Sleep Prediction Disorder

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- Model selection
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Introduction

Sleep disorders like Insomnia and Sleep Apnea affect millions globally.They disrupt daily life, leading to health complications such as fatigue, cardiovascular issues, and mental health problems.Early detection can improve treatment outcomes.Personalized interventions can enhance sleep quality and overall health.Analyzing sleep-related data to identify patterns.Predicting the likelihood and type of sleep disorder efficiently and accurately.

Objective

Predict and classify sleep disorders (None, Insomnia, Sleep Apnea) using machine learning techniques to aid early diagnosis and intervention.Understand and highlight patterns contributing to sleep disorders.Identify sleep disorders before they lead to severe health complicationsProvide insights tailored to individual sleep patterns and health profiles.Develop and evaluate machine learning models to ensure reliable predictions.Deliver actionable insights for doctors and patients through intuitive visualizations and reports.

Data Preprocessing

Data Cleaning:

- Identify and handle missing values using techniques like mean imputation or median substitution.
- Remove duplicates and correct inconsistent data entries.

Encoding Categorical Variables:

- Convert categories (e.g., gender: male/female) into numerical formats using techniques like one-hot encoding or label encoding.

Feature Selection:

- Identify relevant features (e.g., sleep duration, BMI) using correlation analysis and domain knowledge.
- Handling imbalanced datasets (e.g., fewer cases of rare sleep disorders).

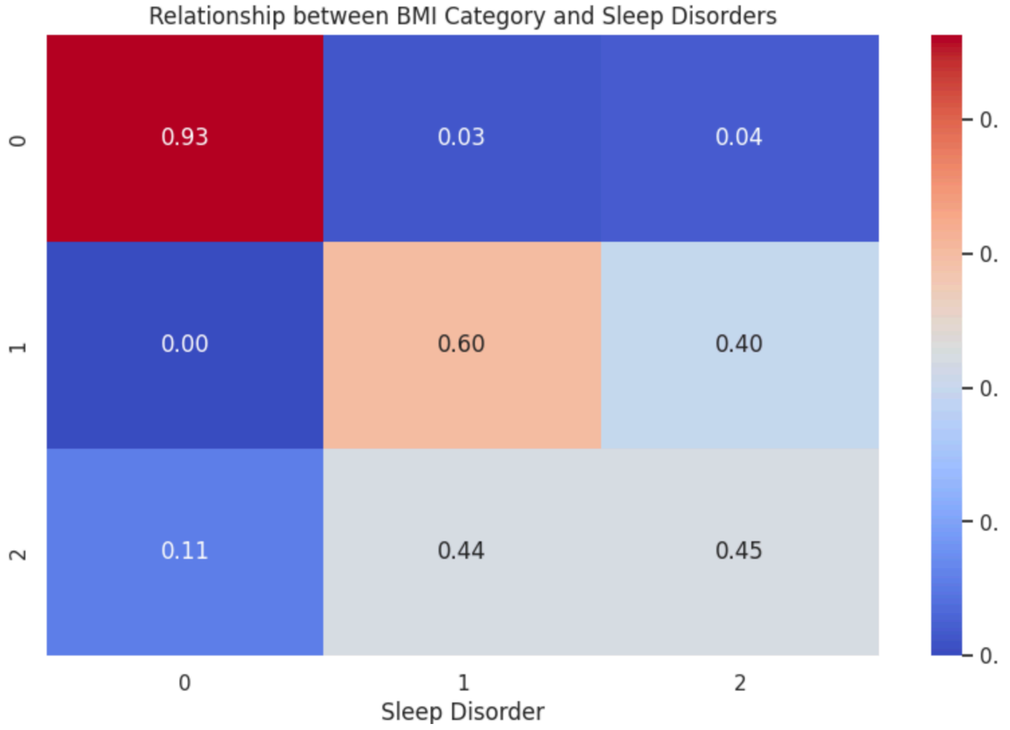
Noise detection:

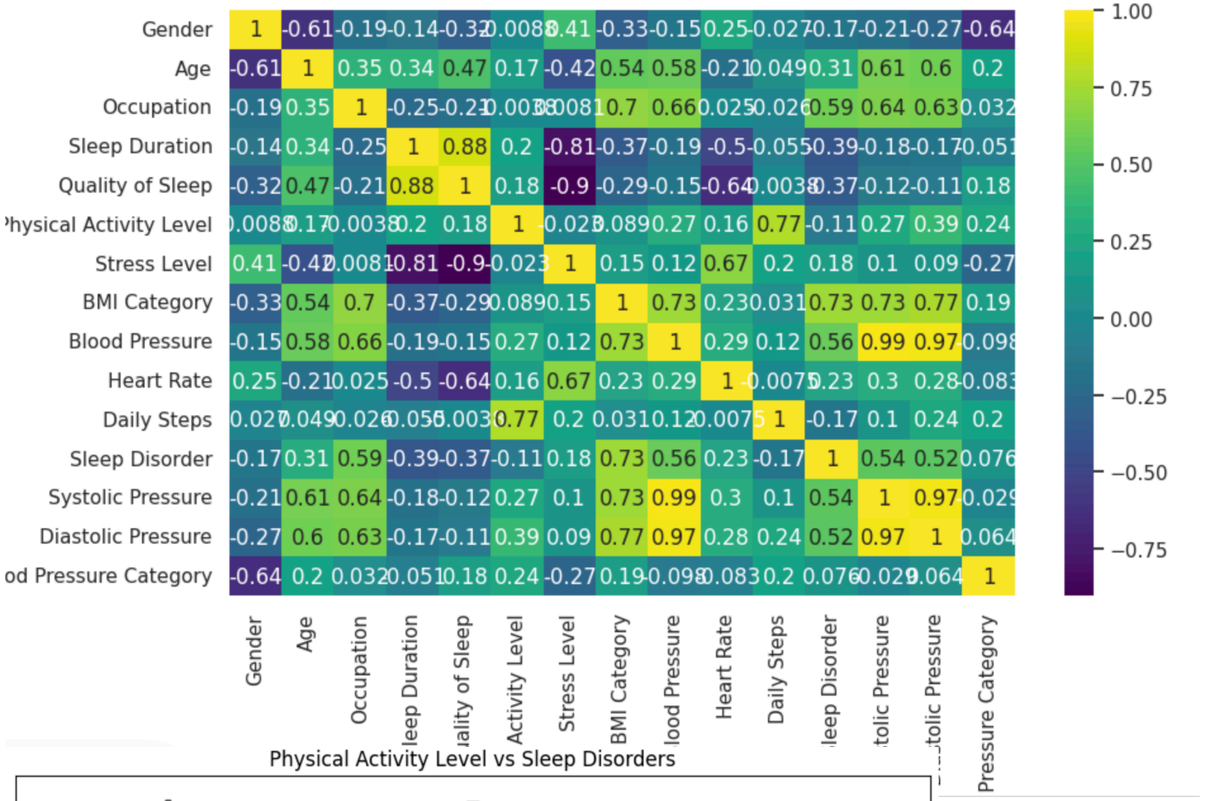
- Removing outliers to ensure meaningful insights.

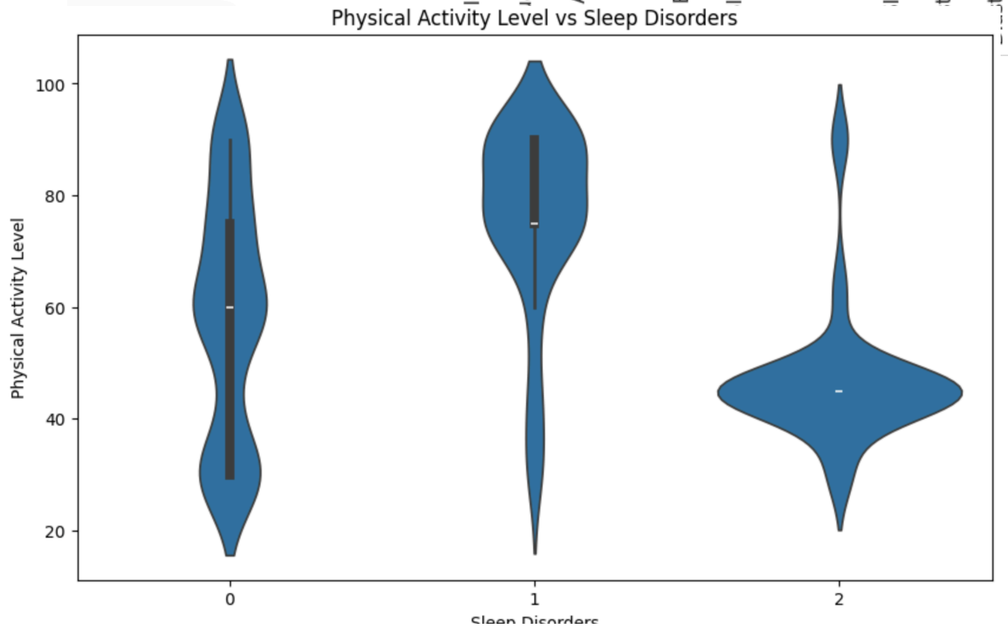
EDA

Understand the dataset's structure, trends, and relationships.

Identify patterns and anomalies in sleep-related features.







INSIGHTS:

From the Explanatory Data Analysis conducted, we have identified 5 potential predictors:

- Age
- Sleep Duration
- Occupation
- Gender
- BMI Category

Note that systolic pressure and diastolic pressure are excluded from analysis as these values are specifically used to calculate and categorise individuals into blood pressure categories.

To determine the top three predictors for machine learning in our analysis of sleep disorders, we will use a correlation matrix. This matrix helps us analyze the strength and direction of linear relationships between variables, allowing us to identify the most influential factors for predictive modeling

Model selection

- Tested models including Logistic Regression, Random Forest, XGBoost, and Neural Networks for multi-class classification.
- Evaluated interpretability, performance metrics (accuracy, F1-score), and ability to handle class imbalance.

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Selecting the right machine learning model for predicting sleep disorders involves evaluating models that can handle classification tasks effectively.

1.Decision Tree Classifier

2.Randomforestclassifier

3.Gradient Boosting Classifier

Selected model: Decisiontreeclassifier

Model Evaluation

Metrics Used: Accuracy, Precision, Recall, F1-Score, and ROC-AUC to ensure robust evaluation, with a focus on sensitivity to detect disorders.

Best Model: Decisiontreeclassifier achieved 0.918% accuracy with high precision and recall for all classes.

Outcome: The model effectively differentiates between no disorder, insomnia, and sleep apnea, supporting early diagnosis and care.

Visualization

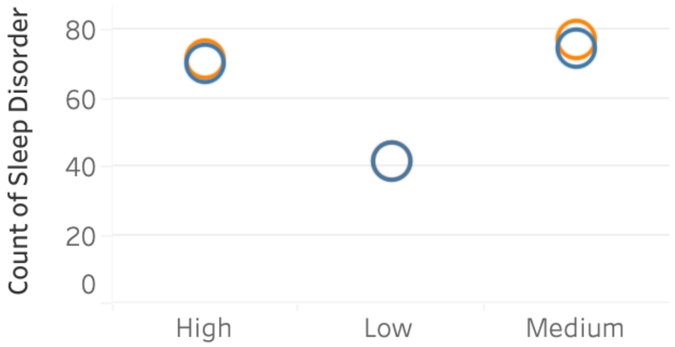
SLEEP DISORDER PREDICTION

Total Patients
374
Male
189
Female
185

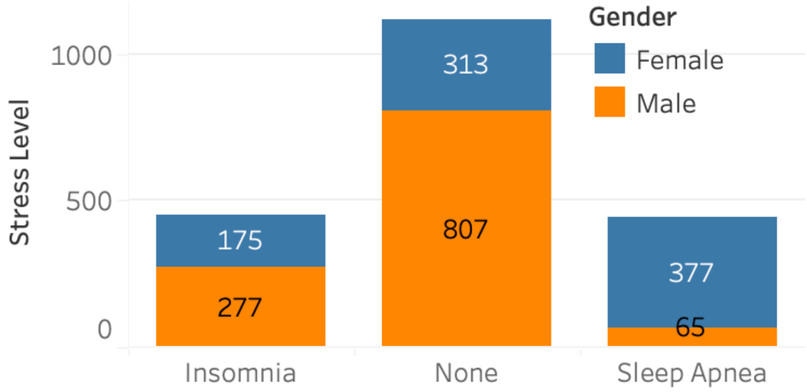
Sleep Disorder vs Blood Pressure

Blood Pressure (g..	BMI Category	Insomnia	None	Sleep Apnea
High-Normal	Normal	6	115	2
	Normal Weight		3	
	Overweight	37	12	4
Hypertensi..	Normal Weight	2		2
	Obese	4		6
	Overweight	27	7	61
Normal	Normal	1	68	3
	Normal Weight		14	

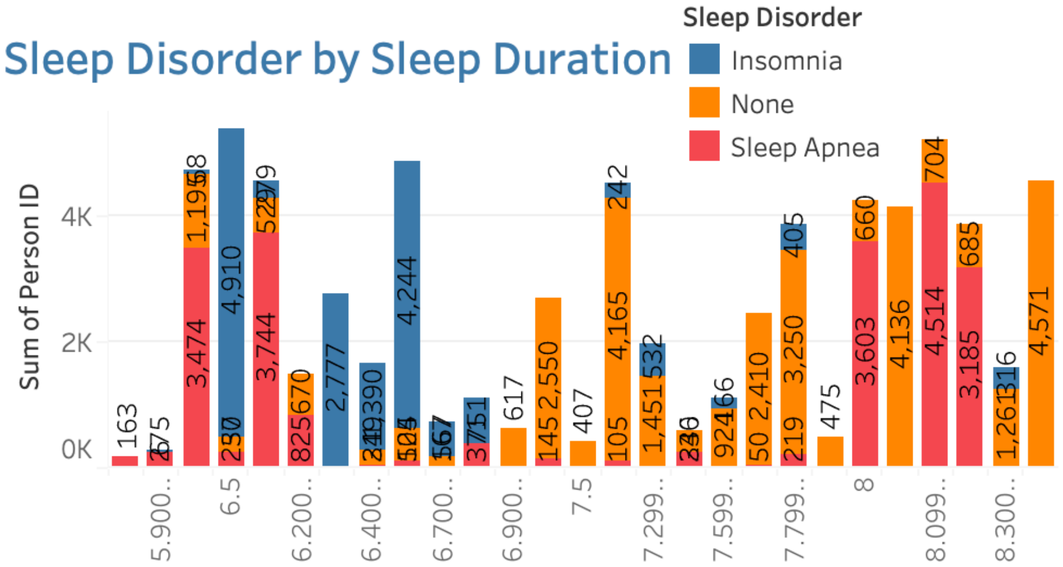
Physical Activity vs Sleep Disorder



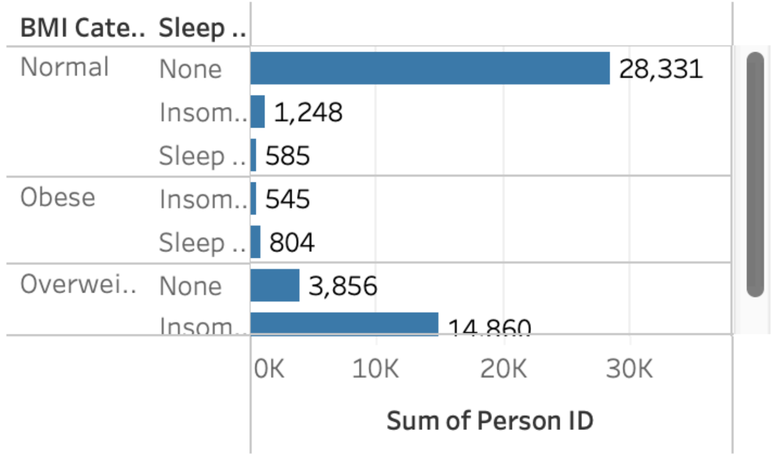
Sleep Disorder By Stress level



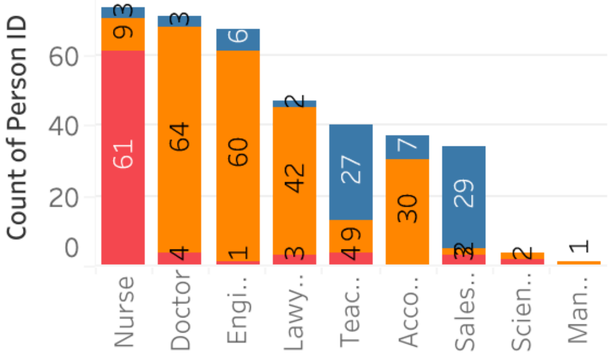
Sleep Disorder by Sleep Duration



Sleep Disorder vs BMI



Sleep Disorder by occuption



SUMMARY

The selected model achieved high accuracy and recall, providing reliable insights for healthcare applications and future research.

This project developed a machine learning model to predict sleep disorders, focusing on None, Insomnia, and Sleep Apnea. Comprehensive data preprocessing, feature engineering, and exploratory analysis were performed to extract meaningful insights. Various models were tested, including Logistic Regression, Random Forest, and XGBoost, with evaluation based on metrics like accuracy, recall, F1-score, and ROC-AUC to ensure reliable and sensitive predictions. The final model demonstrated strong performance and interpretability, supporting early detection and personalized interventions.

Based on our analysis of the models, we recommend increasing daily exercise and prioritizing sufficient sleep duration.