

AI-Assisted Analysis & Enhancement of Social Media Addiction in Students Prediction Models



INFORMATION
TECHNOLOGY
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Artificial Intelligence - F2025

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1. INTRODUCTION

This research project explores the critical intersection of digital habits and psychological well-being by analyzing the impact of **Social Media Addiction (SMA)** on **student mental health**. Grounded in the benchmark study by Zewude et al. (2025), which utilized **Structural Equation Modeling** to establish a negative link between addiction scores and mental health.

2. PROBLEM STATEMENT

- The Issue:** Social Media Addiction (SMA) is a significant public health concern, increasingly linked to anxiety, depression, and sleep disorders among students.
- The Gap:** Traditional statistical methods often assume linear relationships, failing to capture the complex, non-linear behavioral patterns that drive mental health outcomes.
- Our Goal:** To replicate a benchmark study and leverage advanced AI/Machine Learning techniques to build a more accurate and robust predictive model.

3. BENCHMARK STUDY & DATASET

- Benchmark Paper:** A Multi-Mediation Analysis on the Impact of Social Media and Internet Addiction... by Zewude et al. (2025).
- Proxy Dataset:** "Students Social Media Addiction" (705 student records from various countries).
- Key Features:**
 - *Addicted Score (Primary Predictor)*
 - *Avg. Daily Usage Hours*
 - *Sleep Hours Per Night*
 - *Social Conflicts*

4. METHODOLOGY: THE AI WORKFLOW

Our group implemented a 3-stage pipeline to enhance the predictive capability.

- STAGE 1: Preprocessing & Baseline**
 - **Preprocessing:** Applied Label Encoding to categorical data and Standard Scaling to normalize numerical features for gradient-based algorithms.
 - **Baseline Model:** Implemented Linear Regression ($R^2 = 89.4\%$) to establish a performance benchmark.
- STAGE 2: AI-Assisted Enhancement**
 - Recognized the non-linear nature of human behavior.
 - Selected Ensemble Learning methods to capture feature interactions:
 - Random Forest (Bagging)
 - XGBoost (Gradient Boosting)
- STAGE 3: Advanced Tuning**
 - Optimized the XGBoost model using Grid Search (GridSearchCV) to find the best hyperparameter combination (Learning Rate: 0.05, Max Depth: 5, Estimators: 200).



3 GOOD HEALTH AND WELL-BEING



This project directly supports UN Sustainable Development Goal (SDG) 3

- Specific Target:** It contributes to the goal of ensuring healthy lives and promoting well-being for all ages by addressing the critical issue of mental health among students.
- Implementation:** By using AI to accurately predict how social media addiction degrades mental health, this project provides a tool for early detection and intervention, helping to safeguard the psychological well-being of the younger generation.

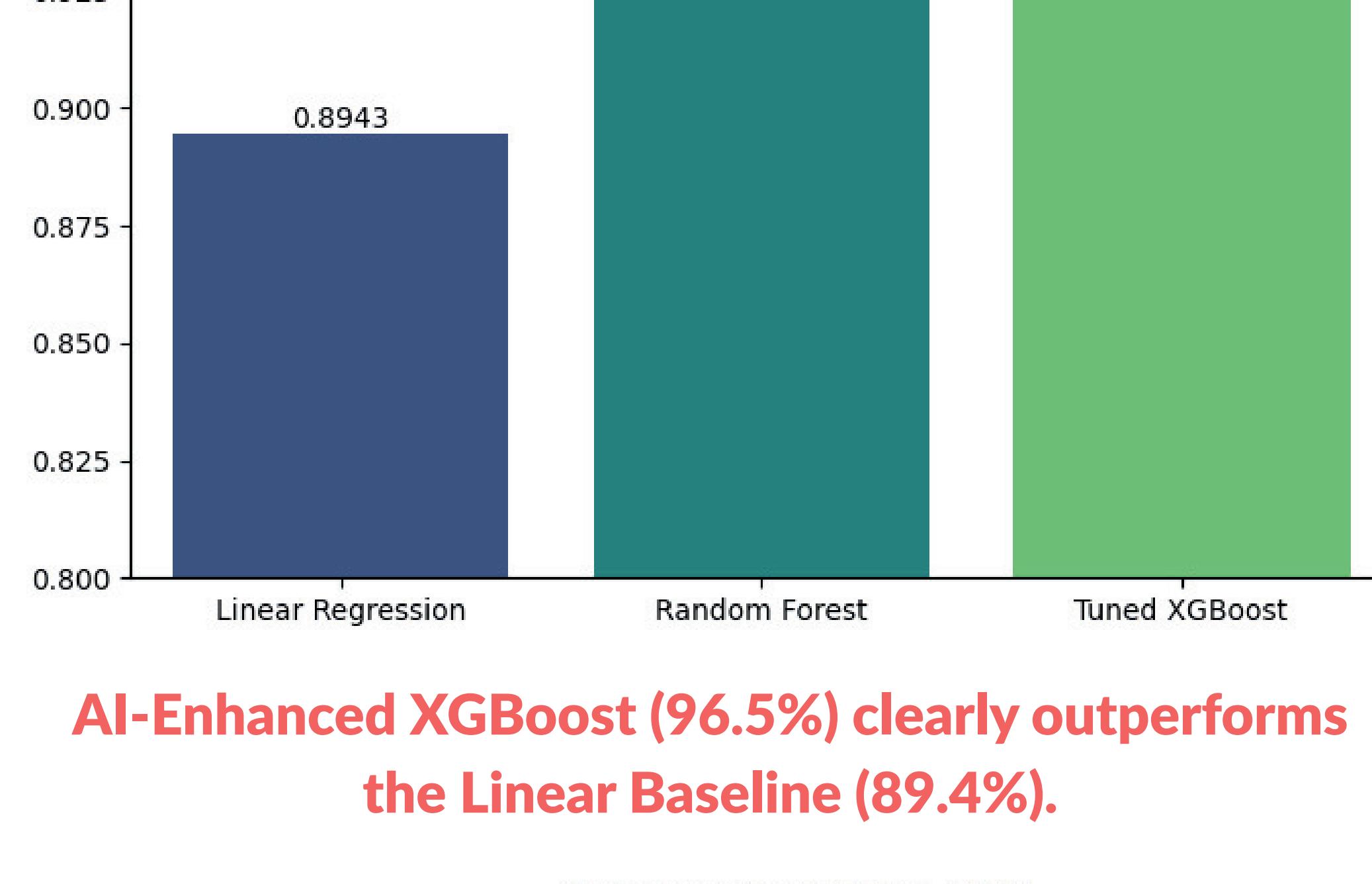
5. RESULTS & KEY FINDINGS

- A. Significant Performance Boost** Our AI-enhanced model outperformed the traditional baseline significantly.

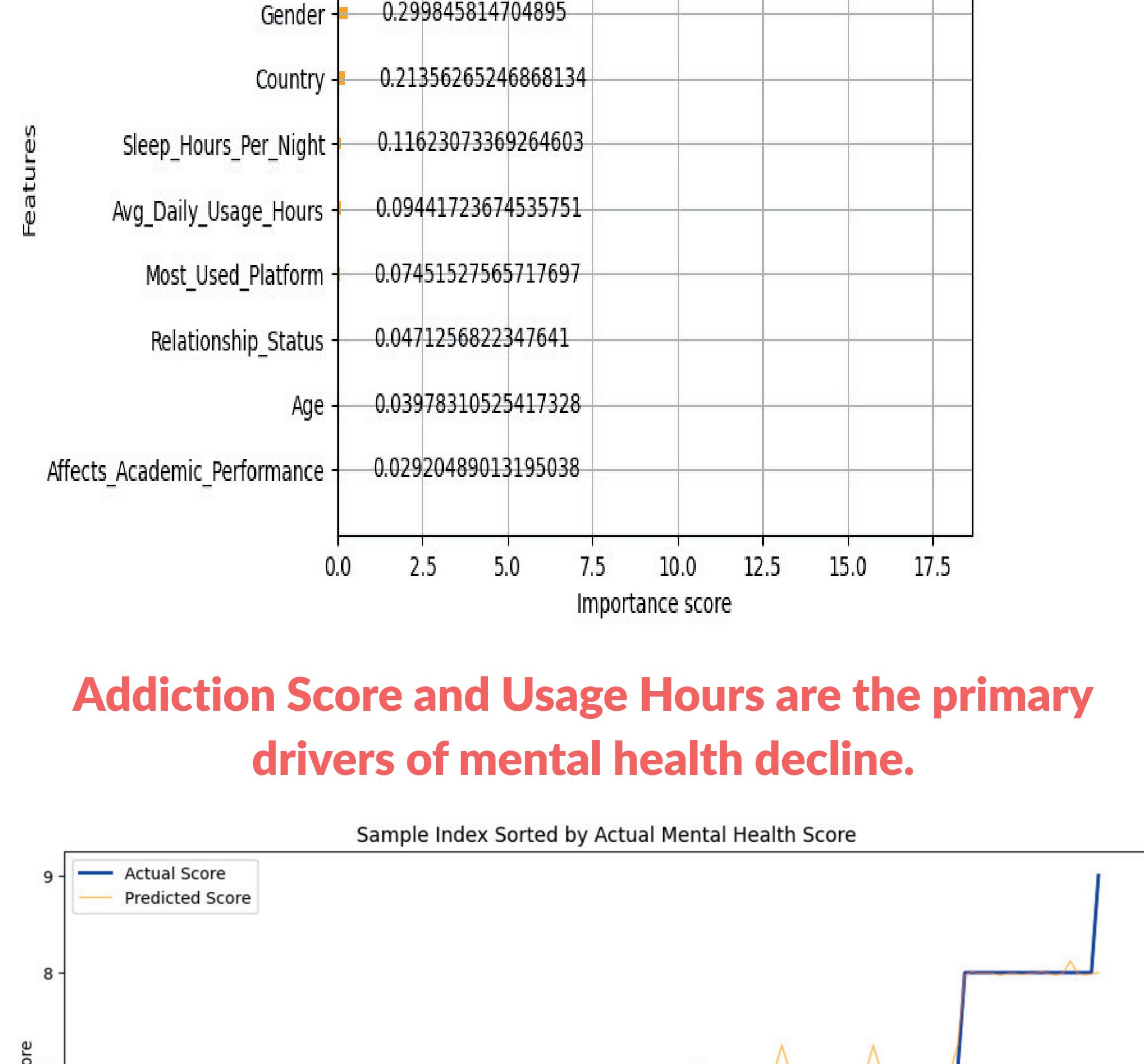
Model	Accuracy (R2)	Error (RMSE)
Linear Regression (Baseline)	89.40%	0.1268
Tuned XGBoost (Enhanced)	96.50%	0.0451

- Impact:** The AI model reduced the prediction error by over 60%, providing a much more reliable tool.

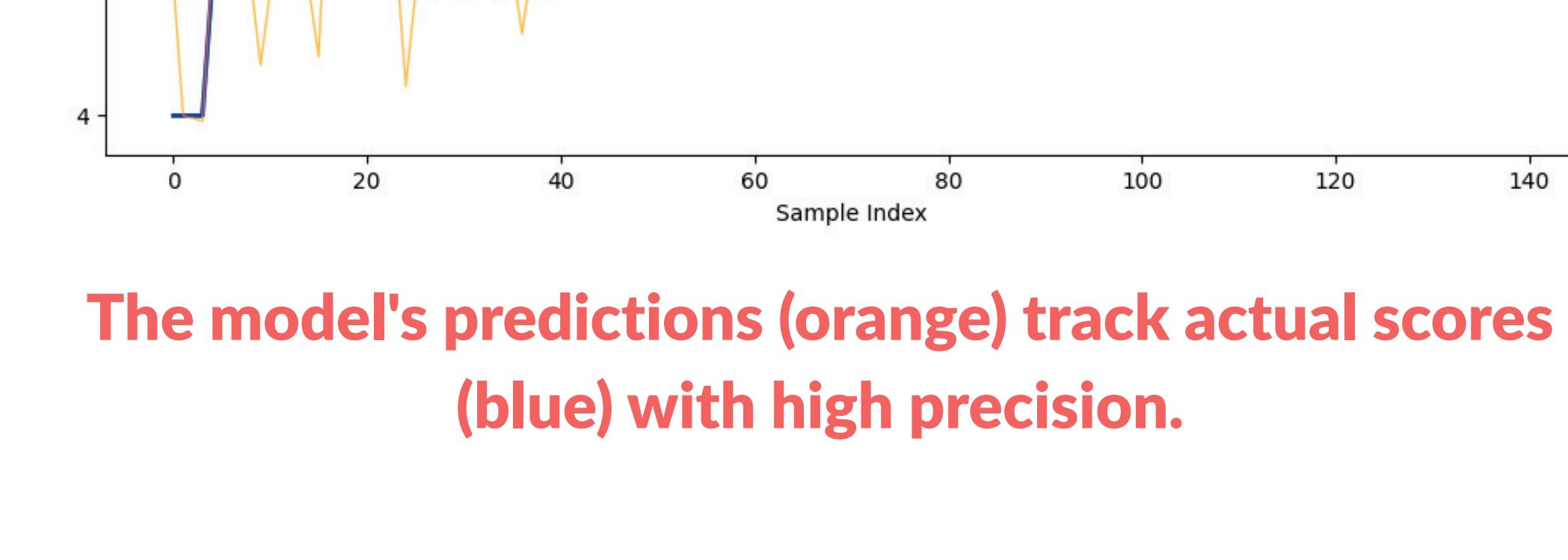
- B. Identifying Critical Risk Factors Feature Importance analysis from the XGBoost model confirmed that **Addiction Score** is the single most critical predictor of poor mental health, followed by **Daily Usage Hours**.**



AI-Enhanced XGBoost (96.5%) clearly outperforms the Linear Baseline (89.4%).



Addiction Score and Usage Hours are the primary drivers of mental health decline.



The model's predictions (orange) track actual scores (blue) with high precision.

CONCLUSION

This project demonstrated that **AI-assisted Ensemble Learning** provides a superior approach for analyzing behavioral data compared to traditional statistics.

The final **Tuned XGBoost** model offers a robust and accurate tool for identifying students at risk of **mental health issues** due to **social media addiction**.



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