

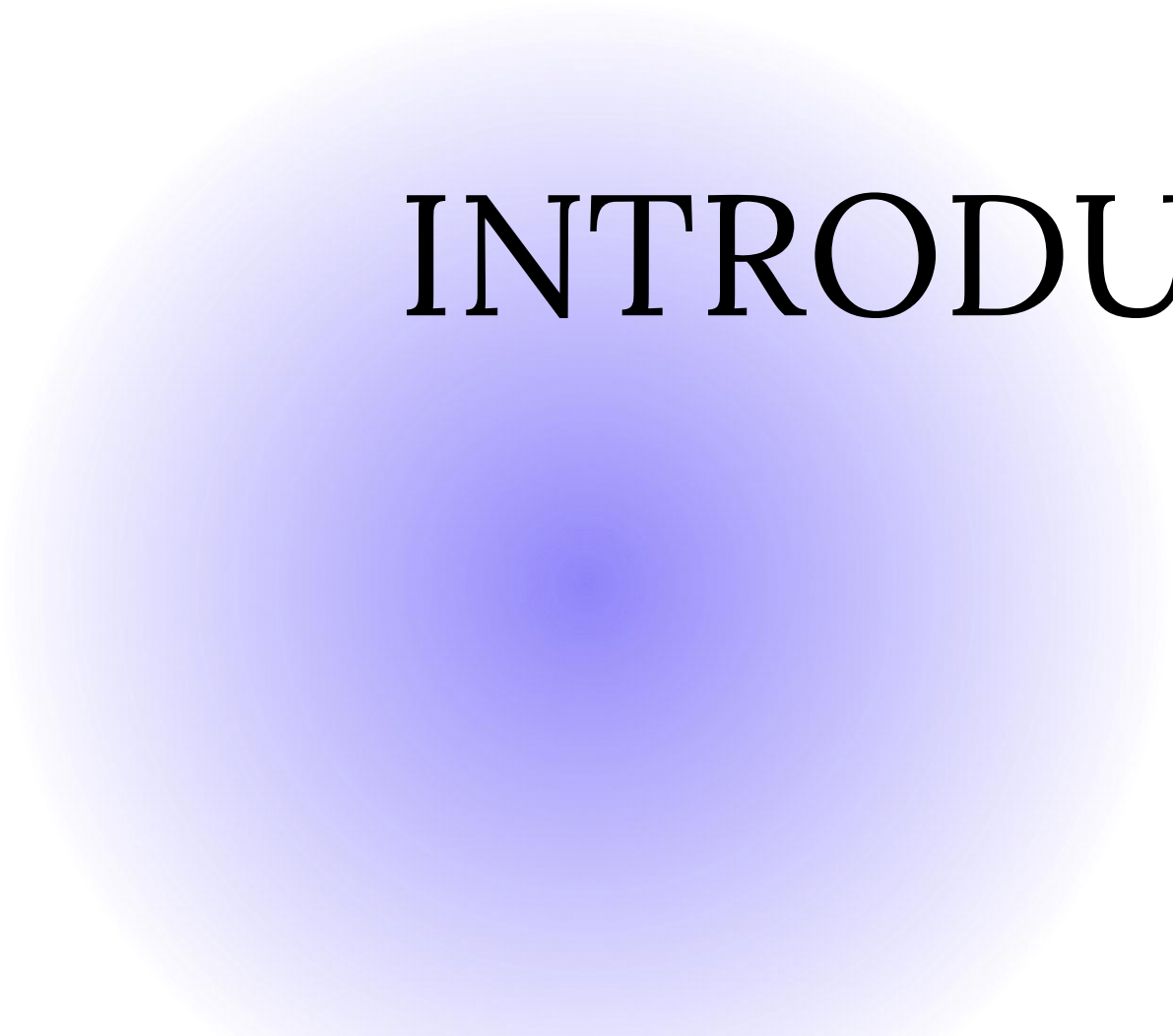
LEVERAGING ARTIFICIAL INTELLIGENCE TO ENHANCE PHYSICAL FITNESS AND MENTAL WELL-BEING AMONG TEENAGERS

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INTRODUCTION

Youth Mental Health Challenges:

- Mental health issues such as **anxiety, depression, and stress** are increasingly prevalent among teenagers and young adults.
- Academic pressure, social media exposure, reduced physical activity, and lifestyle changes have significantly impacted youth wellbeing.
- Traditional mental health support systems often rely on **self-reporting**, which may be subjective, delayed, or inaccessible to all individuals.
- There is a growing need for **early detection and continuous monitoring** of both physical and mental health indicators



Role of AI and Data-Driven Decision Making

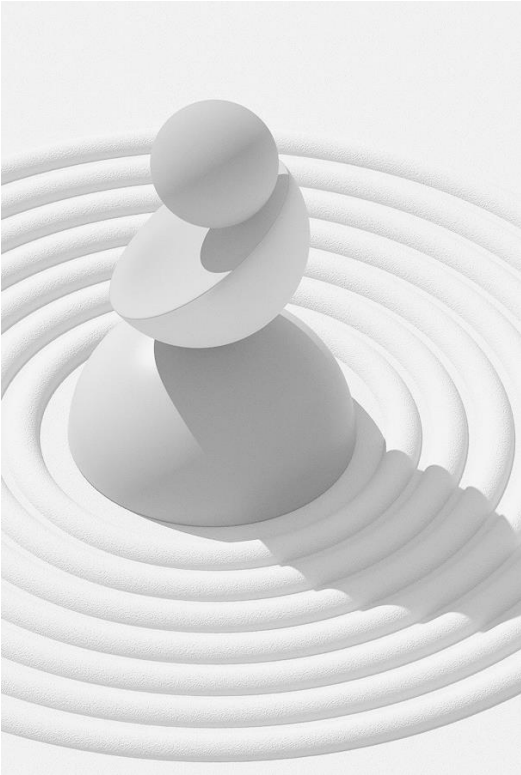
- Artificial Intelligence (AI) enables the analysis of **large-scale, heterogeneous health data** to uncover hidden patterns and trends.
- Machine learning models can support:
 - Early identification of mental health risks
 - Personalised fitness and wellbeing recommendations
 - Scalable and automated health monitoring solutions
- Integrating data from **wearable devices, mental health surveys, and social media platforms** allows for a more **holistic and data-driven understanding** of youth wellbeing.
- AI-driven decision-making supports **evidence-based interventions**, improving prevention strategies and long-term outcomes.





AIM & OBJECTIVES

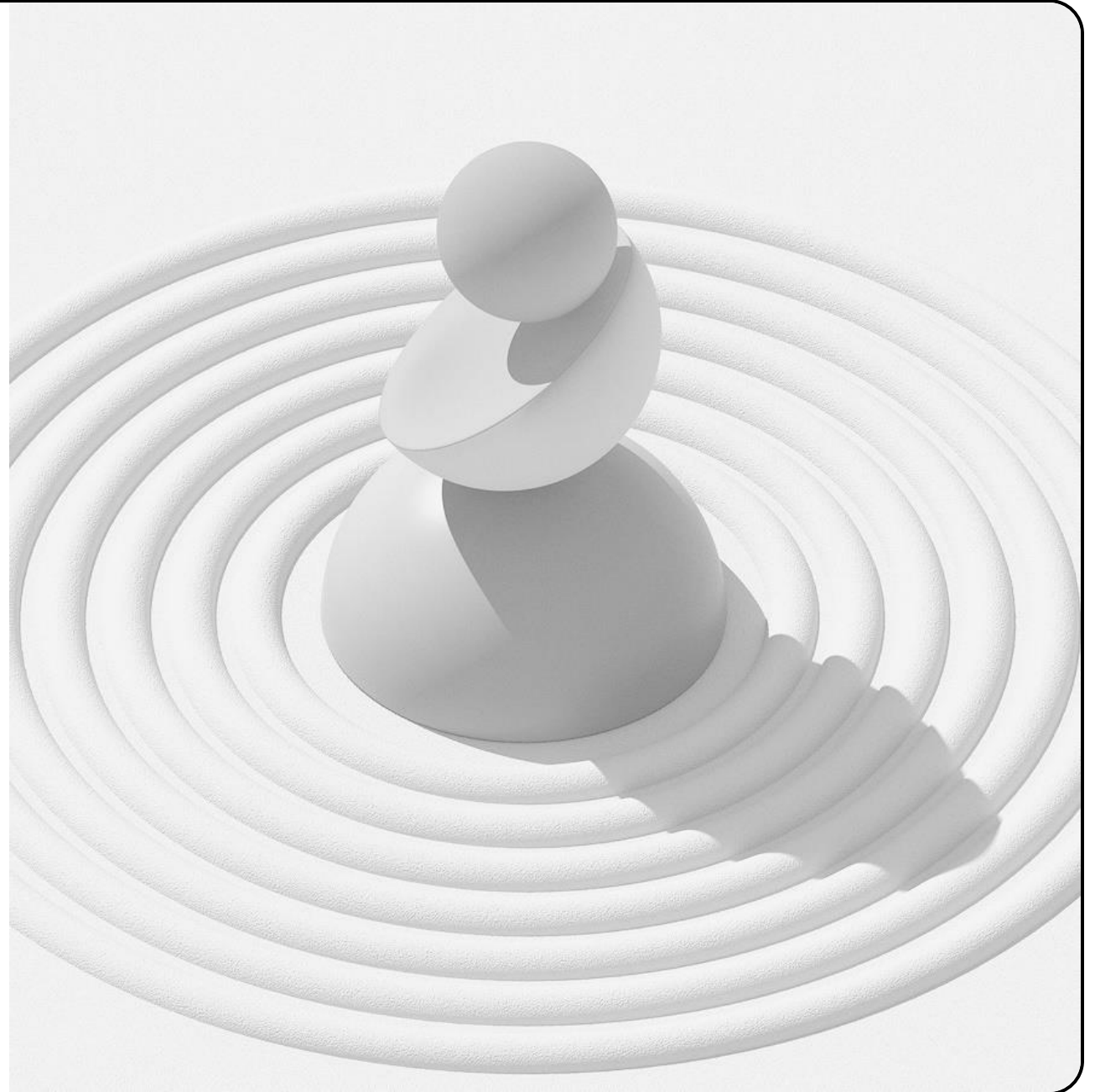
AIM



The aim of this research is to explore how artificial intelligence can enhance physical fitness and support mental health in teenagers, addressing anxiety, depression, and overall well-being.

RESEARCH OBJECTIVES:

- **Identify Mental Health Challenges:** To explore the mental health struggles faced by teenagers, including anxiety and depression, and examine how physical fitness may help mitigate these challenges.
- **Examine the Impact of Physical Activity:** To analyse how exercise and group-based physical activities influence brain function, emotional stability, and social engagement among teenagers.
- **Investigate the Role of AI Tools:** To assess how artificial intelligence technologies, such as wearable fitness trackers, recommendation systems, and data-driven models, can support physical and mental health monitoring.
- **Evaluate Engagement Strategies:** To study how AI-driven personalisation and gamification techniques can improve motivation, participation, and adherence to healthy behaviours.
- **Address Ethical and Practical Concerns:** To examine issues related to data privacy, algorithmic bias, overreliance on AI systems, and the importance of human oversight in AI-supported health interventions.





DATASETS USED

1. Fitabase Dataset (Wearable Fitness Data)

- Contains **wearable sensor data** collected from Fitbit devices.
- Key features include:
 - Daily step count
 - Calories burned
 - Distance travelled
- Used to analyse **physical activity patterns** and classify fitness levels.



2. Student Mental Health Survey Dataset

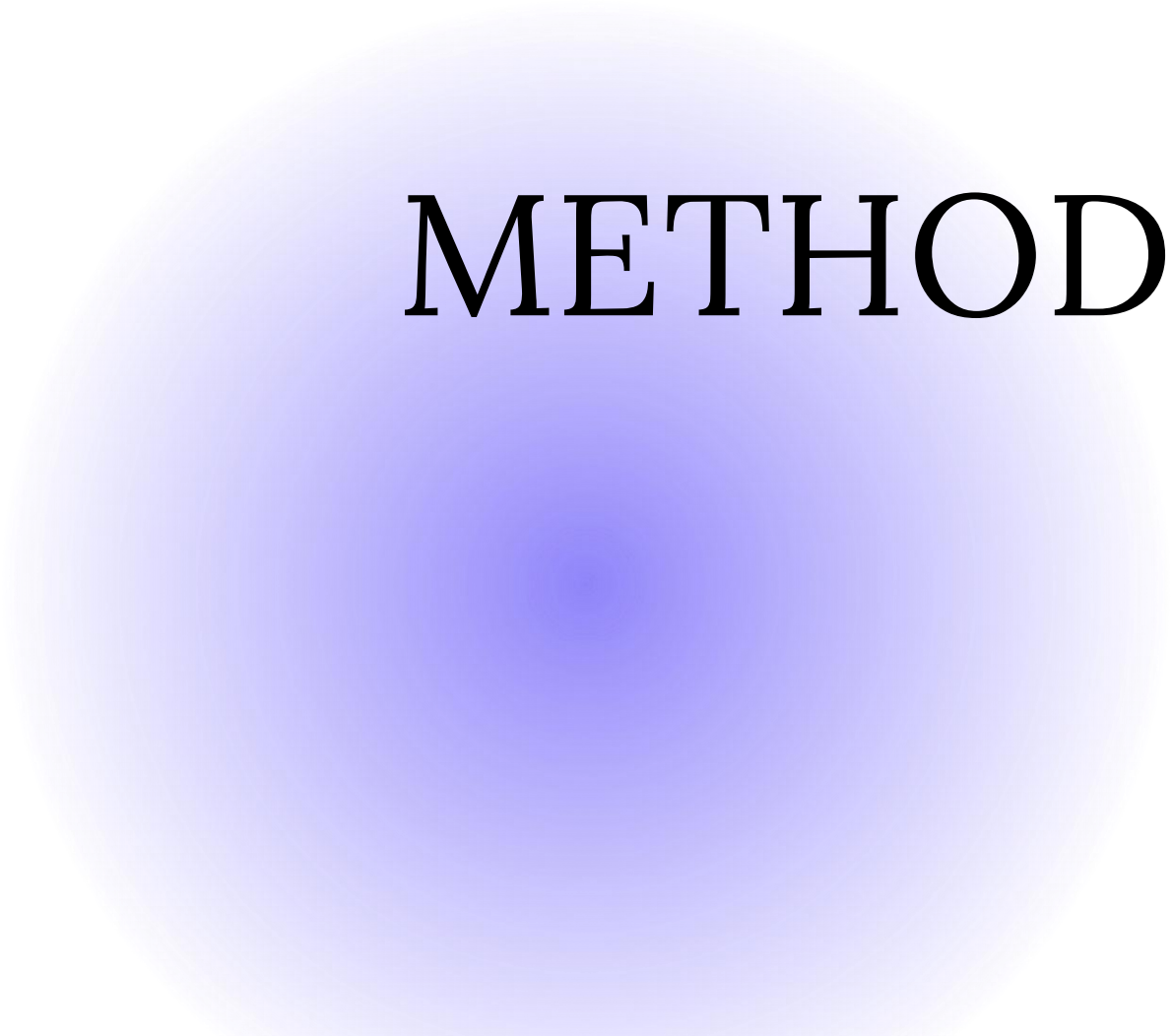
- Self-reported data collected from students.
- Key variables include:
 - Stress level
 - Anxiety score
 - Depression score
- Used to model **mental health risk levels** using supervised machine learning.



3. Instagram Sentiment & Hate Dataset

- Large-scale **social media text dataset**.
- Includes:
 - Post descriptions
 - Sentiment labels (e.g., fear, joy, neutral)
 - Stress/anxiety indicators
 - Hate speech annotations
- Used for **multi-class sentiment analysis** and emotional state detection

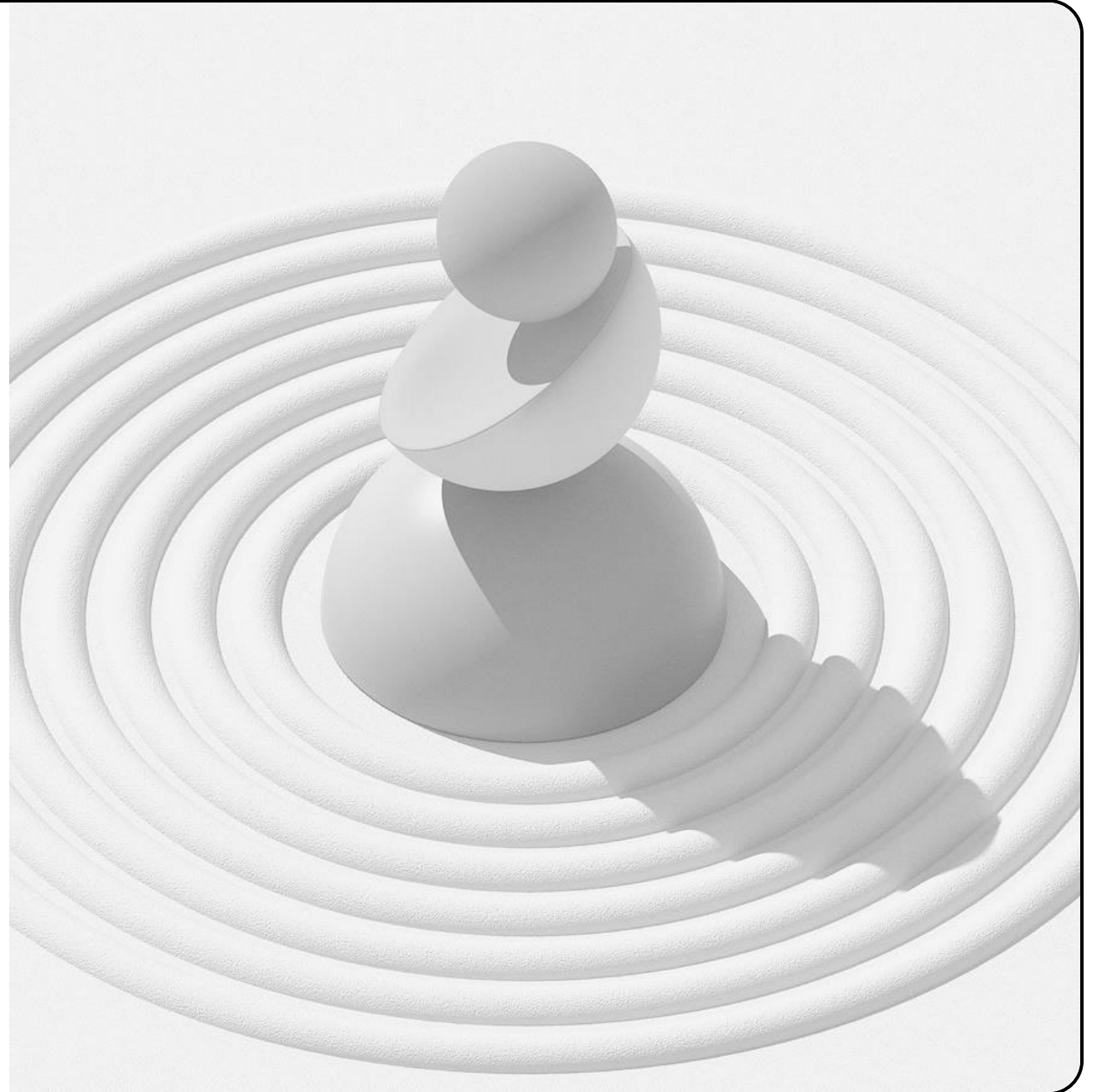




METHODOLOGY

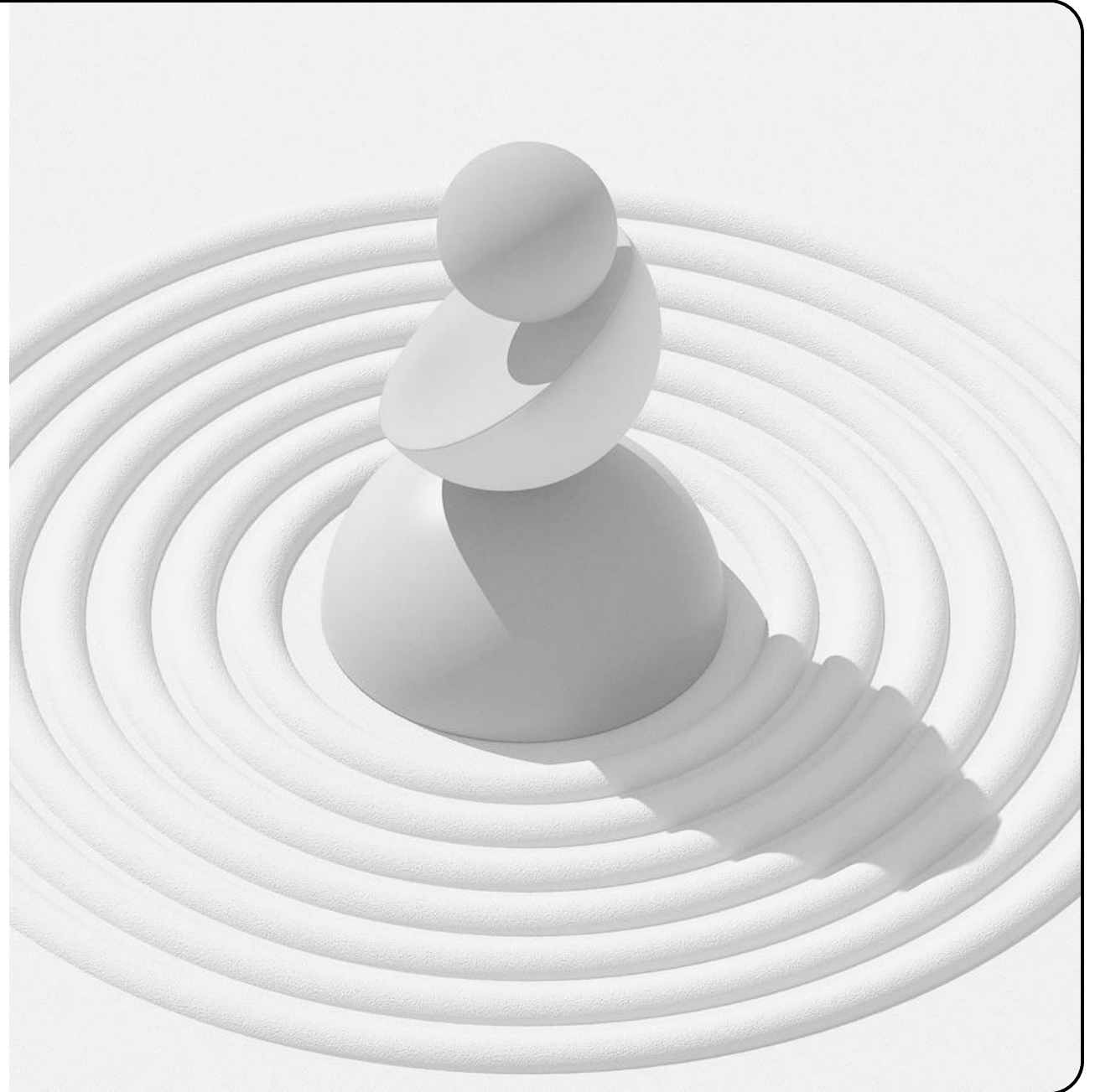
DATA PREPROCESSING & EDA

- Cleaning and standardisation of all datasets
- Handling missing values and duplicates
- Feature scaling and encoding
- Exploratory Data Analysis (EDA) to understand:
- Distributions
- Class balance
- Feature correlations



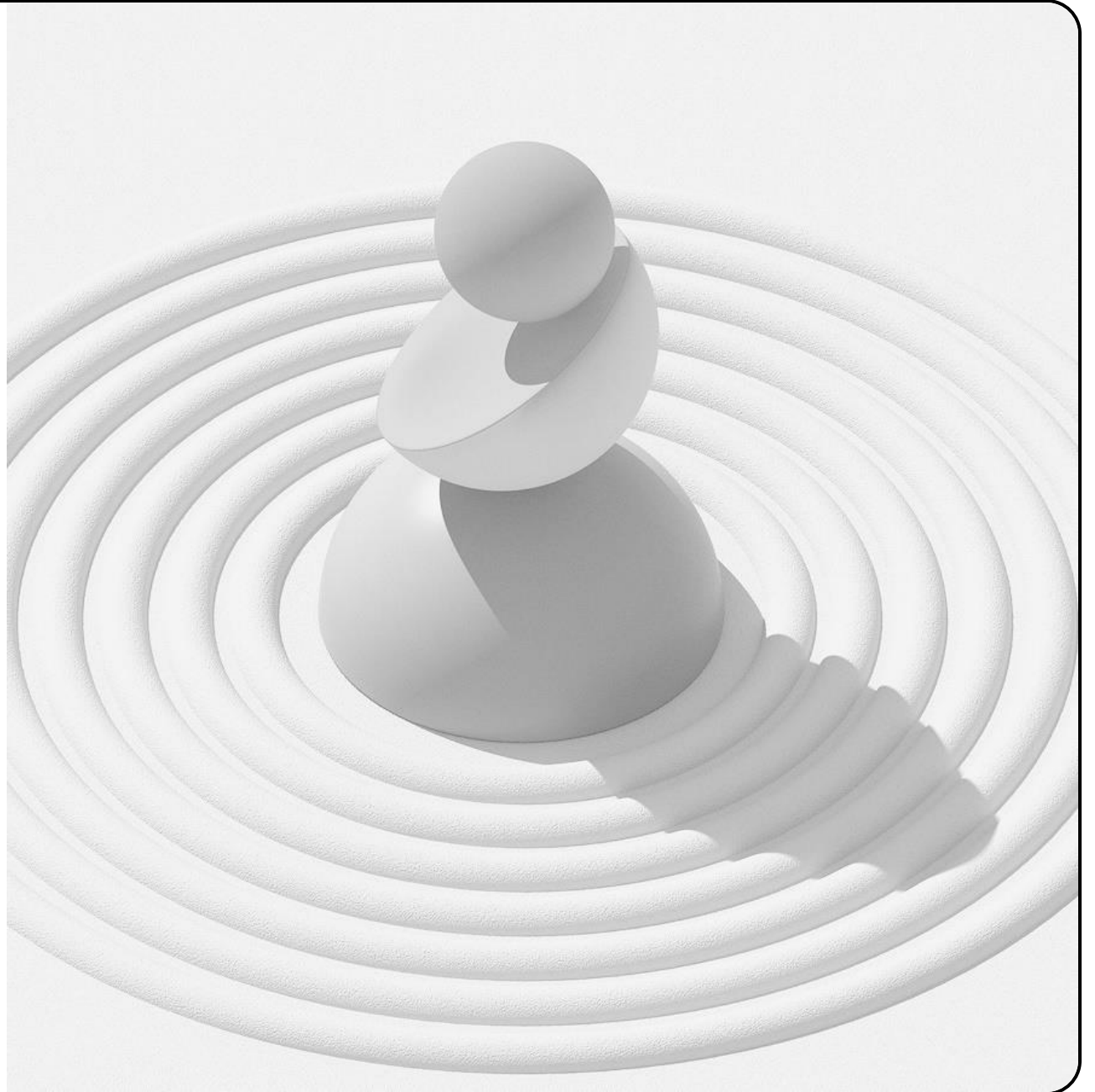
MACHINE LEARNING MODELS

- **Random Forest**
 - Ensemble-based model for robust classification
- **Support Vector Machine (SVM)**
 - Effective for high-dimensional data and text features
- **Logistic Regression**
 - Interpretable baseline model for mental health prediction



EVALUATION METRICS

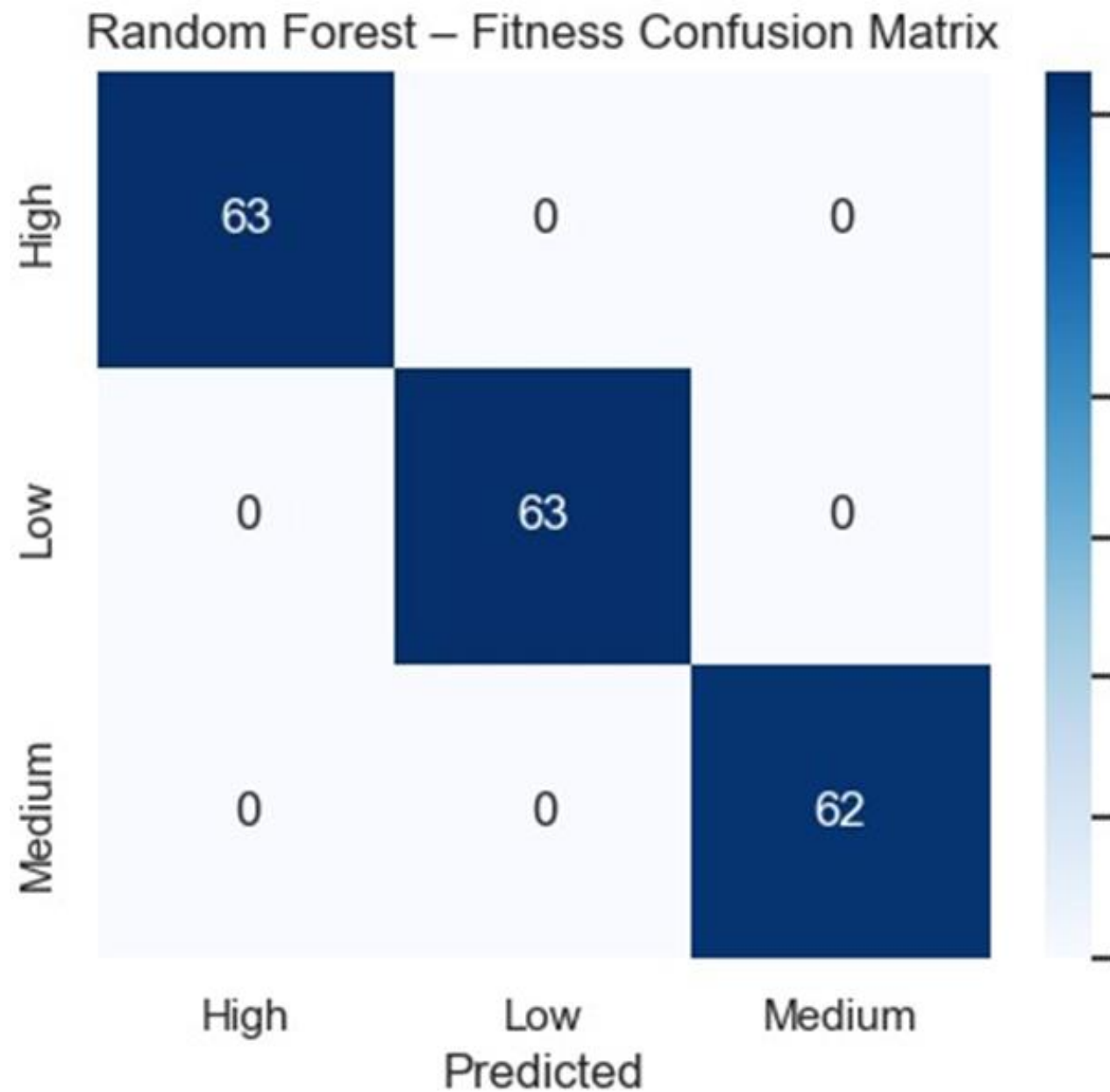
- Accuracy
- Precision
- Recall
- F1-score
- Confusion Matrix





FITNESS RESULTS

- **SUPPORT VECTOR MACHINE (SVM)**
 - Accuracy: **96%**
 - Strong performance in classifying physical activity levels
- **RANDOM FOREST**
 - Accuracy: **94%**
 - Slightly lower than SVM but robust and stable

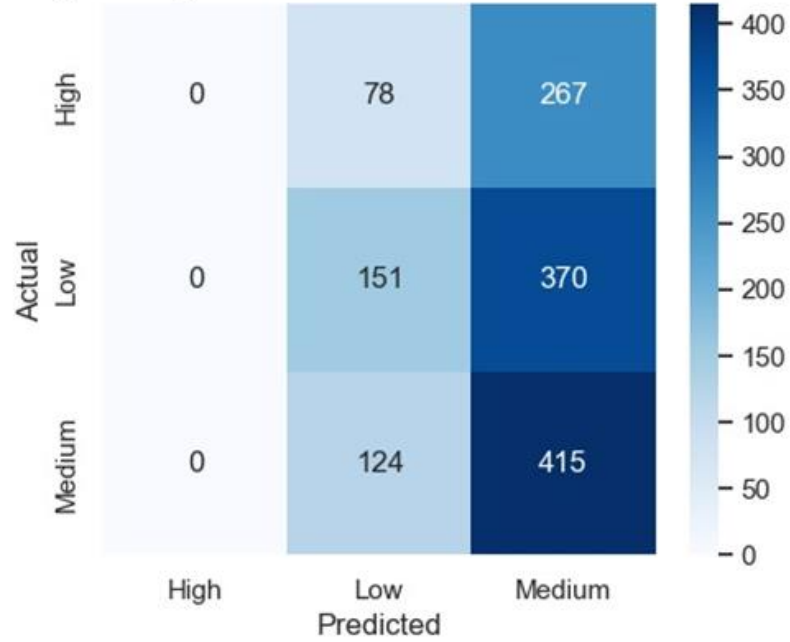




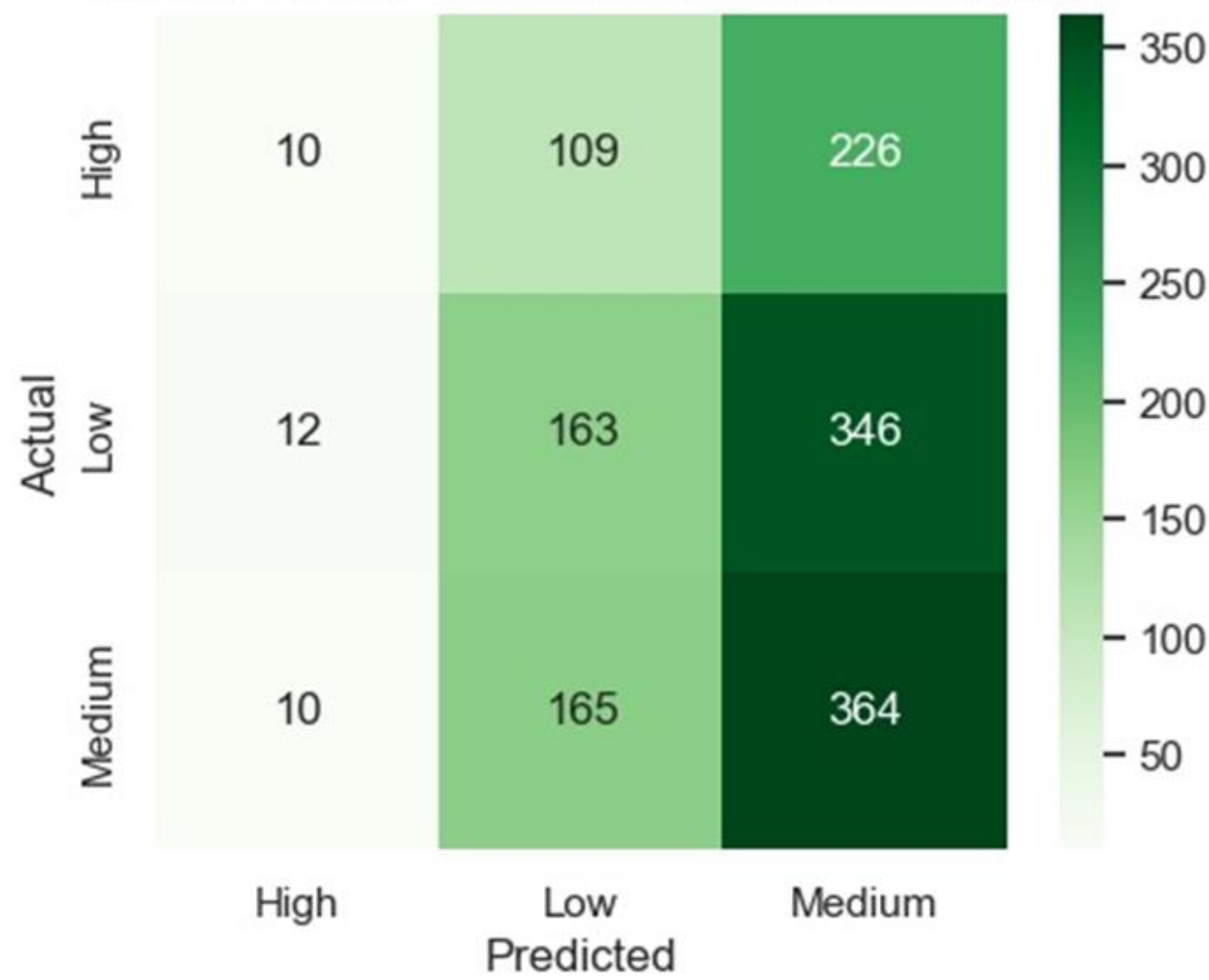
MENTAL HEALTH RESULTS

- **RANDOM FOREST**
 - ACCURACY: **38%**
- **LOGISTIC REGRESSION**
 - ACCURACY: **40%**
- **EXPLANATION:**
 - MENTAL HEALTH DATA IS **HIGHLY COMPLEX AND SUBJECTIVE**
 - CLASS IMBALANCE ACROSS DEPRESSION CATEGORIES
 - OVERLAPPING SYMPTOMS REDUCE MODEL SEPARABILITY

Logistic Regression – Mental Health Confusion Matrix



Random Forest – Mental Health Confusion Matrix

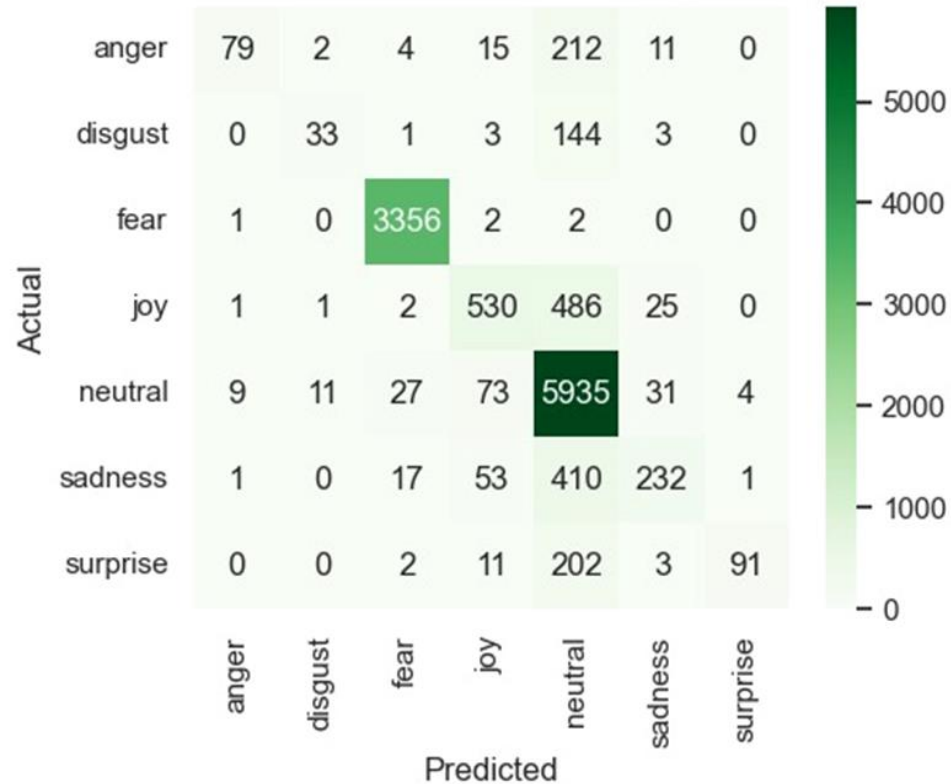




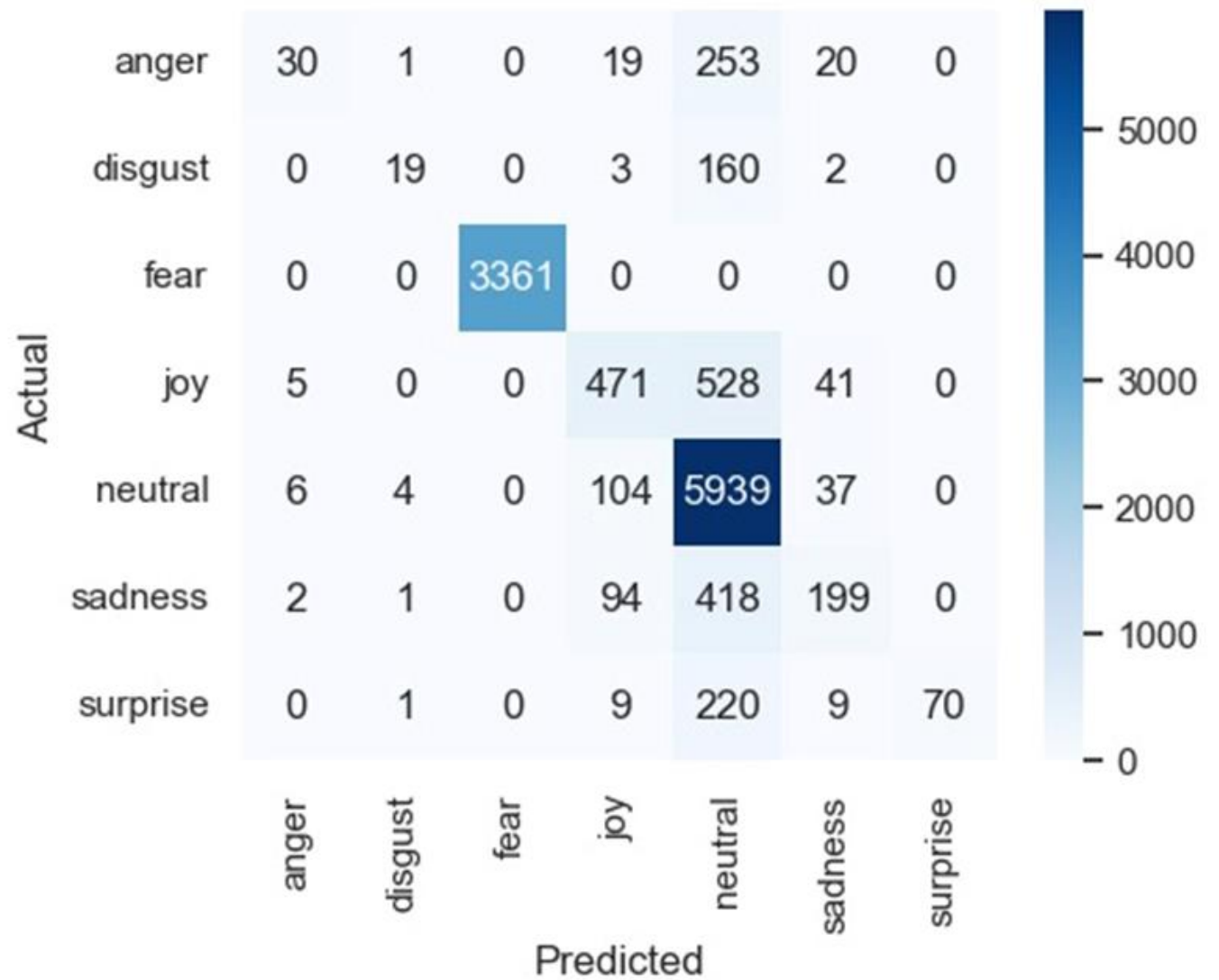
INSTAGRAM RESULTS

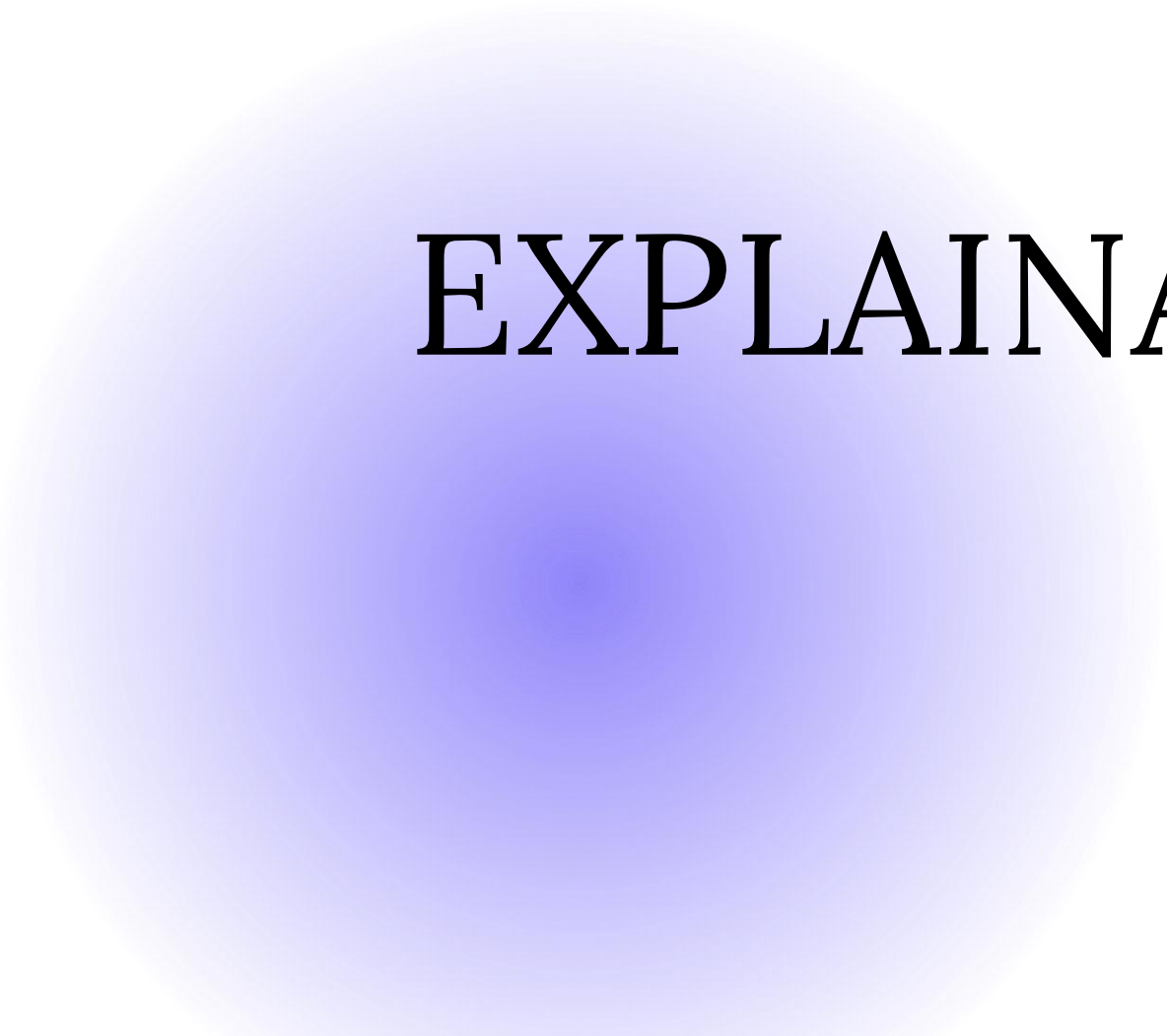
- **RANDOM FOREST**
 - Accuracy: 85%
 - Strong performance in large – scale text behavioural data
- **SUPPORT VECTOR MACHINE (SVM)**
 - Accuracy: 84%
 - Competitive results using TF – IDF text feature

Random Forest Confusion Matrix — Instagram Sentiment



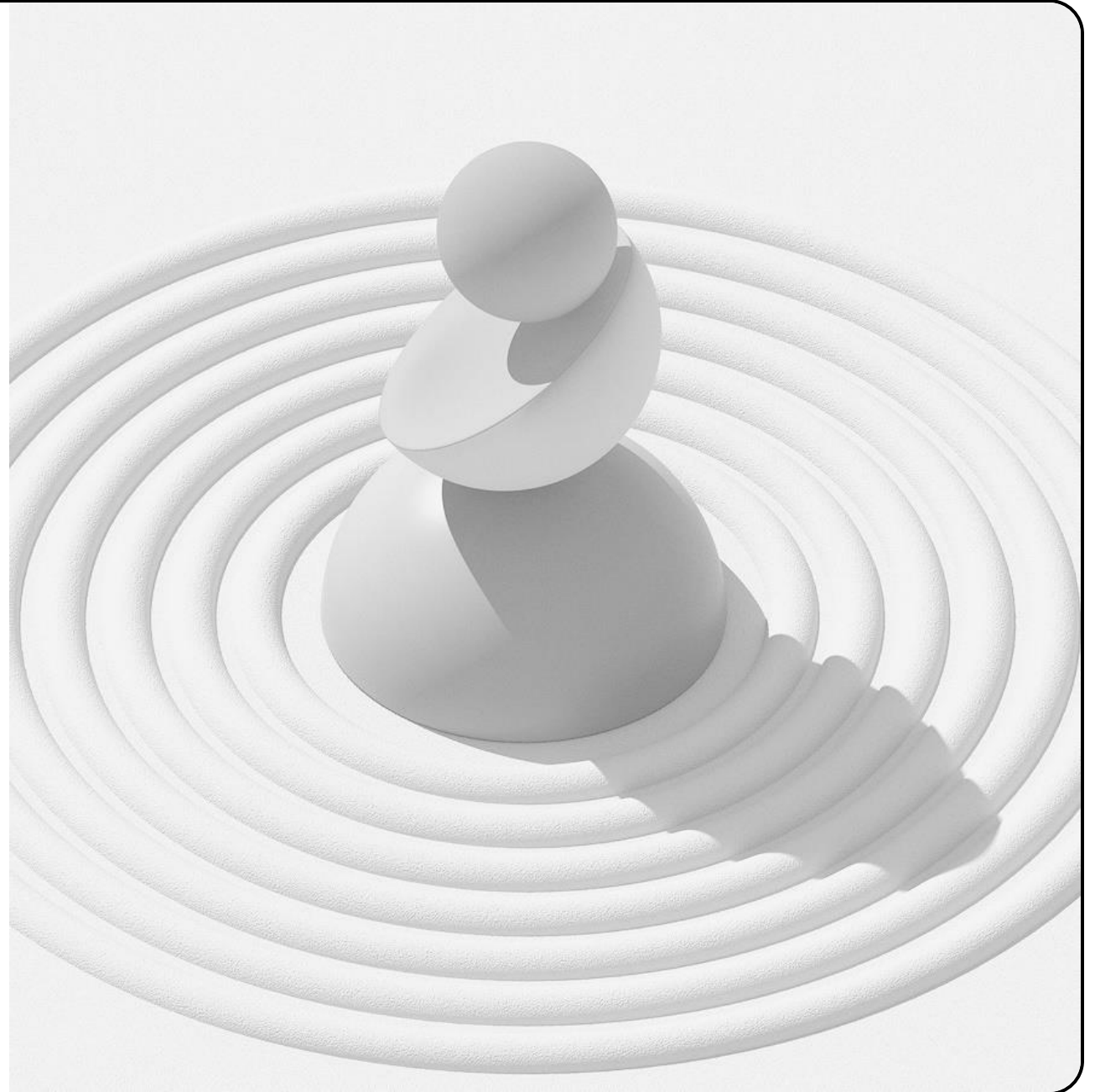
SVM Confusion Matrix — Instagram Sentiment

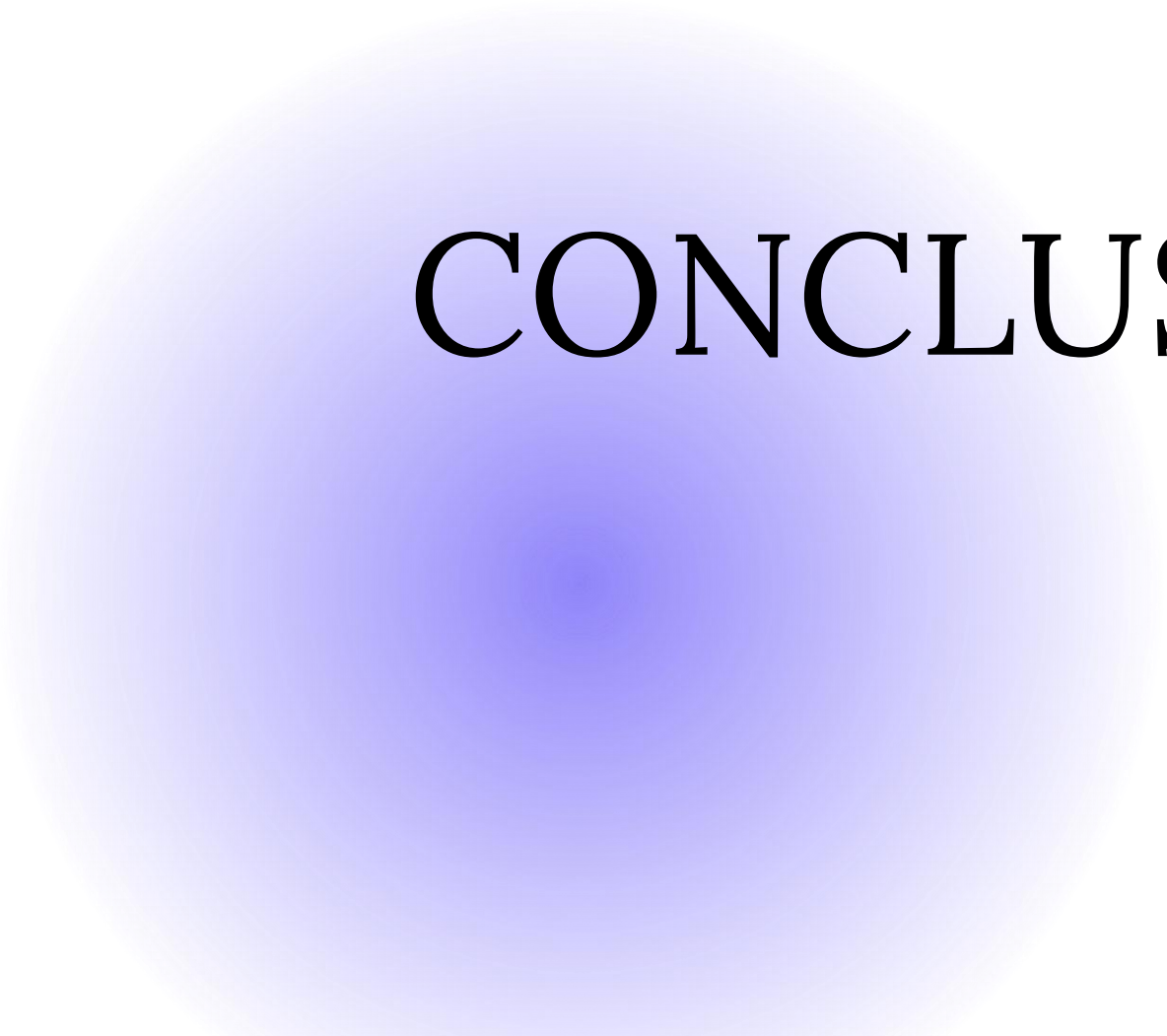




EXPLAINABLE AI

- SHAP (SHapley Additive Explanations) was applied to enhance model interpretability
- Enabled **transparent decision-making** in mental health prediction models
- Identified **key feature contributions** (e.g., stress and anxiety indicators)
- Supported **ethical AI principles**, ensuring trust, accountability, and fairness





CONCLUSION

- **Multi-modal AI** provides deeper and more holistic insights than single-source models
- Integration of **fitness, mental health, and social media data** improves wellbeing assessment
- Results demonstrate strong potential for **real-world youth mental health support systems**



THANK YOU