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

INFORMATION TECHNOLOGY UNIVERSITY

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).

UNDP

3 GOOD HEALTH AND WELL-BEING

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

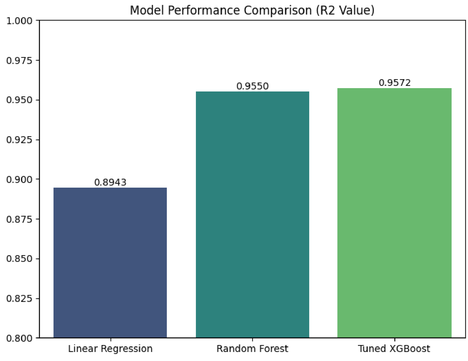
- ***Specific Target:** It contributes to the goal of ensuring healthy lives and promoting well-being for all ages by addressing the critical issue of mental health among students.*
- ***Implementation:** By using AI to accurately predict how social media addiction degrades mental health, this project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

5. RESULTS & KEY FINDINGS

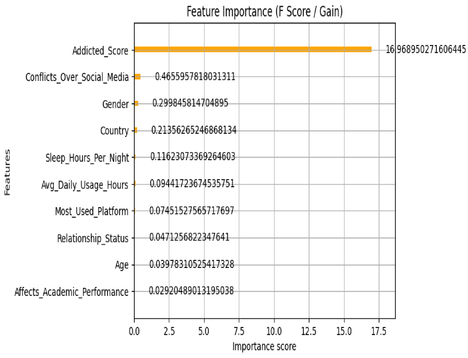
- **A. Significant Performance Boost** Our AI-enhanced model outperformed the traditional baseline significantly.

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

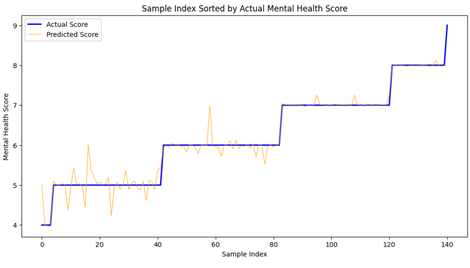
  - **Impact:** The AI model reduced the prediction error by over 60%, providing a much more reliable tool.
- **B. Identifying Critical Risk Factors Feature** Importance analysis from the XGBoost model confirmed that **Addiction Score** is the single most critical predictor of poor mental health, followed 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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