Depression Tendency Prediction

Presented by Duy Khanh

Abstract

The goal of this project is to predict characteristics that influence an individual's mental health utilizing classifier models such logit regression and random forests. Data is gathered on a group of people with a wide range of living situations, health, and socioeconomic status.

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Agenda Overview

01 Problem Statement

02 Data Understanding and Preparation

03 EDA and Visualization

04 Predicting with Classification Model and Evaluation

05 Actionable Recommendation

06 Conslusion

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Problem

01

What are the significant life, economic, and social factors that greatly influence the development of psychological disorders?

02

Exploring the key factors that influence and can predict the development of depression in an individual

03

Predicting, preventing, and assisting individuals who may have mental health issues and those who already have mental health problems.

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Data Understanding and Preparation

This dataset contains information on individuals with various attributes related to their personal and lifestyle factors. It is designed to facilitate analysis in areas such as health, lifestyle, and socio-economic status. It includes 16 columns divided into 4 feature groups as follows:

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Data Understanding and Preparation

Demographuc Information

- Name
- Age
- Marital Status
- Number of Children
- Education Level

Health and Lifestyle

- Smoking Status
- Physical Activity Level
- Alcohol Consumption
- Dietary Habits
- Sleep Patterns
- Chronic Medical Conditions

Socioeconomic Status

- Employment Status
- Income

Mental Health History

- History of Mental Illness
- History of Substance Abuse
- Family History of Depression

Data Understanding and Preparation

Data Checking

Checking missing values, inconsistencies, potential outlier, duplicates,..

Data Preparing

- Remove the column containing personally identifiable information.
- Convert categorical features (e.g., Marital Status, Smoking Status) into numerical values.
- Scale numerical features (e.g., Age, Income) to a standard range to ensure the models perform optimally.

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Data Understanding and Preparation

```
RangeIndex: 413768 entries, 0 to 413767
Data columns (total 15 columns):
 #   Column                          Non-Null Count   Dtype  
---  ------                          --------------   -----  
 0   Age                             413768 non-null  int64  
 1   Marital Status                  413768 non-null  int64  
 2   Education Level                 413768 non-null  int64  
 3   Number of Children              413768 non-null  int64  
 4   Smoking Status                  413768 non-null  int64  
 5   Physical Activity Level         413768 non-null  int64  
 6   Employment Status               413768 non-null  int64  
 7   Income                          413768 non-null  float64
 8   Alcohol Consumption             413768 non-null  int64  
 9   Dietary Habits                  413768 non-null  int64  
 10  Sleep Patterns                  413768 non-null  int64  
 11  History of Mental Illness       413768 non-null  int64  
 12  History of Substance Abuse      413768 non-null  int64  
 13  Family History of Depression    413768 non-null  int64  
 14  Chronic Medical Conditions      413768 non-null  int64
```

	Age	Number of Children	Income
count	413768.000000	413768.000000	413768.000000
mean	49.000713	1.298972	50661.707971
std	18.158759	1.237054	40624.100565
min	18.000000	0.000000	0.410000
25%	33.000000	0.000000	21001.030000
50%	49.000000	1.000000	37520.135000
75%	65.000000	2.000000	76616.300000
max	80.000000	4.000000	209995.220000

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EDA and Visualization

Overview

Grouping the factors, calculating, and visualizing them using charts show that the dataset is collected from individuals aged 18 and above, categorized quite thoroughly and evenly. The dataset is gathered from individuals with diverse aspects in all areas. Therefore, this dataset is highly comprehensive when applying mental health prediction models.

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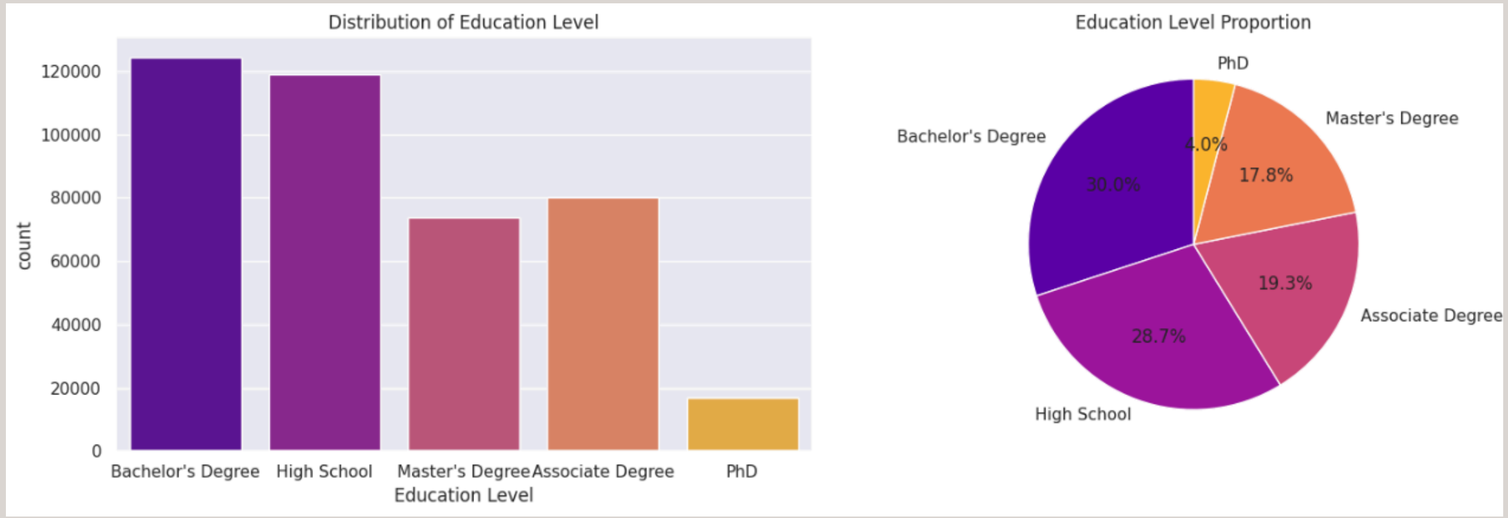
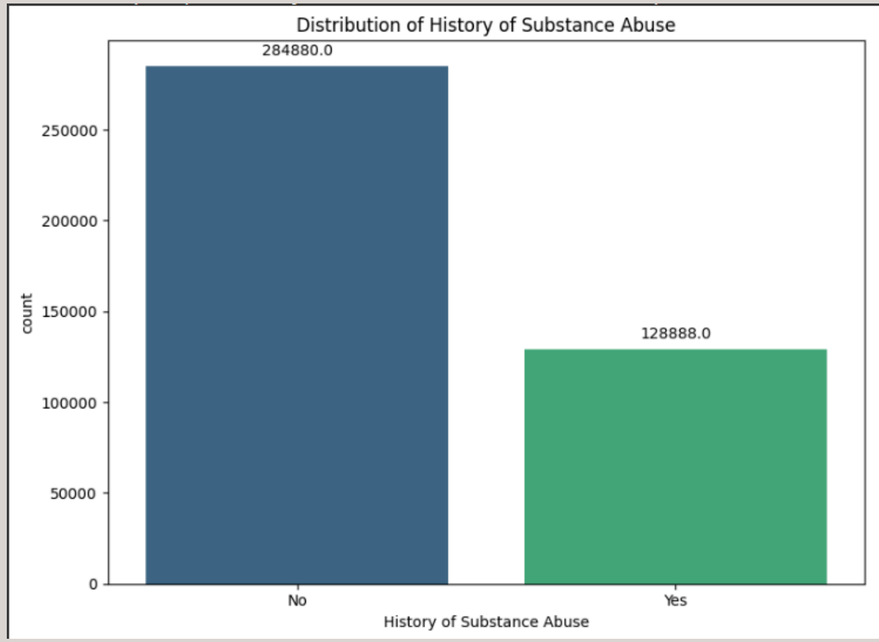
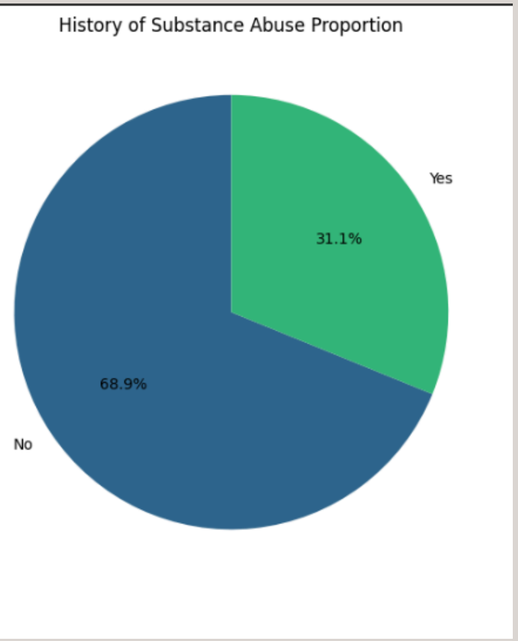


Education Level

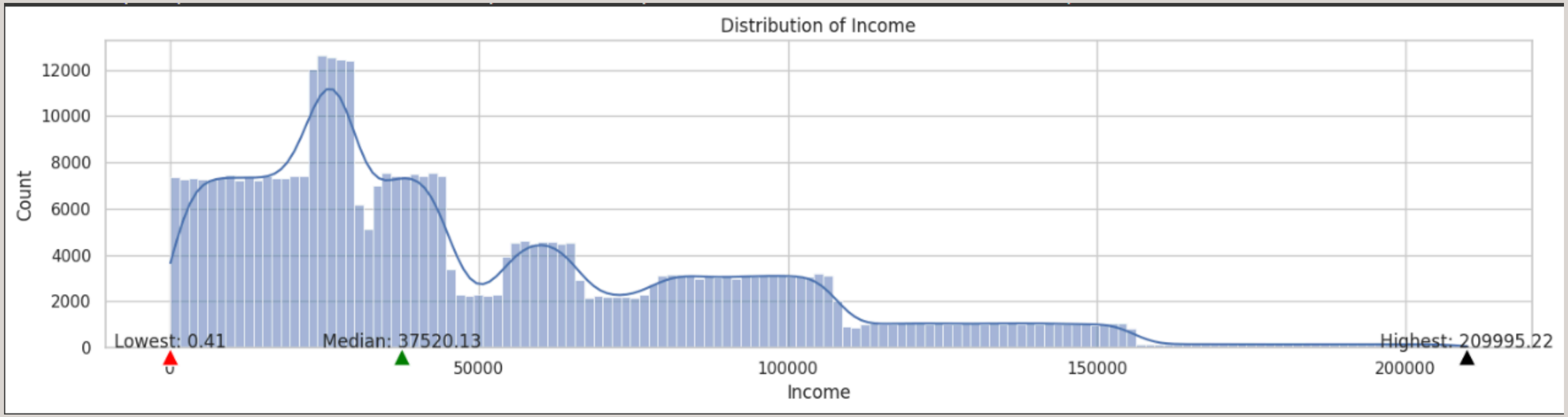
History of Substance Abuse





Employment Status

Income



EDA and Visualization

Additional

Grouping the factors into different categories helps to gain clearer insights into the relationships and influences between the features, especially the relationship between History of Mental Illness and other features.

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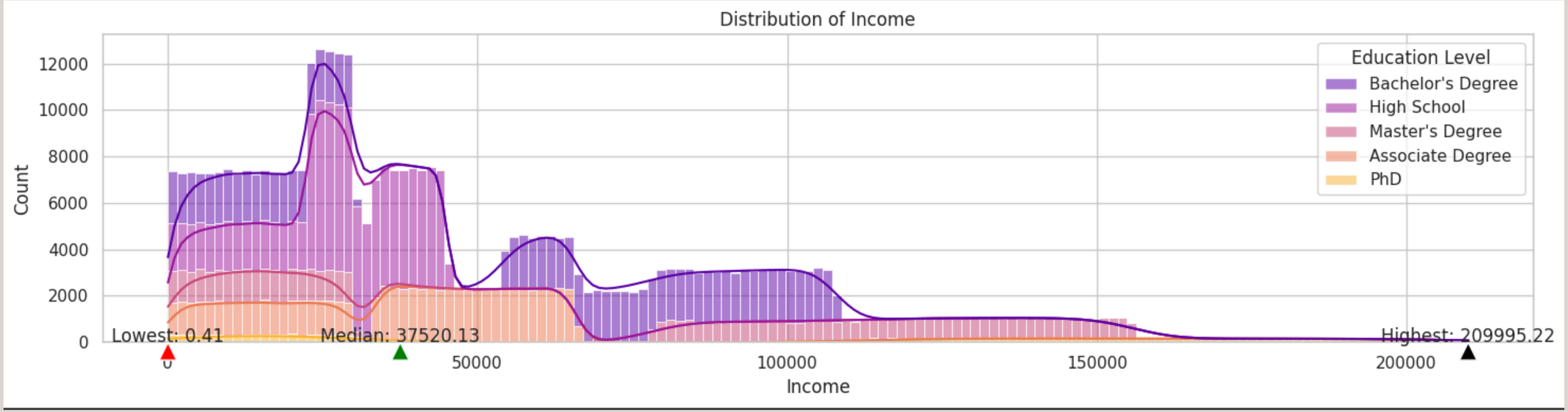
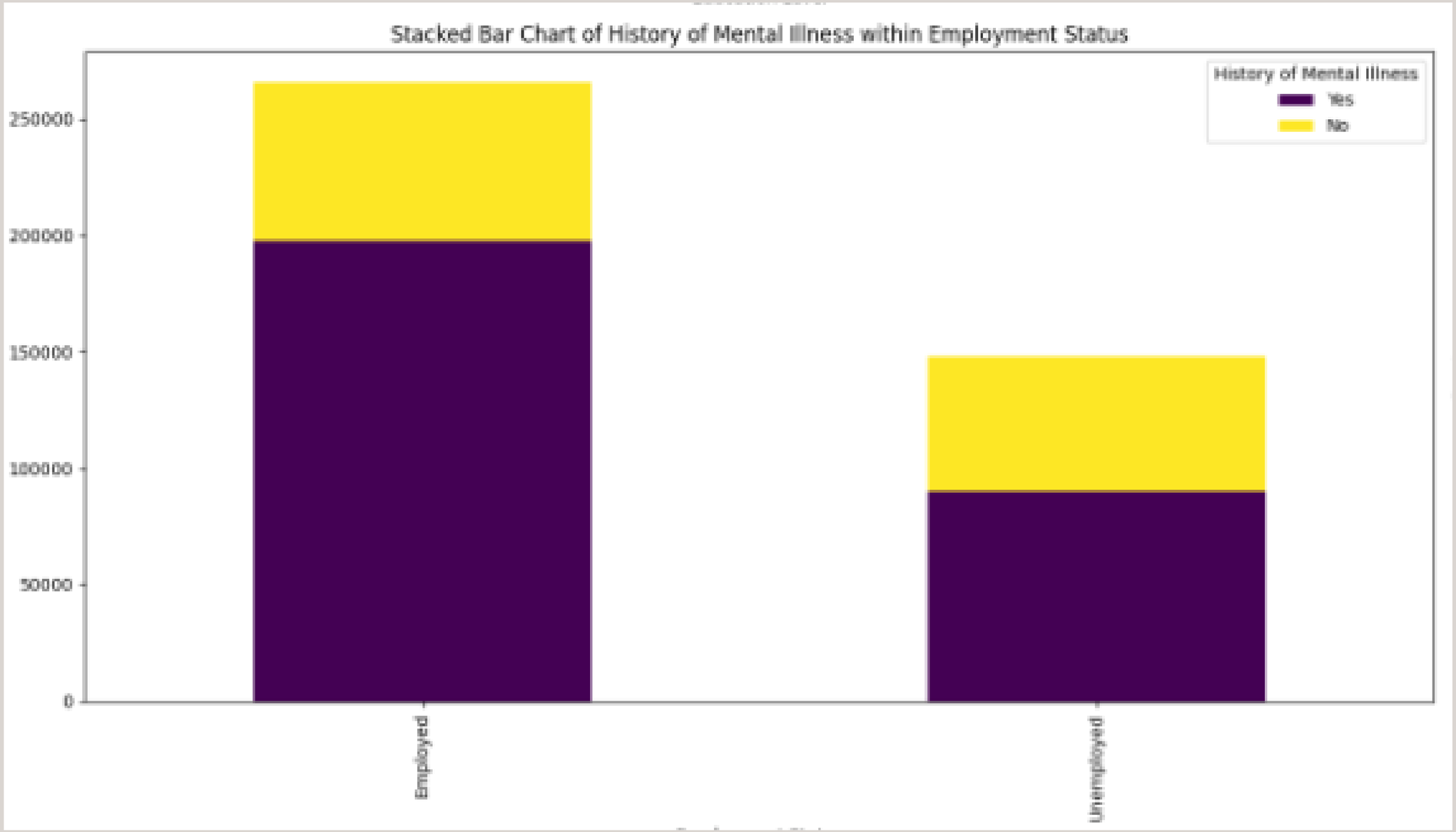
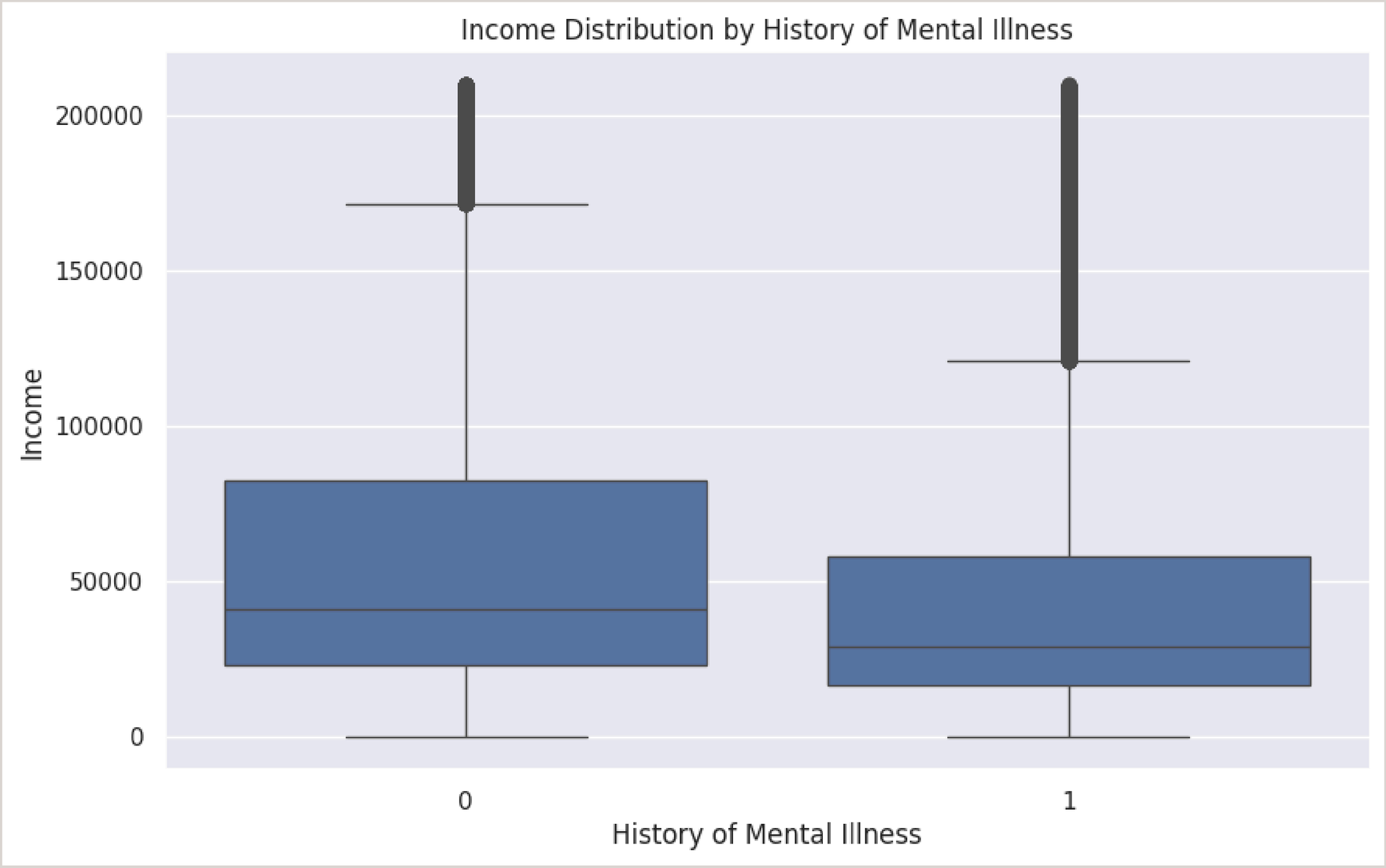
Relationship between Income and Education Level



Relationship between History of Mental Illness and Employment Status



Relationship between History of Mental Illness and Income



EDA and Visualization

Key Features

1. Marital Status: Single, divorced, and widowed individuals show a higher count of history of mental illness compared to married individuals.
2. Education Level: Individuals with lower education levels (e.g., no formal education or primary education) show a higher count of history of mental illness compared to those with higher education levels (e.g., college or university degree).
3. Employment Status: Unemployed individuals have a higher count of history of mental illness compared to employed individuals.
4. History of Substance Abuse: Individuals with a history of substance abuse show a higher count of history of mental illness compared to those without.
5. Family History of Depression: A family history of depression is associated with a higher count of history of mental illness.
6. Income: Individuals with no history of mental illness tend to have higher median incomes compared to those with a history of mental illness

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Depression Predicting with Classification Model and Evaluation

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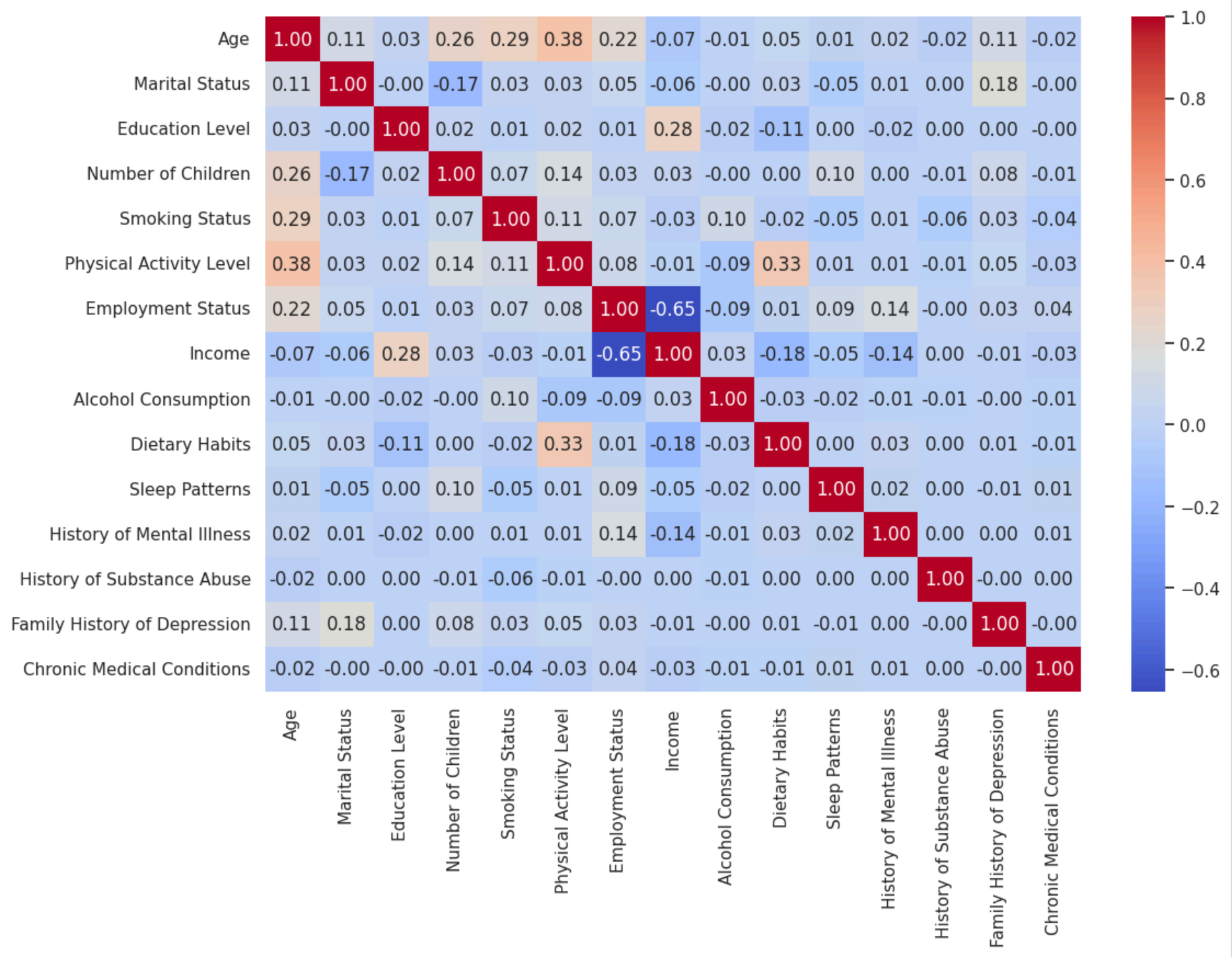

Correlation Matrix

1. **Employment Status: 0.14**
   - Indicating that individuals with a history of mental illness are more likely to be unemployed.
2. **Income: -0.14**
   - Suggesting that individuals with a history of mental illness tend to have lower incomes.
3. **History of Substance Abuse: 0.14**
   - Indicating that individuals with a history of mental illness are more likely to have a history of substance abuse.

```
Optimization terminated successfully.
         Current function value: 0.602386
         Iterations 5
                           Logit Regression Results
==============================================================================
Dep. Variable:     History of Mental Illness   No. Observations:               331014
Model:                                Logit   Df Residuals:                   330999
Method:                                MLE   Df Model:                           14
Date:                     Mon, 30 Dec 2024   Pseudo R-squ.:                0.01933
Time:                             13:41:25   Log-Likelihood:            -1.9940e+05
converged:                            True   LL-Null:                   -2.0333e+05
Covariance Type:                 nonrobust   LLR p-value:                     0.000
================================================================================================
                                   coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------------------------
const                          -0.7887      0.020    -39.393      0.000      -0.828      -0.749
Age                             0.0003      0.000      1.284      0.199      -0.000       0.001
Marital Status                 -0.0043      0.005     -0.916      0.359      -0.013       0.005
Education Level                 0.0032      0.004      0.862      0.388      -0.004       0.010
Number of Children              0.0011      0.003      0.331      0.740      -0.005       0.008
Smoking Status                 -0.0118      0.006     -2.050      0.040      -0.023      -0.001
Physical Activity Level        -0.0176      0.006     -2.975      0.003      -0.029      -0.006
Employment Status               0.3807      0.011     33.570      0.000       0.358       0.403
Income                      -4.558e-06   1.47e-07    -30.995      0.000   -4.85e-06   -4.27e-06
Alcohol Consumption            -0.0057      0.005     -1.174      0.240      -0.015       0.004
Dietary Habits                  0.0405      0.006      7.011      0.000       0.029       0.052
Sleep Patterns                  0.0071      0.004      1.613      0.107      -0.002       0.016
History of Substance Abuse      0.0101      0.008      1.218      0.223      -0.006       0.026
Family History of Depression    0.0059      0.009      0.673      0.501      -0.011       0.023
Chronic Medical Conditions      0.0059      0.008      0.728      0.467      -0.010       0.022
================================================================================================
Accuracy: 0.69573676196921
```

Logictis Regression Model

- Model Accuracy: 69,5%
- Significant Predictors:
  - Income
  - Employment Status
  - History of Substance Abuse
  - Family History of Depression

```
Accuracy: 0.6641612490030694
Feature Importances:
                          Feature  Importance
7                          Income    0.388671
0                             Age    0.249901
3                Number of Children    0.057259
8              Alcohol Consumption    0.040443
2                  Education Level    0.036566
5          Physical Activity Level    0.033874
4                   Smoking Status    0.029311
9                   Dietary Habits    0.029125
1                   Marital Status    0.027599
10                  Sleep Patterns    0.026182
13    Chronic Medical Conditions    0.023782
11    History of Substance Abuse    0.023175
12  Family History of Depression    0.022739
6                Employment Status    0.011373
```

Random Forrest Model

- Model Accuracy: 66,4%

Actional Recommendation

Family

- Income support.
- Physical Activity, Dietary Habits and Sleep Pattern.

Social workers

Assessing economic and financial situations and providing support services for unemployment and job placement are essential. Additionally, workshops and outdoor activities that enhance understanding and awareness of mental health are also very beneficial.

Psychologists

A comprehensive assessment of patients, including factors such as family history, income, employment status, and substance use, is essential in the treatment process. Providing advice on improving mental health by eliminating addictive substances, or incorporating job placement and vocational training during treatment, is crucial.

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Conclusion

These systems are based on the significant factors identified in the logistic regression analysis and are aimed at improving the mental health and well-being of individuals through targeted interventions and support. By addressing these factors, families, psychologists, and medical social workers can work together to reduce the tendency of depression and enhance overall mental health outcomes.

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Thank You

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