

Panic Disorder Detection

Final Project Report

Project ID: SWTID1720075414

1. Introduction

1.1 Project Overview

The Panic Disorder Detection project aims to develop a machine learning model that can be accessed through a website, enabling individuals to diagnose themselves with panic disorder using multi-modal physiological data. By analyzing various patterns in family history, personal history, current stressors, symptoms, severity, impact on life, demographics, medical history, psychiatric history, substance use, coping mechanisms, social support, and lifestyle factors to identify individuals with panic disorder. The system should be user-friendly, integrating seamlessly with existing healthcare workflows and electronic health records (EHRs) to offer personalized treatment recommendations and alerts. This innovative solution seeks to improve early detection and management of panic disorder, ultimately enhancing patient outcomes and accessibility to mental health care.

1.2 Objectives

- a) Develop a Machine Learning Model:
 - Create a robust and accurate machine learning model capable of detecting panic disorder symptoms using physiological data.

- b) Data Analysis from various databases:
 - Implement a system for real-time data collection and analysis to monitor physiological signals and detect panic disorder episodes promptly.

c) Web-Based Diagnostic Tool:

- Develop a user-friendly website that allows individuals to access the machine learning model for self-diagnosis of panic disorder.

d) Accessibility and Awareness:

- Increase accessibility to mental health care by providing an easy-to-use online tool, and raise awareness about panic disorder and its management.

2. Project Initialization and Planning Phase

2.1 Define Problem Statement

Problem statement: Accurately diagnosing and monitoring panic disorder is challenging due to the reliance on subjective self-reports and clinical interviews, often resulting in misdiagnosis and delayed treatment. There is a critical need for an objective, accurate detection system that utilizes machine learning to analyze physiological and historical data among others, enabling individuals to self-diagnose through a user-friendly website, thereby improving early detection, timely intervention, and overall management of panic disorder.

Panic Disorder Detection Problem Statement Report: [LINK](#)

2.2 Project Proposal

The proposed project, "Panic Disorder Detection" aims to use machine learning for better, more accurate detection of Panic Disorders among individuals. This is done so by using an extensive and comprehensive dataset that includes data including family history, personal history, current stressors, symptoms, severity, impact on life, demographics, medical history,

psychiatric history, substance use, coping mechanisms, social support, and lifestyle factors. The project aims to make a model that, on the basis of the user input of specific factors, diagnoses the user of panic disorder or otherwise. This initiative enables more efficient, and accurate analysis of panic disorder among individuals.

Panic Disorder Detection Project Proposal Report: [LINK](#)

2.3 Initial Project Planning

The initial Project Planning involves collecting a diverse and well-balanced dataset from the internet. It then involves going through the dataset and using Python and the various libraries available in python, preparing the dataset by performing processes such as oversampling and feature selection. It then moves to figurative analysis of the data to check imbalances, followed by then tuning the data and model building. The model will then be integrated with a website, the model running in the background. The decided plan aims to systematically simplify the data obtained from the dataset, makes It digestible for the model to utilize, and the model to then be used for accurate and efficient prediction of Panic Disorder.

Panic Disorder Detection Project Planning Report: [LINK](#)

3. Data Collection and Preprocessing Phase

3.1 Data Collection Plan and Raw Data Sources Identified

The dataset used for this project was sourced from Kaggle, containing extensive parameters ranging from symptoms and family history to psychiatric history and potential stressors that may trigger panic disorder. To verify the credibility of the data, missing values were addressed, categorical

data was appropriately encoded, and techniques like under-sampling and oversampling were applied to balance the dataset. Following these steps, a careful feature selection process was carried out, ensuring the data was prepared for training the selected model to accurately detect Panic Disorder.

Panic Disorder Detection Data Collection Report: [LINK](#)

3.2 Data Quality Report

Ensuring top-notch data quality for this project involved a detailed validation and preprocessing of the Kaggle-sourced dataset, which includes diverse parameters such as symptoms, family history, psychiatric history, and triggering stressors for panic disorder. Key quality assurance steps encompassed addressing missing values through imputation, encoding categorical variables using methods like label encoding, and balancing the dataset via oversampling technique like SMOTE.

Panic Disorder Detection Data Quality Report: [LINK](#)

3.3 Data Exploration and Preprocessing

Data Exploration involves analyzing the chosen dataset to identify and understand patterns and outliers. Preprocessing includes handling missing values, removing noise in the data, oversampling/under-sampling, scaling, among others. These steps enable improved data quality, improving reliability and efficiency for proper analysis.

Panic Disorder Detection Data Exploration and Preprocessing Report: [LINK](#)

4. Model Development Phase

4.1 Feature Selection Report

Feature selection is crucial for enhancing model performance and interpretability in predicting Panic Disorder. Each feature underwent evaluation based on its relevance and impact on prediction accuracy. Unique identifiers, such as Participant ID, were excluded due to their irrelevance in predicting the disorder. Features like Age, Gender, Family History, Personal History, Current Stressors, Symptoms, and their Severity were selected for their direct relevance in assessing the diversity, potential biases, and specific indicators of panic disorder. Demographic factors, medical and psychiatric histories, substance use, coping mechanisms, social support, and lifestyle factors were also included, as they influence the likelihood and severity of panic disorder. This rigorous selection process ensures the inclusion of only relevant features, streamlining decision-making and improving model transparency and effectiveness.

Panic Disorder Detection Feature Selection Report: [LINK](#)

4.2 Model Selection Report

The Model Selection Report provides an evaluation of various models, detailing their descriptions, hyperparameters, and performance metrics to determine the most effective approach for predicting Panic Disorder. The Random Forest model, utilizing multiple decision trees, achieved an accuracy of 98.4% with its best hyperparameters optimizing features such as 'max_depth' and 'n_estimators'. The Decision Tree model, offering clear insights into risk factors, showed the highest accuracy of 98.7% with 'entropy' criterion and other tuned parameters. KNN, focusing on the proximity of similar cases, had a lower accuracy of 77.2%. The Extra Tree

Classifier, highlighting diverse symptom patterns, achieved an accuracy of 97.6%. XGBoost, refining predictions through complex relationships, demonstrated a substantial accuracy of 86.7%, leveraging parameters like 'colsample_bytree' and 'max_depth'.

Panic Disorder Detection Model Selection Report: [LINK](#)

4.3 Initial Model Training Code, Model Validation, and Evaluation Report

The Initial Model Training Code demonstrates the setup for various models including Random Forest, Decision Tree, K-Nearest Neighbor, Extra Trees Classifier, and XGBoost, with training code shown via screenshots. The Model Validation and Evaluation Report provides comprehensive performance metrics for each model, including classification reports, accuracy scores, and confusion matrices, also shown through screenshots. The Random Forest and Decision Tree models achieved high accuracy rates of 98.4% and 98.69% respectively, while the K-Nearest Neighbors model had a lower accuracy of 77.2%. The Extra Trees Classifier and XGBoost models showed accuracies of 97.6% and 86.8%, respectively. This report aids in understanding each model's performance and efficacy in predicting Panic Disorder.

Panic Disorder Detection Model Development Phase Report: [LINK](#)

5. Model Optimization and Tuning Phase

5.1 Hyper-parameter Tuning Documentation

For the project, the Decision Tree Model was chosen as the final model because of its exceptional accuracy compared to the other models.

5.2 Performance Metrics Comparison Report

The Performance Metrics Comparison Report contains the results provided by all the trained models, highlighting the improved performance of all the models done by Hyperparameter Tuning. By looking at the results, Decision Tree was found to have the highest amount of accuracy and efficiency. Hence, this assessment has provided a proper and clear understanding of the various results that were been provided by the models by hyper-parameter tuning, and enabled us to choose the best.

5.3 Final Model Selection Justification

The Final Model Selection Justification contains the various reasons for choosing the model, in this case being the Decision Tree Model, as the final model. In our case it was the exceptional accuracy and efficiency with which the output was provided by the model that convinced us to move ahead with this model for the project.

Panic Disorder Detection Model Optimization and Tuning Phase: [LINK](#)

6. Results

6.1 Output Screenshots

a) index.html

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About Panic Disorder

Panic Disorder is a mental health condition characterized by sudden and recurrent episodes of intense fear and discomfort, often referred to as panic attacks. These attacks can occur unexpectedly and can include symptoms such as palpitations, sweating, trembling, shortness of breath, chest pain, dizziness, and a fear of losing control or impending doom. Panic disorder can significantly impact a person's daily life, but it is treatable with proper medical and psychological interventions. Early detection and treatment are crucial for managing symptoms and improving quality of life.

Form Submission

Participant ID (Not Required):

Age:

Gender:

☐ Male

☐ Female

Family History:

☐ Yes

☐ No

Personal History:

☐ Yes

☐ No

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Impact on Life:

☐ Mild

☐ Moderate

☐ Significant

Demographics:

☐ Rural

☐ Urban

Medical History:

Psychiatric History:

Substance Use:

Coping Mechanisms:

Social Support:

☐ Low

☐ Moderate

☐ High

Lifestyle Factors:

Submit

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b) contributors.html

Contributors

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Contributors

This project has been jointly worked on by:

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c) Case 1: User is Normal

Input:

Participant ID (Not Required):

19281029

Age:

21

Gender:

☒ Male ☐ Female

Family History:

☒ Yes ☐ No

Personal History:

☒ Yes ☐ No

Current Stressors:

☐ Low ☒ Moderate ☐ High

Symptoms:

Panic attacks

Severity:

☐ Mild ☐ Moderate ☒ Severe

Impact on Life:

☐ Mild ☐ Moderate ☒ Significant

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Impact on Life:

☐ Mild ☒ Moderate ☐ Significant

Demographics:

☐ Rural ☒ Urban

Medical History:

Psychiatric History:

Substance Use:

Coping Mechanisms:

Social Support:

☐ Low ☒ Moderate ☐ High

Lifestyle Factors:

Submit

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Output:

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Patient is normal

Form Submission

Participant ID (Not Required):

Age:

Gender:

☐ Male ☐ Female

Family History:

☐ Yes ☐ No

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d) Output 2: Patient might face panic disorder

Input:

Form Submission

Participant ID (Not Required):

Age:

Gender:
☐ Male ☒ Female

Family History:
☒ Yes ☐ No

Personal History:
☒ Yes ☐ No

Current Stressors:
☐ Low ☐ Moderate ☒ High

Symptoms:

Severity:
☐ Mild ☐ Moderate ☒ Severe

Impact on Life:
☒ Mild ☐ Moderate ☐ Significant

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Impact on Life:
☒ Mild ☐ Moderate ☐ Significant

Demographics:
☒ Rural ☐ Urban

Medical History:

Psychiatric History:

Substance Use:

Coping Mechanisms:

Social Support:
☐ Low ☐ Moderate ☒ High

Lifestyle Factors:

Submit

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Output:

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Patient might face panic disorder

Form Submission

Participant ID (Not Required):

Age:

Gender:
☐ Male ☐ Female

Family History:
☐ Yes ☐ No

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7. Advantages and Disadvantages

Using models for the detection of panic disorder on a website has various benefits. They are accessible, allowing people to diagnose themselves from the comfort of their own homes. This is especially helpful for people who do not have easy access to mental health care. The ability to act promptly is made possible by proper diagnosis. Furthermore, the incorporation of both physiological and spatiotemporal data improves detection accuracy and provides a more thorough and objective evaluation than conventional techniques that rely on self-reports.

Nevertheless, there are drawbacks to utilizing models for the detection of panic disorder on a website. Because sensitive physiological and location

data collection and analysis have to conform to strict guidelines and protect user information, privacy and security considerations are of utmost importance. The digital divide may get wider if people who lack access to these resources are left behind due to the dependence on internet connectivity and digital literacy. Additionally, there's a chance of false positives or negatives, which could lead to unneeded worry or a delusion of security, respectively. Lastly, even though the model can help with detection, it cannot replace professional diagnosis and treatment, underscoring the importance of integrating such tools within broader healthcare support systems.

8. Conclusion

To sum up, the Panic Disorder Detection project offers a user-friendly web-based platform that allows people to diagnose panic disorder based on their input, which is an important advance in mental health self-assessment tools. Through the use of machine learning to evaluate data submitted by users, this research helps identify possible panic disorder symptoms early on. It aims to enable people to better understand their mental health state and seek appropriate professional care when needed, with a focus on accuracy and convenience of use. In the future, encouraging proactive mental health management in the community will depend on improving user education on mental health and making sure such tools are accessible.

9. Future Scope

The Panic Disorder Detection project's future goals include improving machine learning models' accuracy and validation using a variety of datasets. In order to present a thorough picture of the patterns and triggers related to mental health. This involves including further behavioral data. Users will be helped in efficiently managing their condition through the

development of customized materials and systems for personalized feedback. Over time, the platform might grow to include self-care tools, instructional resources, and symptom monitoring features. Global accessibility initiatives will cater to a range of cultural and linguistic needs, while collaboration with healthcare providers will guarantee a smooth formation into clinical operations. The integration of the most recent developments in mental health diagnostics will be driven by ongoing research and innovation, positioning the project to continuously improve and expand its influence on mental health awareness and support.

10. Appendix

10.1 Source Code

app.py Code: [LINK](#)

Model Training and Testing Code: [LINK](#)

10.2 Github and Project Demo Link

Github Link: [LINK](#)

Project Demo Link: [LINK](#)