on IDLE (Python 3.7 64-bit) and launch the program

Step 4: To go ahead with working in IDLE you must first save the file.

Click on File > Click on Save

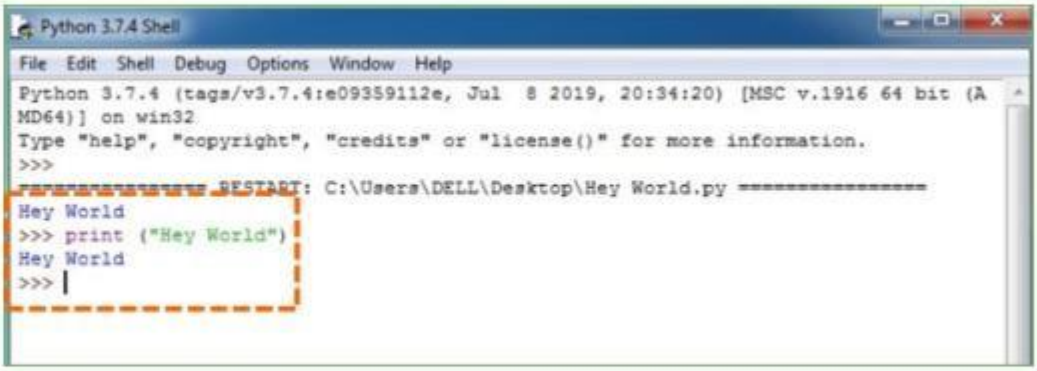


```
:e09359112e, Jul  8 2019, 20:34:20) [MSC v.1916 64 bit

 "credits" or "license()" for more information.
```

Step 5: Name the file and save as type should be Python files. Click on SAVE. Here I have named the files as Hey World.

Step 6: Now for e.g. **enter print ("Hey World")** and Press Enter.



```
Python 3.7.4 (tags/v3.7.4:e09359112e, Jul  8 2019, 20:34:20) [MSC v.1916 64 bit (A
MD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
================ RESTART: C:\Users\DELL\Desktop\Hey World.py ================
Hey World
>>> print ("Hey World")
Hey World
>>> 
```

You will see that the command given is launched. With this, we end our tutorial on how to install Python. You have learned how to download python for windows into your respective operating system.

Note: Unlike Java, Python doesn’t need semicolons at the end of the statements otherwise it won’t work.

This stack that includes:

□ world.

Django – Design Philosophies

Django comes with the following design philosophies −

- **Loosely Coupled** − Django aims to make each element of its stack independent of the others.
- **Less Coding** − Less code so in turn a quick development.
- **Don't Repeat Yourself (DRY)** − Everything should be developed only in exactly one place instead of repeating it again and again.
- **Fast Development** − Django's philosophy is to do all it can to facilitate hyper-fast development.
- **Clean Design** − Django strictly maintains a clean design throughout its own code and makes it easy to follow best web-development practices.

Advantages of Django

Here are few advantages of using Django which can be listed out here −

- **Object-Relational Mapping (ORM) Support** − Django provides a bridge between the data model and the database engine, and supports a large set of database systems including MySQL, Oracle, Postgres, etc. Django also supports NoSQL database through Django-nonrel fork. For now, the only NoSQL databases supported are MongoDB and google app engine.
- **Multilingual Support** − Django supports multilingual websites through its built-in internationalization system. So you can develop your website, which would support multiple languages.

- **Framework Support** − Django has built-in support for Ajax, RSS, Caching and various other frameworks.

- **Administration GUI** − Django provides a nice ready-to-use user interface for administrative activities.

- **Development Environment** − Django comes with a lightweight web server to facilitate endto-end application development and testing.

As you already know, Django is a Python web framework. And like most modern framework, Django supports the MVC pattern. First let's see what is the Model-View-Controller (MVC) pattern, and then we will look at Django’s specificity for the Model-View-Template (MVT) pattern.

MACHINE LEARNING:

Machine learning involves building mathematical models to help understand data. "Learning" enters the fray when we give these models tunable parameters that can be adapted to observed data; in this way the program can be considered to be "learning" from the data. Once these models have been fit to previously seen data, they can be used to predict and understand aspects of newly observed data.

Types of machine learning:

Supervised Learning – This involves learning from a training dataset with labeled data using classification and regression models. This learning process continues until the required level of performance is achieved.

Unsupervised Learning – This involves using unlabelled data and then finding the underlying structure in the data in order to learn more and more about the data itself using factor and cluster analysis models.

Semi-supervised Learning – This involves using unlabelled data like Unsupervised Learning with a small amount of labeled data. Using labeled data vastly increases the learning accuracy and is also more cost-effective than Supervised Learning.

Reinforcement Learning – This involves learning optimal actions through trial and error. So the next action is decided by learning behaviors that are based on the current state and that will maximize the reward in the future.

Challenges in machine learning:

Quality of data − Having good-quality data for ML algorithms is one of the biggest challenges. Use of low-quality data leads to the problems related to data preprocessing and feature extraction.

Time-Consuming task − Another challenge faced by ML models is the consumption of time especially for data acquisition, feature extraction and retrieval.

Lack of specialist persons − As ML technology is still in its infancy stage, availability of expert resources is a tough job.

No clear objective for formulating business problems − Having no clear objective and well- defined goal for business problems is another key challenge for ML because this technology is not that mature yet.

Issue of overfitting & underfitting − If the model is overfitting or underfitting, it cannot be represented well for the problem.

Curse of dimensionality − Another challenge ML model faces is too many features of data points. This can be a real hindrance.

Difficulty in deployment − Complexity of the ML model makes it quite difficult to be deployed in real life.

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Difficulty in deployment − Complexity of the ML model makes it quite difficult to be deployed in real life.

Applications of machine learning:

Machine Learning is the most rapidly growing technology and according to researchers we are in the golden year of AI and ML. It is used to solve many real-world complex problems which cannot be solved with traditional approach. Following are some real-world applications of ML −

- Emotion analysis
- Sentiment analysis
- Error detection and prevention
- Weather forecasting and prediction
- Stock market analysis and forecasting
- Speech synthesis
- Speech recognition
- Customer segmentation
- Object recognition
- Fraud detection
- Fraud prevention
- Recommendation of products to customer in online shopping

Terminologies of Machine Learning

Model – A model is a specific representation learned from data by applying some machine learning algorithm. A model is also called a hypothesis.

Feature – A feature is an individual measurable property of the data. A set of numeric features can be conveniently described by a feature vector. Feature vectors are fed as input to the model. For example, in order to predict a fruit, there may be features like color, smell, taste, etc.

Target (Label) – A target variable or label is the value to be predicted by our model. For the fruit example discussed in the feature section, the label with each set of input would be the name of the fruit like apple, orange, banana, etc.

Training – The idea is to give a set of inputs(features) and it’s expected outputs(labels), so after training, we will have a model (hypothesis) that will then map new data to one of the categories trained on.

Prediction – Once our model is ready, it can be fed a set of inputs to which it will provide a predicted output(label).

Advantages of Machine learning :-

1. Easily identifies trends and patterns -

Machine Learning can review large volumes of data and discover specific trends and patterns that would not be apparent to humans. For instance, for an e-commerce website like Amazon, it serves to understand the browsing behaviors and purchase histories of its users to help cater to the right products, deals, and reminders relevant to them. It uses the results to reveal relevant advertisements to them.

2. No human intervention needed (automation)

With ML, you don’t need to babysit your project every step of the way. Since it means giving machines the ability to learn, it lets them make predictions and also improve the algorithms on their own. A common example of this is anti-virus softwares; they learn to filter new threats as they are recognized. ML is also good at recognizing spam.

3. Continuous Improvement

As ML algorithms gain experience, they keep improving in accuracy and efficiency. This lets them make better decisions. Say you need to make a weather forecast model. As the amount of data you have keeps growing, your algorithms learn to make more accurate predictions faster.

4. Handling multi-dimensional and multi-variety data

Machine Learning algorithms are good at handling data that are multi-dimensional and multi-variety, and they can do this in dynamic or uncertain environments.

5. Wide Applications

You could be an e-tailer or a healthcare provider and make ML work for you. Where it does apply, it holds the capability to help deliver a much more personal experience to customers while also targeting the right customers.

Disadvantages of Machine Learning :-

1. Data Acquisition

Machine Learning requires massive data sets to train on, and these should be inclusive/unbiased, and of good quality. There can also be times where they must wait for new data to be generated.

2. Time and Resources

ML needs enough time to let the algorithms learn and develop enough to fulfill their purpose with a considerable amount of accuracy and relevancy. It also needs massive resources to function. This can mean additional requirements of computer power for you.

3. Interpretation of Results

Another major challenge is the ability to accurately interpret results generated by the algorithms. You must also carefully choose the algorithms for your purpose.

4. High error-susceptibility

Machine Learning is autonomous but highly susceptible to errors. Suppose you train an algorithm with data sets small enough to not be inclusive. You end up with biased predictions coming from a biased training set. This leads to irrelevant advertisements being displayed to customers. In the case of ML, such blunders can set off a chain of errors that can go undetected for long periods of time. And when they do get noticed, it takes quite some time to recognize the source of the issue, and even longer to correct it.

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5.3MODULE IMPLEMENTATION:

```
import os
import cv2
import numpy as np
from keras.utils.np_utils import to_categorical
from keras.layers import  MaxPooling2D
from keras.layers import Dense, Dropout, Activation, Flatten
from keras.layers import Convolution2D
from keras.models import Sequential
from keras.models import model_from_json
import pickle
import pandas as pd
df=pd.read_csv("ToddlerAutism.csv")
X = df.drop(['Class/ASD Traits '], axis = 1)
y = df['Class/ASD Traits ']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.40, random_state =42)
```

```
X.isnull().sum()
X.info()
models = []
models.append(('LR', LogisticRegression()))
models.append(('LDA', LinearDiscriminantAnalysis()))
models.append(('KNN', KNeighborsClassifier()))
#models.append(('CART', DecisionTreeClassifier()))
models.append(('NB', GaussianNB()))
models.append(('SVM', SVC()))
models.append(('RF', RandomForestRegressor()))
models.append(('XGB', XGBClassifier()))
models.append(('GBR', GradientBoostingRegressor()))
models.append(('ABR', AdaBoostRegressor()))
for name, model in models:
    model.fit(X_train, y_train)
    y_hat_test = model.predict(X_test).astype(int)
    y_hat_train = model.predict(X_train).astype(int)
    print(name, 'Accuracy Score is : ', round(accuracy_score(y_test, y_hat_test)))
for name, model in models:
    y_hat_test = model.predict(X_test).astype(int)
    y_hat_train = model.predict(X_train).astype(int)
    print(name, 'Accuracy Score is : ',round( accuracy_score(y_test, y_hat_test),2))
svc = SVC()

params = {
    'C': [0.1,0.8,0.9,1,1.1,1.2,1.3,1.4],
    'kernel':['linear', 'rbf'],
    'gamma' :[0.1,0.8,0.9,1,1.1,1.2,1.3,1.4]
}

clf = GridSearchCV(svc, param_grid = params, scoring = 'accuracy', cv = 10, verbose = 2)
clf.fit(X_train, y_train)
clf.best_params_
# Re-running model with best parametres
from sklearn.svm import SVC
svc1 = SVC(C = 0.8, gamma = 0.1, kernel = 'linear')
svc1.fit(X_train, y_train)
y_hat_test = svc1.predict(X_test)
#print(accuracy_score(y_test, y_hat_test))
metrics(svc1, y_train, y_test, y_hat_train, y_hat_test)
svcgrid_test_acc = round(accuracy_score(y_test, y_hat_test), 2)

svcgrid_test_acc
import pickle
# Save trained model to file
pickle.dump(best_clf_estimator, open("autism.pkl", "wb"))
loaded_model = pickle.load(open("autism.pkl", "rb"))
loaded_model.predict(X_test)
loaded_model.score(X_test,y_test)

A1 = input()
A2 = input()
A3 = input()
A4 = input()
A5 = input()
A6 = input()
A7 = input()
A8 = input()
A9 = input()
A10 = input()
Age_Mons = input()
Sex = input()
Ethnicity = input()
Jaundice = input()
Family_mem_with_ASD = input()
```

```
row_df                                                                                  =
pd.DataFrame([pd.Series([A1,A2,A3,A4,A5,A6,A7,A8,A9,A10,Age_Mons,Sex,Ethni
city,Jaundice,Family_mem_with_ASD])])
prob = loaded_model.predict_proba(row_df)[0][1]
print(f"The probability of you having austim is {prob}")
r=loaded_model.predict(row_df)[0]
if r==1:
    print("Victim having austim spectram disorder")
else:
    print("Victim is not effected with austim spectram disorder")



from flask import Flask,request, url_for, redirect, render_template
import pickle
import pandas as pd
app = Flask(__name__)

model = pickle.load(open("autism.pkl", "rb"))



@app.route('/')
def hello_world():
    return render_template("index.html")



@app.route('/predicts',methods=['POST','GET'])
def predict():
    text1 = request.form['1']
    text2 = request.form['2']
    text3 = request.form['3']
    text4 = request.form['4']
    text5 = request.form['5']
    text6 = request.form['6']
    text7 = request.form['7']
    text8 = request.form['8']
    text9 = request.form['9']
    text10 = request.form['10']
    text11 = request.form['11']
    text12 = request.form['12']
    text13 = request.form['13']
    text14 = request.form['14']
    text15 = request.form['15']


    row_df = pd.DataFrame([pd.Series([text1,text2,text3,text4,text5,text6,text7,text8,text9,text10,text11,text12,text13,text14,text15])])

    #print(row_df)
    prediction=model.predict_proba(row_df)
    outpu='{0:.{1}f}'.format(prediction[0][1], 2)
    output = str(float(outpu)*100)+'%'
    if outpu>str(0.5):
        return render_template('result.html',pred=f'You have chance of having ASD.\nProbability of having ASD is {output}')
    else:
        return render_template('result.html',pred=f'You are safe.\n Probability of having ASD is {output}')

if __name__ == '__main__':
    app.run(debug=True)
```

Front End Code

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta  http-equiv="Content-Type"  content="text/html;  charset=UTF-
8"/>     <meta  name="viewport"  content="width=device-width,  initial-
scale=1, maximumscale=1.0"/>
  <title>Austim Spectrum Disorder prediction</title>
<img align="left"

  <!-- CSS  -->
  <link                    href="https://fonts.googleapis.com/icon?family=Material+Icons"
rel="stylesheet">
  <link       href="../static/css/materialize.css"       type="text/css"       rel="stylesheet"
media="screen,projection"/>
  <link         href="../static/css2/style.css"         type="text/css"         rel="stylesheet"
media="screen,projection"/>
</head>

<body>
  <nav class="light-blue lighten-1" role="navigation">
    <div    class="nav-wrapper    container"><a    id="logo-container"    href="#"
class="brandlogo">AUSTIM SPECTRUM DISORDER Prediction</a>       <ul
class="right hide-on-med-and-down">
        <li><a href="#">Home</a></li>
      </ul>

  </nav>


  <div class="section no-pad-bot" id="index-banner">
    <div class="container">
     <h5 style="text-align: center; color: brown; font-weight: 600;">{{pred}}</h5>
      <h1 class="header center orange-text">Austim Spectrum Disorder
prediction</h1>     <div class="row center">
        <h5 class="header col s12 light">Predict the probability of having ustim
Spectrum
Disorder
        <br>
        </h5>
      </div>


      <div class="row">
        <form action='/predict' method="post" class="col s12">
            <div class="row">
                <div class="input-field col s4">
                    <label for="first_name"><b>I often notice small sounds when others do
not</b>        </label>                   <br>
         <br>
         <br>
                    <input placeholder="1 or 0" name="1" id="first_name" type="text"
class="validate">                 </div>
      <div class="input-field col s4">
            <label for="last_name"><b>I usually concentrate more on the whole picture,
rather than the small details </b></label>
                    <br>
         <br>
         <br>
                    <input id="last_name" name="2" placeholder="1 or 0"  type="text"
class="validate">


                </div>


                <div class="input-field col s4">
```

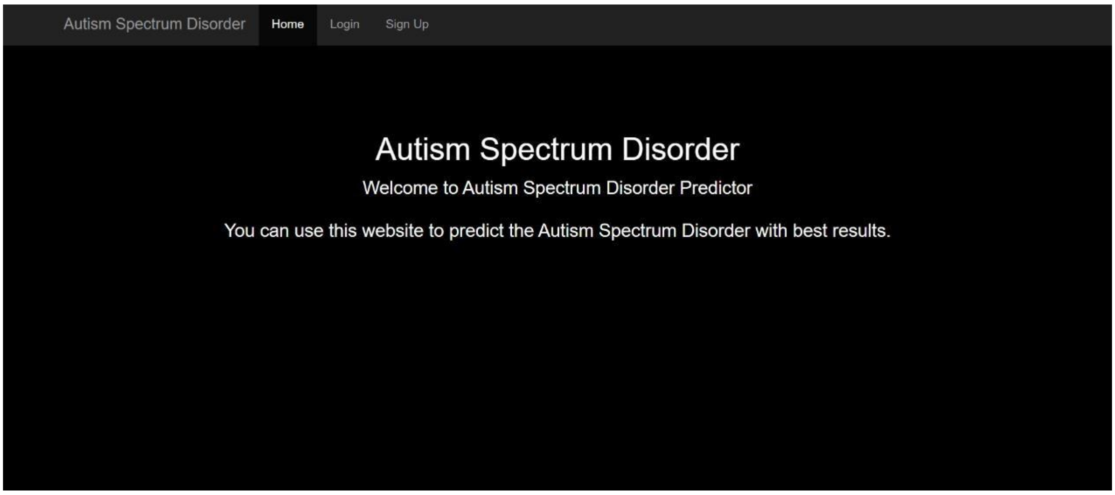
```
          <label for="_name"><b>I find it easy to do more than one thing at once</b></label>
          <br>
     <br>
     <br>
          <input id="_name" name="3" placeholder="1 or 0" type="text" class="validate">


        </div>
        <div class="input-field col s4">
          <label for="first_name"><b>If there is an interruption, I can switch back to what I was doing very quickly</b></label>
          <br>
          <br>
     <br>
          <input placeholder="1 or 0" name="4" id="first_name" type="text" class="validate">
        </div>
        <div class="input-field col s4">
          <label for="last_name"><b>I find it easy to read between the lines when someone is talking to me </b></label>
          <br>
          <br>
     <br>
          <input id="last_name" name="5" placeholder="1 or 0"  type="text" class="validate">
        </div>
        <div class="input-field col s4">
         <label ><b>I know how to tell if someone listening to me is getting bored</b></label>            <br>
          <br>
     <br>
         <input name = '6' placeholder="1 or 0">
```

```
                </div>
                <div class="input-field col s4">
                    <label for="last_name"><b>When I'm reading a story, I find it
difficult to work out the character's intentions </b></label>                  <br>
          <br>
  <br>
                  <input  id="last_name"  name="7"  placeholder="1  or  0"    type="text"
class="validate">
                </div>
                <div class="input-field col s4">
                    <label for="_name"><b>I like to collect information about categories of
things</b></label>                    <br>
                    <br>
          <br>
                    <input   id="_name"   name="8"   placeholder="1   or   0"   type="text"
class="validate">
                </div>



   <div class="input-field col s4">
                    <label for="first_name"><b>I find it easy to work out what someone is
thinking or feeling just by looking at their face</b></label>
                    <br>
                    <br>
          <br>
                    <input  placeholder="1  or  0"  name="9"  id="first_name"  type="text"
class="validate">
                </div>
                <div class="input-field col s4">
                    <label  for="last_name"><b>I  find  it  difficult  to  work  out  people's
intentions  </b></label>                   <br>
                    <br>
```

```
       <br>
            <input id="last_name" name="10" placeholder="1 or 0"  type="text" class="validate">
          </div>
         <div class="row center">

         <button   type="submit"   class="btn-large   waves-effect   waves-light orange">Predict Probability</button>

       </div>
      </form>
  </div>
    <br>
   <br><br>
  </div>
</div>

  <footer class="page-footer orange" style="position: fixed;left: 0;bottom: 0; width: 100%;">
   <div class="footer-copyright">
    <div class="container" style="padding-bottom: 0.5rem; position: fixed; font-size: 1.2rem; margin-left: 5rem;">
<p>&copy; enter name
<p>enter ur mail</p>
   </div>
   </div>
  </footer>


  <!-- Scripts-->
  <script src="https://code.jquery.com/jquery-2.1.1.min.js"></script>
  <script src="../static/js/materialize.js"></script>
  <script src="js/init.js"></script>
  </body>
</html>


<!DOCTYPE html>
<html lang="en">
<head>
  <meta http-equiv="Content-Type" content="text/html; charset=UTF-
8"/>     <meta name="viewport" content="width=device-width, initial-
scale=1, maximumscale=1.0"/>
  <title>Diabetes prediction</title>
  <!-- CSS  -->
  <link href="https://fonts.googleapis.com/icon?family=Material+Icons"
rel="stylesheet">
  <link href="./static/css/materialize.css" type="text/css" rel="stylesheet"
media="screen,projection"/>
  <link href="./static/css2/style.css" type="text/css" rel="stylesheet"
media="screen,projection"/>
</head>
<body>
  <nav class="light-blue lighten-1" role="navigation">
    <div class="nav-wrapper container"><a id="logo-container" href="/"
class="brandlogo">ASD Prediction</a>
      <ul class="right hide-on-med-and-down">
        <li><a href="/">Home</a></li>
      </ul>
  </nav>
      <div class="row" style="margin:15% 0% 0% 10%">
            <h3 >{{pred}}</h3>
  </div>
      <br>
  <br><br>
```

```
 </div>
 </div>>
 <footer class="page-footer light-blue lighten-1" style="position: fixed;left:
0;bottom:
0; width: 100%;">
   <div class="footer-copyright light-blue lighten-1">
     <div class="" style="padding-bottom: 1rem; position: fixed; font-size: 1.2rem;
margin-left: 5rem;">
       <p>&copy; Sujith Reddy
       <p>vtu15960@veltech.edu.in</p>
</div>
</div>
</footer>
 <!-- Scripts-->
 <script src="https://code.jquery.com/jquery-2.1.1.min.js"></script>
 <script src=".js/materialize.js"></script>
 <script src="js/init.js"></script>
 </body>
</html>
```

5.4 SCREENSHOTS

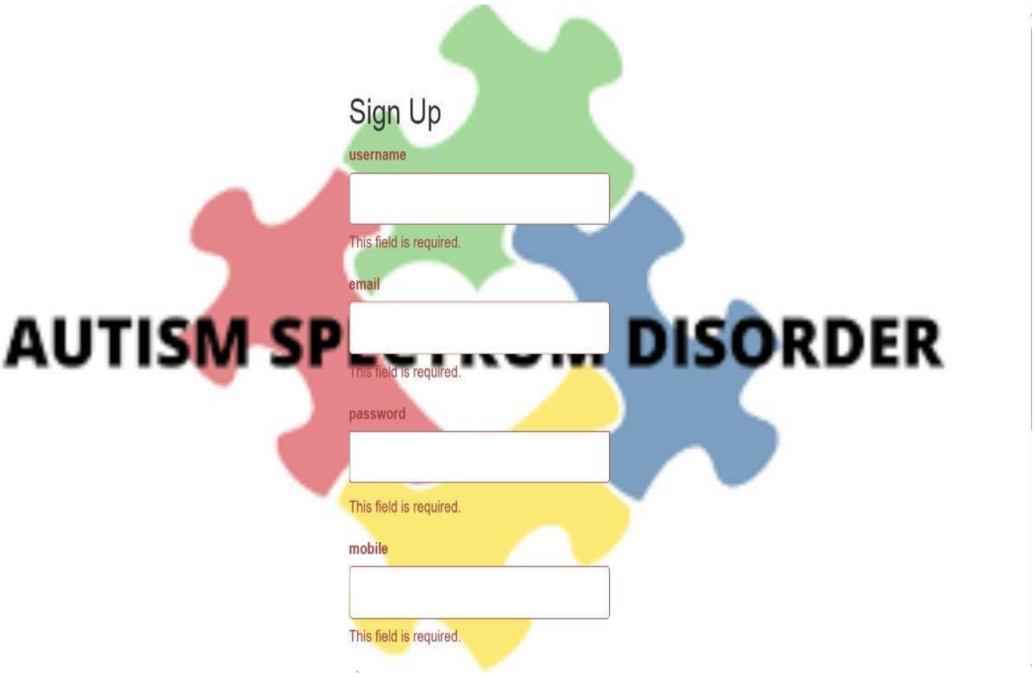


Autism Spectrum Disorder

Welcome to Autism Spectrum Disorder Predictor

You can use this website to predict the Autism Spectrum Disorder with best results.

Fig 5: main page



Sign Up

username

This field is required.

email

This field is required.

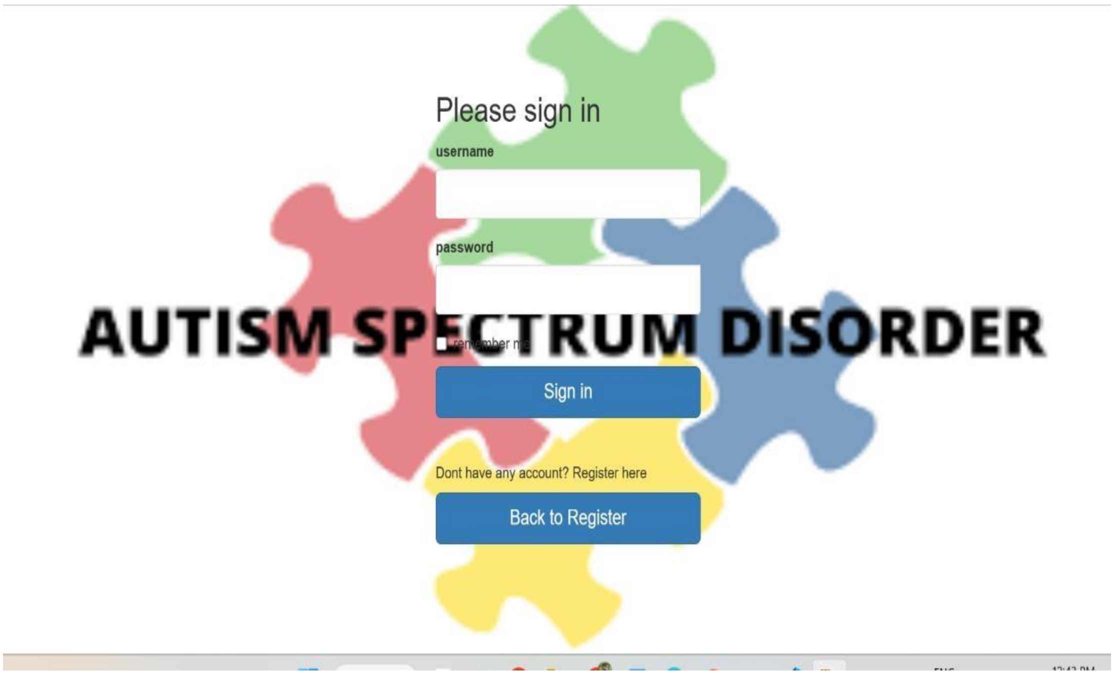
password

This field is required.

mobile

This field is required.

Fig 6: Sign up page



Please sign in

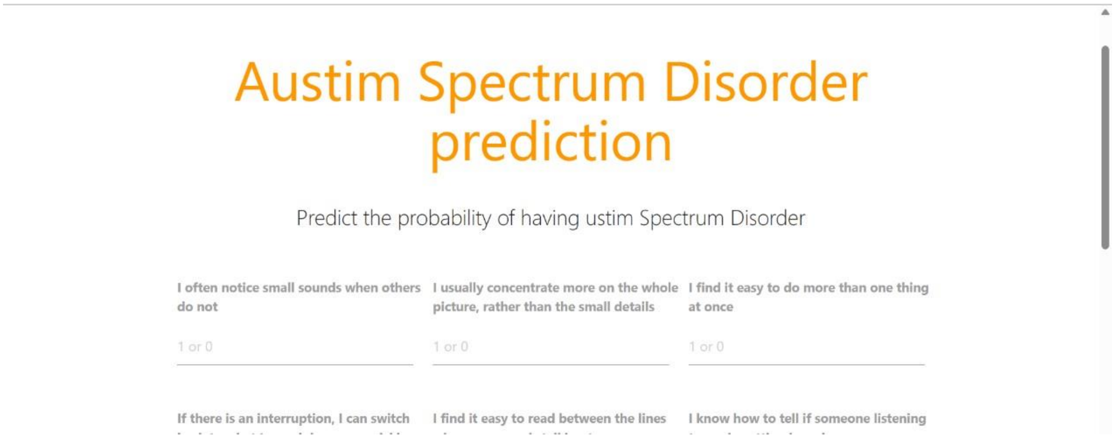
username

password

□ remember me

Dont have any account? Register here

Fig 7: Login Screen

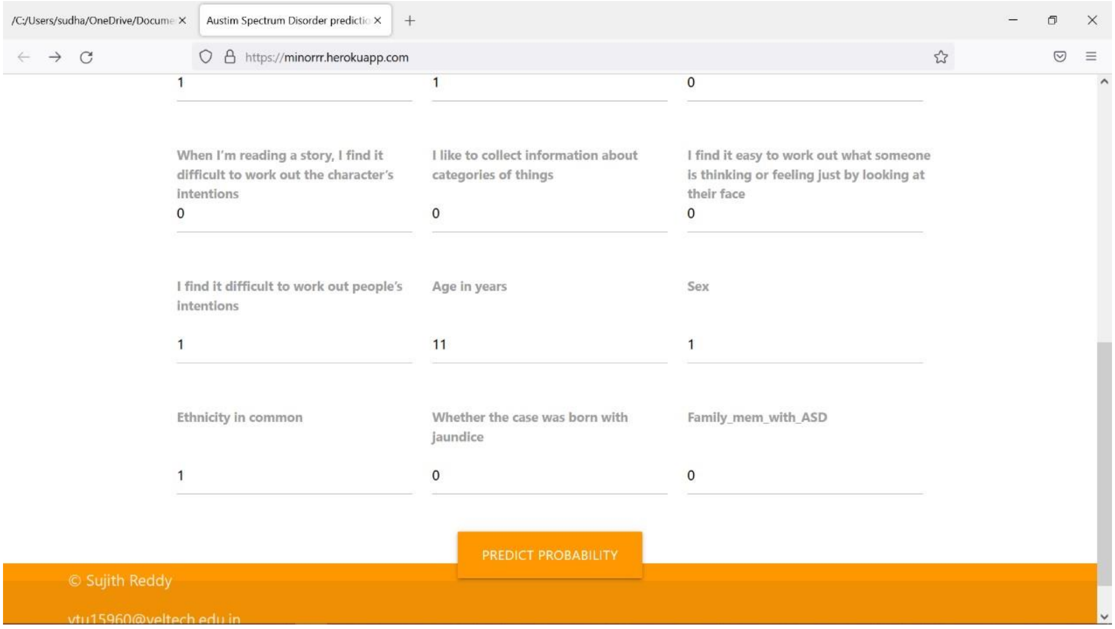


Austim Spectrum Disorder prediction

Predict the probability of having ustim Spectrum Disorder

I often notice small sounds when others do not	I usually concentrate more on the whole picture, rather than the small details	I find it easy to do more than one thing at once
1 or 0	1 or 0	1 or 0
If there is an interruption, I can switch	I find it easy to read between the lines	I know how to tell if someone listening

Fig 8:Data Input Screen1


/C:/Users/sudha/OneDrive/Docume
Austim Spectrum Disorder predictio
https://minorrr.herokuapp.com
PREDICT PROBABILITY

1

1

0

When I'm reading a story, I find it difficult to work out the character's intentions

0

I like to collect information about categories of things

0

I find it easy to work out what someone is thinking or feeling just by looking at their face

0

I find it difficult to work out people's intentions

1

Age in years

11

Sex

1

Ethnicity in common

1

Whether the case was born with jaundice

0

Family_mem_with_ASD

0

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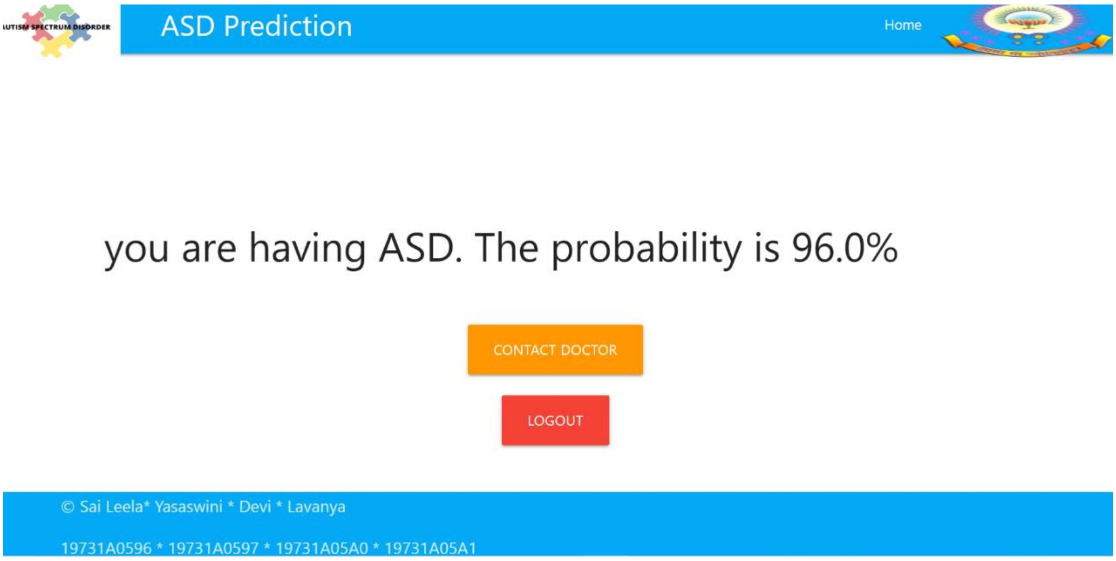
vtu15960@veltech.edu.in

Fig 9: Data input Screen

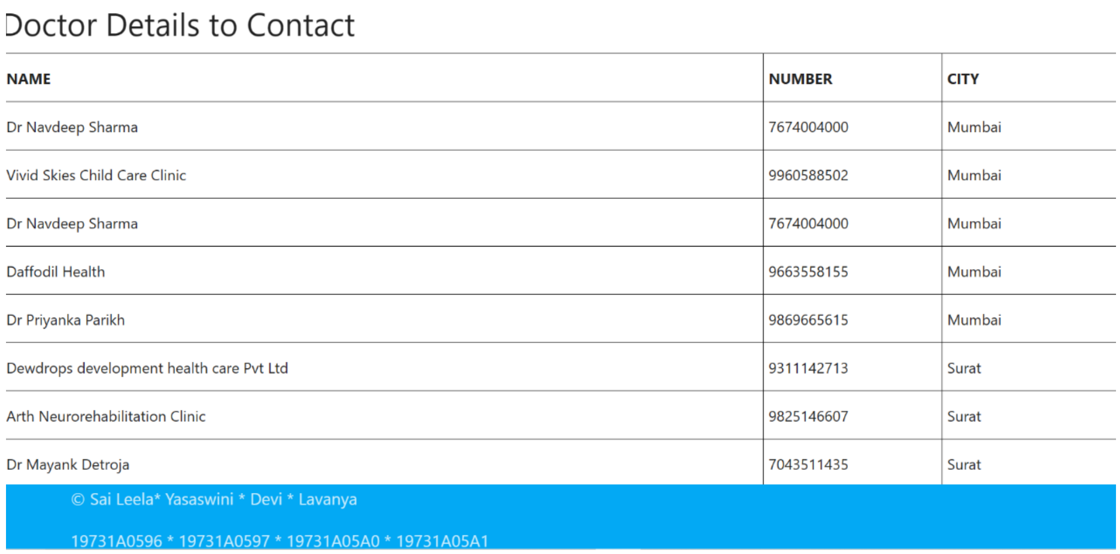


you are having ASD. The probability is 96.0%

© Sai Leela* Yasaswini * Devi * Lavanya

19731A0596 * 19731A0597 * 19731A05A0 * 19731A05A1

Fig 10: Disease Detected



Doctor Details to Contact

NAME	NUMBER	CITY
Dr Navdeep Sharma	7674004000	Mumbai
Vivid Skies Child Care Clinic	9960588502	Mumbai
Dr Navdeep Sharma	7674004000	Mumbai
Daffodil Health	9663558155	Mumbai
Dr Priyanka Parikh	9869665615	Mumbai
Dewdrops development health care Pvt Ltd	9311142713	Surat
Arth Neurorehabilitation Clinic	9825146607	Surat
Dr Mayank Detroja	7043511435	Surat

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19731A0596 * 19731A0597 * 19731A05A0 * 19731A05A1

Fig 11: Doctor Contact Details

6. TESTING AND VALIDATION

Introduction

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, subassemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of testing. Each test type addresses a specific testing requirement.

TYPES OF TESTS

Unit testing

Unit testing, a testing technique using which individual modules are tested to determine if there are issues by the developer himself.. it is concerned with functional correctness of the standalone modules. The main aim is to isolate each unit of the system to identify, analyze and fix the defects. Designing test cases for unit testing ensures that the core programme logic is working correctly and that programme inputs result in legitimate outputs. It is important to check all internal code flow and decision branches. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive.

White box testing

White box testing is a type of testing where the software tester is familiar with the inner workings, structure, and language of the software, or at the at least, knows what it is intended to do. It has a goal. It is employed to test regions that are inaccessible from a black.

Black Box testing

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.
testing is centered on Functional the following items:

Valid Input : identified classes of valid input must be accepted. Invalid Input identified classes of invalid input must be rejected.
Functions : identified functions must be exercised.
Output : identified classes of application outputs must be exercised.
Systems/Procedures: interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

System Testing

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot ―see‖ into it. The test provides inputs and responds to outputs without considering how the software works.

Unit Testing:

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases. Test strategy and approach Field testing will be performed manually and functional tests will be written in detail.

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

7.CONCLUSION

In this work, detection of autism spectrum disorder was attempted using various machine learning and deep learning techniques. Various performance evaluation metrics were used to analyze the performance of the models implemented for ASD detection on non-clinical dataset from three sets of age groups viz. Child, Adolescents and the Adult. When comparing the result with another recent study These results strongly suggest that a Random Forest model can be implemented for detection of autism spectrum disorder in addition to enhance the prediction process that decide if the person has autism spectrum disorder or not and also showing the estimated percentage.

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