

# Prediction of Mental Health in Students during Covid19 Based on Mamdani Fuzzy Inference System

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Submitted: 01-04-2022

Revised: 06-04-2022

Accepted: 11-04-2022

## ABSTRACT

According to World Health Organization, 10-20% of children and adolescents all over the world are experiencing mental disorders. The COVID-19 pandemic has affected the health behavior of university students. Thus, factors influencing students' health behaviors during the COVID-19 outbreak should be examined. The outbreak of the 2019 novel coronavirus disease (COVID-19) not only caused physical abnormalities, but also caused psychological distress, especially for undergraduate students who are facing the pressure of academic study and work. An explore the prevalence rate of probable anxiety and probable insomnia and find the risk factors among a longitudinal study of undergraduate students using the approach of machine learning. A hybrid intelligent fuzzy random approach for classification of countries based on a mixture of fractal theoretical concepts and fuzzy logic mathematical constructs. The mathematical definition of the fractal dimension provides a way to approximate the complexity of the non-linear dynamic behavior exhibited by the time series of the countries. Fuzzy logic offers a way to represent and handle the inherent unpredictability of the classification problem. The hybrid intelligent approach is composed of a fuzzy system formed by a set of fuzzy rules that uses the fractal dimensions of the data as inputs and produces as a final output the classification of countries. The hybrid approach calculations are based on the COVID-19 data of confirmed and death cases. The main contribution is the proposed hybrid approach composed of the fractal dimension definition and fuzzy logic concepts for achieving an accurate classification of countries based on the complexity of the COVID-19 time series data.

Publicly available datasets of 11 countries have been the basis to construct the fuzzy system and 15 different countries were considered in the validation of the proposed classification approach. Simulation results show that classification accuracy over 93% can be achieved, which can be considered good for this complex problem. This is evaluated using Classification Algorithms in Machine Learning and implemented in ASP.NET with the support of SVM module. Various expert systems have already been developed for diagnosing mental disorders like Schizophrenia, Depression, Dementia, etc. This study focuses on predicting basic mental health problems, like Attention and Academic problem, Anxiety Symptoms, Developmental delay, Attention Deficit Hyperactivity Disorder, Pervasive Developmental Disorder using machine learning techniques, Bayesian Networks and Fuzzy. Mamdani Fuzzy inference systems are used in determining the level of mental health of students. The results of this study explain about using the Mamdani fuzzy inference system using Machine Learning can easily discuss the mental health of students at a certain level.

**Keywords:** Fuzzy Inference System, Mental health, Prediction

## I. INTRODUCTION

Human behavior depends on number of psychological parameters, and extraversion, neuroticism, anxiety are few of them. Extraversion represents tendency to be sociable, assertive, active and directive. Neuroticism represents a tendency to exhibit poor emotional adjustment and experiences negative effects such as fear, anxiety, and impulsivity. Studies show that extraversion is associated with happiness, whereas neuroticism is associated with unhappiness. Many studies have established an associ-

ation between anxiety and neuroticism. Anxiety represents a 'state of arousal' caused by threat to well-being. It means a condition of tension, uneasiness, threat and readiness which involves an entire organism to act and respond. 'Threat' means anticipation of pain, danger or serious interference with goal seeking activities. Simulation of human behavior as an interdisciplinary research yield has attracted the keen interest of mathematician and psychologist. In recent years, it has been extensively studied and applied in psychological research. Sade gave the notion of fuzzy set to handle the uncertainty which is caused by imprecise information and vague data.

## II. LITERATURE REVIEW

The interest of psychologist in fuzzy logic has visibly been growing since mid-1980s. Psychology is not only a field in which profound applications of fuzzy logic is anticipated, but is also very important for the development of fuzzy set theory itself. Fuzzy logic allows researcher to handle the imprecision and vague inference of input data in depth and develop more reliable model for computing input-output relations. Many researchers proposed integration of fuzzy logic in psychological research for more logical outcomes. Given its interpretability, Fuzzy Logic (FL) simplifies the design and analysis of rule-based systems in different research areas. Within the research, various proposals have arisen to improve predictability: some chose optimization algorithms; others chose a combination of Artificial Neural Networks (ANNs) with Fuzzy Inference Systems (FISs) to achieve Adaptive Neuro-Fuzzy Inference Systems (ANFISs).

Today, the information from different educational institutions worldwide, whether physical or virtual, is becoming an essential aspect of data analysis; many proposals have been made to allow students and teachers of virtual courses to monitor academic performance, taking into account the concept of competency-based learning. Teachers analyze student's competency and see the progress made.

On the other hand, some researchers applied fuzzy logic to the evaluation processes of exams or activities, and the assessment of the results could be carried out linguistically. Then, a fuzzy logic system was proposed to modify the evaluation of the exams, taking into account the difficulty of each question and the time it should take for it to be answered, regarding the complexity of the question. This

allows obtaining the "cost" of answering a question thanks to these data. Depending on these factors, an adjusted assessment is generated.

With the Corona Virus cases multiplying day by day, researchers are putting tremendous efforts by developing novel rapid point-of-care diagnostics to control the spread. The unknown nature and the volatility of the situation keep on edge, wondering individuals what will come next. This situation

can create panic and make individual feel afraid, overwhelmed, and helpless. While the threat is real, fear and having our emotions run amok will make the situation even worse. Uncertainty and anxiety go hand-in-hand, according to experts at the Yale Center for Emotional Intelligence (CEI), and that is why the many unknowns about the Corona Virus pandemic, when cases will peak, when schools will reopen, when it will be safe to visit loved ones, are creating widespread anxiety. In fact, people should adhere to strategies that can help mitigate anxiety as they are socially distancing and are briefed with constant pandemic updates. Fuzzy rule-based approaches depend on the selection of membership functions and its intervals to depict the inherent system fuzziness. It is to be kept in mind that the range of the values of the membership functions should always be within system. The fuzzy inputs to the model, viz., positive score and negative score are characterized by the Gaussian membership functions.

## III. METHODOLOGY

Mamdani fuzzy inference was first introduced as a method to create a control system by synthesizing a set of linguistic control rules obtained from experienced human operators. In a Mamdani system, the output of each rule is a fuzzy set.

Since Mamdani systems have more intuitive and easier to understand rule bases, they are well-suited to expert system applications where the rules are created from human expert knowledge, such as medical diagnostics.

- Step 1 – Set of fuzzy rules need to be determined in this step.
- Step 2 – In this step, by using input membership function, the input would be made fuzzy.
- Step 3 – Now establish the rule strength by combining the fuzzy field inputs according to fuzzy rules

#### IV. MODULE DESCRIPTION

##### Dataset Upload

Upload dataset figure shows that collection of related set of information that is composed of separate elements but can be manipulated as a unit by a computer. A data set is organized into some type of data structure. In a database, for example, thyroid disease data set might contain a collection of thyroid data. The experiment uses thyroid dataset obtained from UC machine learning repository. Covid-19 dataset.

##### Read CSV File Dataset

The dataset was downloaded as CSV file and the dataset file defined as a command limited it will provide the covid-19 dataset, the file has to be read as csv file dataset, the row and the column and all of the dataset csv file full used storage will be read in the module.

##### Prediction of ML

The algorithm makes predictions and is corrected by the operator – and this process continues until the algorithm achieves a high level of accuracy/performance. Under the umbrella of supervised learning fall: Classification, Regression and Forecasting. Here our dataset was predicted by On Mamdani Fuzzy Inference System the classification and the train test then training test will be predicted by ML algorithm.

##### Classification of Dataset

The classification of the dataset module, while

the invasive model was able to provide better mortality predictions for the imminent future, non-invasive features displayed better performance for more distant expiration intervals. Early mortality prediction using non-invasive models can give us insights as to where and with whom to intervene. The dataset was classified by the fuzzy inference system the prediction and classified dataset files were described in this module.

##### Result

An accuracy of 93% using the Fuzzy method and 94.01% using fuzzy inference was obtained.

Along with the improvement in the performance and methodological contribution, the early detection and treatment of and mental health issues can together aid in taking preventive measures in advance. The psychological well-being of the women was also objectively evaluated and can be brought into the treatment protocol.

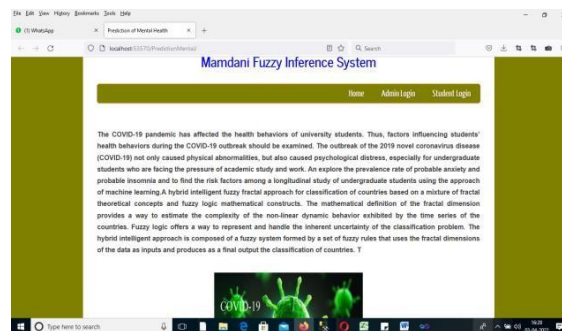
##### Student

##### Prediction Of Result

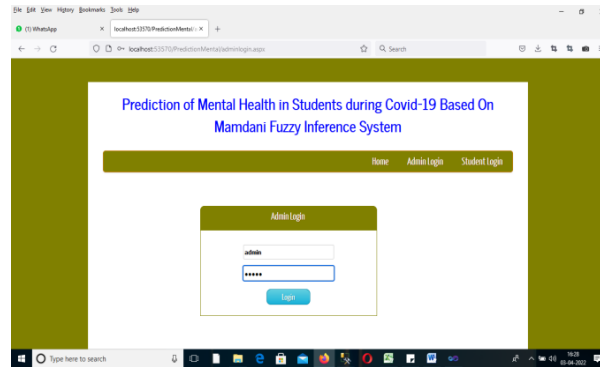
The result of prediction details and the mental health related disease while along with covid-19 situation it will be developed and predicted by the admin site, then the prediction of the algorithm the dataset will be classified and give the accurate result, so the result is reviewed by the user of the student who logs in the portal.

#### V. RESULT

##### HomePage



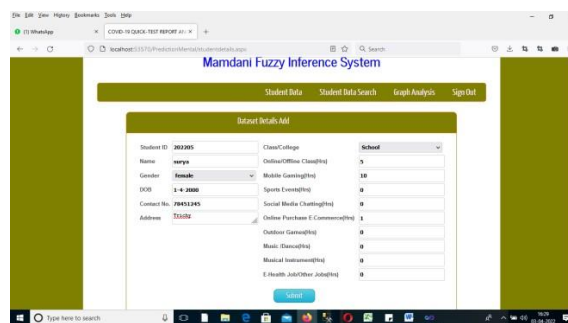
### AdminLogin



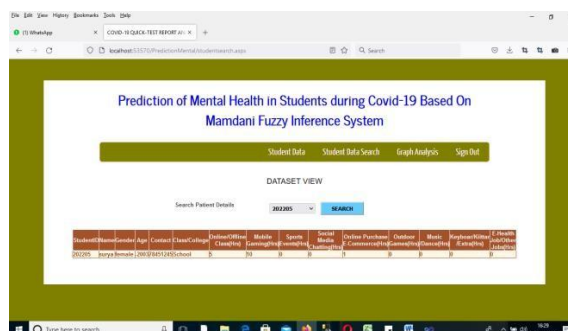
### AdminMainpage



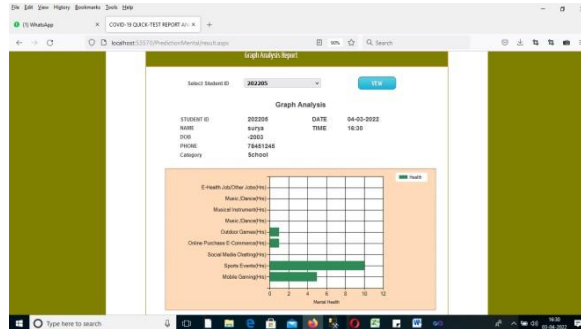
### StudentData



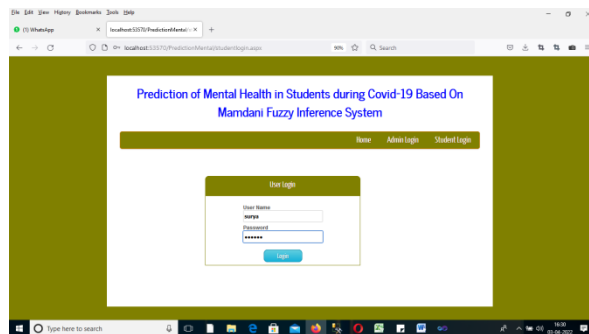
### StudentDatasearch



### GraphAnalysis



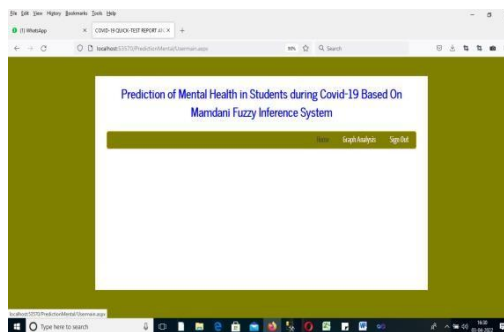
### StudentLogin



The screenshot shows the 'Student Login' page. The title is 'Prediction of Mental Health in Students during Covid-19 Based On Mamdani Fuzzy Inference System'. There are navigation links for 'Home', 'Admin Login', and 'Student Login'. A central 'User Login' box contains the following fields:

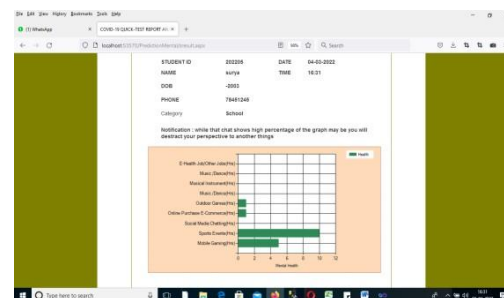
- User Name:
- Password:
- Sign In button

### StudentMain



The screenshot shows the 'Student Main' page. The title is 'Prediction of Mental Health in Students during Covid-19 Based On Mamdani Fuzzy Inference System'. There are navigation links for 'Home', 'Graph Analysis', and 'Sign Out'.

### Notification



## VI. FUTURE ENHANCEMENT

The unpredictability in the decision-making process required for achieving a good classification. In dependency, we plan to consider the relation of the current works on other facets of the COVID-19 problem, like the ones presented in, or in forecasting the COVID-19 time series. Finally, the approach with neural network models (like self-organizing maps or ensemble models) to study spatial and temporal patterns of countries, like in.

## VII. CONCLUSION

The precision of existing mental health prediction methods is low because the relationship between the feature variables and the prediction results is non-linear and the prediction dataset contains a lot of immaterial and redundant features. At the same time, current mental health prediction methods cannot estimate the extent to which the feature variables are important to the prediction results. We applied to estimate the complexity of the dynamics in the time series of the countries. Fuzzy Logic was employed to represent the inherent decision-making unpredictability in performing the classification.

The proposed method is formed by a fuzzy model, comprising fuzzy rules, that consider the fractal dimensions as input values and produces as output the classification of the countries based on the COVID-19 data. The main contribution of this article is the proposed method hybridizing in a prudent fashion the fractal dimension and fuzzy logic theoretical constructs for realizing an accurate classification of COVID-19 data.

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