Overstimulation Analysis: Final Report

# 🌟 Objective

To investigate the relationship between behavioral, lifestyle, and psychological features with overstimulation, and build predictive models to classify overstimulated individuals.

# 📄 Dataset Overview

Records: 2,000  
Features: 20 (19 predictors + 1 target)  
Target Variable: Overstimulated (binary)

# 🧹 Data Preparation

Missing Value Treatment  
None detected in the dataset.

Duplicates  
No duplicate rows found.

Outlier Treatment  
Applied IQR-based clipping on numeric features to reduce extreme values.

Data Summary  
Numeric features ranged as expected (e.g., Age: 18-59, Screen Time: 1-12 hrs).  
Target distribution: ~64% Overstimulated, ~36% Not.

# 🔢 Exploratory Data Analysis

Correlation with Overstimulation  
Screen\_Time: +0.445  
Sleep\_Hours: -0.403  
Stress\_Level: +0.277  
Weak or negligible correlation with: Anxiety, Tech\_Usage, Depression, Meditation, Exercise

# Hypothesis Testing Results

Feature Correlation (r) p-value Interpretation  
Sleep\_Hours -0.4027 < 0.0001 Less sleep = more overstimulation  
Screen\_Time 0.4453 < 0.0001 More screen time = more overstimulation  
Stress\_Level 0.2770 < 0.0001 Higher stress linked to overstimulation  
Tech\_Usage\_Hours T-test p = 0.9629 > 0.05 No group difference in overstimulation  
Anxiety\_Score 0.0213 0.3402 Not significant

# 🤖 Machine Learning Models

Preprocessing & Modeling Pipeline  
StandardScaler used for all features  
RandomUnderSampler to balance classes  
Train/test split: 80/20

# Model Results

📊 Logistic Regression  
F1 Score: 0.81  
Accuracy: 81%  
Better at identifying overstimulated than non-overstimulated

🌳 Decision Tree Classifier  
F1 Score: 0.995  
Accuracy: 99%  
Top Features: Sleep\_Hours, Screen\_Time, Stress\_Level  
Likely overfitting

🌳 Random Forest Classifier  
F1 Score: 0.995  
Accuracy: 99%  
Top Features: Screen\_Time, Sleep\_Hours, Stress\_Level  
More robust than a single tree but still high risk of overfitting

# 🔍 Key Insights

Behavioral patterns (screen exposure, sleep) are stronger indicators of overstimulation than psychological states.  
Stress contributes but is less impactful than sleep/screen time.  
Tree-based models highlight the same top 3 features consistently.

# 🔧 Recommendations

☕ Reduce Screen Exposure  
Set daily limits  
Avoid screens 1 hour before sleep

💭 Prioritize Sleep  
Aim for 7-9 hours  
Practice sleep hygiene

😬 Stress Management  
Mindfulness, breathing exercises, regular breaks

🏃️ Encourage Exercise  
Moderate physical activity helps cognitive function

📊 Monitor Tech Usage  
Use tracking apps to balance screen time

# 📆 Next Steps

Apply cross-validation to confirm generalizability  
Use SHAP or permutation importance for deeper model interpretation  
Collect new data on environment, sensory input, neurodivergence for broader scope

# ✅ Conclusion

Behavioral factors like excessive screen time, poor sleep, and high stress levels are the strongest contributors to overstimulation. Preventive actions focused on lifestyle adjustment can reduce cognitive overload and promote mental well-being.