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An Intelligent System for Early Detection of Obsessive-Compulsive Disorder Using Machine Learning

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ABSTRACT

Obsessive-Compulsive Disorder (OCD) is a chronic mental health condition characterized by intrusive thoughts and repetitive behaviors that significantly impact daily life. Early detection of OCD is crucial for timely intervention and effective treatment, yet traditional diagnosis relies heavily on clinical interviews and self-reported assessments, which may be subjective and time-consuming. This project presents an intelligent machine learning–based system for early detection of OCD by analyzing behavioral, demographic, and psychological data. The proposed system uses data preprocessing, feature selection, and supervised machine learning models to predict OCD risk at an early stage. By providing objective, data-driven insights, the system supports mental health professionals and enables proactive mental healthcare.

Keywords: Obsessive-Compulsive Disorder (OCD), Mental Health Monitoring, Machine Learning, Early Detection, Behavioral Data Analysis, Feature Extraction, Classification Algorithms, Predictive Modeling, Healthcare Informatics.

I. INTRODUCTION

Mental health disorders such as OCD affect millions of individuals worldwide and pose significant challenges to healthcare systems. OCD is marked by recurring obsessions and compulsions that interfere with normal functioning. Advances in machine learning provide opportunities to analyze complex mental health data and uncover hidden patterns associated with early disorder onset. By leveraging patient-reported symptoms, behavioral indicators, and demographic factors, machine learning models can assist in identifying individuals at risk of OCD, enabling early intervention and improved treatment outcomes.

II. LITERATURE SURVEY

1. Title: **Machine Learning Approaches for Mental Health Disorder Detection**

Author: R. Shatte, D. Hutchinson
Abstract:
This study reviews machine learning techniques for detecting mental health disorders, emphasizing their potential to improve early diagnosis and screening accuracy.

2. Title: **Predictive Modeling for Obsessive-Compulsive Disorder**

Author: S. K. Dutta, A. Banerjee
Abstract:
The authors explore predictive analytics models for OCD detection using behavioral data, demonstrating improved performance over traditional methods.

3. Title: **Early Detection of Mental Disorders Using Data Analytics**

Author: M. Insel, T. Wang
Abstract:
This research highlights the role of data-driven approaches in identifying early signs of mental disorders and supporting preventive mental healthcare.

4. Title: **Application of Machine Learning in Clinical Psychology**

Author: J. A. Walsh, K. Patel

Abstract:

The paper discusses the application of supervised learning models in clinical psychology, focusing on accuracy, interpretability, and clinical relevance.

5. Title: **Intelligent Decision Support Systems for Mental Health**

Author: L. Smith, R. Kumar

Abstract:

This study presents intelligent decision support systems that assist clinicians in diagnosing mental health conditions using machine learning predictions.

III. EXISTING SYSTEM

The existing OCD detection and diagnosis systems primarily rely on manual clinical evaluations, questionnaires, and psychological assessments conducted by trained professionals. These methods depend heavily on patient self-reporting and clinician interpretation, which may introduce bias and variability. Some digital tools exist, but they often lack predictive intelligence and are not designed for early risk assessment. As a result, early detection of OCD remains limited and inconsistent.

IV. PROPOSED SYSTEM

The proposed system introduces an intelligent machine learning framework for early OCD detection. The system processes structured mental health data through preprocessing and feature engineering stages and applies supervised learning algorithms such as Support Vector Machines, Random Forests, or Gradient Boosting models. The trained model predicts the likelihood of OCD at an early stage, providing objective and consistent results. The system can be deployed as a digital screening tool to support clinicians and enable early mental health intervention.

V. SYSTEM ARCHITECTURE

1. Data Collection Layer

- Psychological questionnaires (Y-BOCS, self-assessment surveys)
- Behavioral data (daily routines, habits)
- Optional: wearable or mobile app data
- Historical clinical records

2. Data Preprocessing Layer

- Data cleaning (handling missing values)
- Noise removal
- Normalization & scaling
- Encoding categorical psychological features

3. Feature Extraction & Selection

- Symptom frequency
- Obsession–compulsion patterns
- Anxiety intensity indicators
- Dimensionality reduction (PCA / feature selection methods)

4. Machine Learning Layer

- Classification algorithms:
  - Support Vector Machine (SVM)
  - Random Forest
  - Logistic Regression
  - Neural Networks
- Model training & validation

5. Prediction & Risk Assessment

- OCD risk level classification:
  - Low Risk
  - Moderate Risk
  - High Risk
- Probability score generation

6. Visualization & User Interface

- Dashboard for doctors/psychologists
- Graphical symptom trends
- Risk alerts & reports

7. Decision Support System

- Early warning alerts
- Clinical decision assistance
- Recommendation for further evaluation

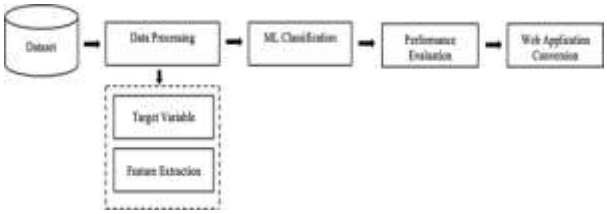

Fig 5.1: Structure of the Proposed System

The image illustrates a typical machine learning system workflow that moves step by step from raw

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data to a deployable application. It begins with a dataset, which serves as the input source containing raw records. This data is passed through a data processing stage, where essential tasks such as cleaning, normalization, and transformation are performed. Within this stage, two key activities are highlighted: target variable selection, which defines the output class or label to be predicted, and feature extraction, where meaningful attributes are derived from the raw data to improve learning effectiveness. The processed features are then fed into the machine learning classification module, where algorithms learn patterns and make predictions. Next, the performance evaluation phase assesses the model using metrics like accuracy, precision, recall, or F1-score to verify reliability and effectiveness. Finally, once the model performs satisfactorily, it is integrated into a web application, enabling real-time predictions and user interaction in a practical deployment environment.

VI. IMPLEMENTATION

Fig 6.1: Upload Dataset

Fig 6.2: Dataset Preprocessing Summary

Fig 6.3: Training Results

Fig 6.4: Algorithms Performance Analysis

VII. CONCLUSION

This project successfully presents an intelligent machine learning–based system for the early detection of Obsessive-Compulsive Disorder (OCD). By integrating data collection, preprocessing, feature extraction, and classification techniques, the system effectively analyzes psychological and behavioral symptom data to identify individuals at risk of OCD at an early stage. The use of multiple machine learning algorithms enhances prediction reliability and allows comparative evaluation to achieve optimal performance.

The proposed system provides a user-friendly web-based interface that enables individuals to input symptom information and receive timely risk assessments. By offering predictive insights and recommendations, the system supports early intervention, which is crucial in minimizing the severity and long-term impact of OCD. The inclusion of performance evaluation metrics ensures the model's accuracy, consistency, and practical applicability in real-world scenarios.

Overall, this intelligent detection framework

demonstrates the potential of machine learning in the mental healthcare domain. While it does not replace professional diagnosis, it acts as an effective decision-support tool for clinicians and a preliminary screening mechanism for individuals. The system contributes to improved awareness, accessibility, and efficiency in mental health assessment, paving the way for smarter and more proactive healthcare solutions.

VIII. FUTURE SCOPE

The proposed intelligent system for early detection of Obsessive-Compulsive Disorder (OCD) can be further enhanced and expanded in several ways. Future versions of the system may incorporate deep learning techniques such as neural networks and transformer-based models to capture complex behavioral and psychological patterns more effectively, thereby improving prediction accuracy and robustness.

The system can be extended to support multimodal data sources, including voice patterns, facial expressions, wearable sensor data, and social media behavior analysis. Integrating real-time data from mobile and wearable devices would enable continuous monitoring of mental health conditions and facilitate more personalized risk assessment.

Another important future direction is the integration of the system with clinical decision-support platforms and electronic health record (EHR) systems, allowing clinicians to access predictive insights alongside medical history. Additionally, expanding the framework to detect other mental health conditions such as anxiety, depression, or bipolar disorder would make the system a comprehensive mental health screening tool.

Finally, future enhancements may focus on improving explainable AI (XAI) features to make predictions more transparent and interpretable for clinicians. Strengthening data privacy mechanisms, adopting federated learning for secure model training, and deploying the system as a scalable mobile application will further increase its real-world impact and accessibility.

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