

Project: Midterm Report

Evan Matthews¹, Vikram Ramavarapu¹, and Krishnaveni Unnikrishnan¹

¹CS 412 Group G6

November 6th, 2024

1 Abstract

TODO: summarizing the project [1–4].

2 Introduction

The internet has become an integral part of our daily lives, with people of all ages spending a significant amount of time online. This trend has given rise to concerns about the potential impacts of excessive internet use, particularly on children and teens. Problematic Internet Use (PIU) is a condition characterized by excessive or poorly controlled preoccupations, urges, or behaviors regarding computer use and internet access that lead to impairment or distress [3]. PIU has been associated with a range of mental health issues, including depression, anxiety, and impulsivity [2]. As such, identifying early signs of PIU in children and teens is crucial for prevention and intervention. In this project, we aim to predict early signs of PIU in children and teens using machine learning techniques, leveraging data from the Child Mind Institute’s Healthy Brain Network. The project plan consists of three phases: data preprocessing, initial model evaluation, and fine-feature reevaluation. We will submit our work to the Child Mind Institute’s (CMI) Kaggle competition on PIU prediction, and we also aim to publish our results as a paper should they outperform competition expectations.

3 Motivation

With the rise of machine learning and pattern prediction models, the ability to analyze and predict upon more complex data and parameters becomes much more approachable. Likewise, child development is a multi-facted situation in which parenting and environmental factors can lead to an incredibly high number of outcomes. This field has had great strides in classical research, but a more modern approach could lead to significant development in the success of future generations. Additionally, predictions against an extensive number of possible outcomes like this represents a current roadblock in machine learning- that is, how modern predictive models can adapt to an ever-increasing set of parameters and decreasing set of training data. Finally, child psychology is interested in recognizing patterns in early behavior in order to reduce the impact of harmful effects from a child’s environment.

4 Related work

Research on Problematic Internet Use (PIU) has gained significant attention due to its increasing prevalence and association with various psychological and behavioral issues. Early investigations into PIU highlighted its similarities with substance use disorders, impulse control disorders, and obsessive-compulsive disorder.

Studies have revealed concerning prevalence rates between 1.5% and 8.2% in the United States and Europe, emphasizing the growing social impact of this condition. The relationship between PIU and psychiatric disorders has been extensively documented, with research showing significant associations with depressive disorders and attention-deficit/hyperactivity disorder (ADHD). A notable study found that individuals with PIU were more than twice as likely to have depressive disorders ($aOR = 2.43$), and showed increased likelihood of having ADHD

combined presentation ($aOR = 1.91$) and Autism Spectrum Disorder ($aOR = 2.24$).

Recent investigations have focused on understanding the personality profiles and emotional factors contributing to PIU. Research has identified specific personality traits associated with PIU, including lower scores in novelty seeking, harm avoidance, and reward dependence. Additionally, emotional dysregulation has emerged as a significant factor, with studies suggesting that PIU may serve as a behavioral mechanism for escaping negative affects.

Treatment approaches for PIU have primarily centered on addressing comorbid conditions, with cognitive behavioral therapy and selective serotonin reuptake inhibitors showing promise as potential interventions. However, researchers emphasize that detailed treatment guidelines require further investigation, particularly given the complex interplay between PIU and various psychological disorders.

The field continues to evolve, with ongoing debates about diagnostic criteria and classification. While the Internet's positive impact on well-being is widely acknowledged, the pathological aspects of its use remain understudied, particularly regarding subtle psychological changes such as online disinhibition. This highlights the need for additional research into the pathophysiology, epidemiology, natural course, and treatment of PIU to develop more effective intervention strategies.

5 scope

Given that the original scope of the project was accepted, we are pressing forward with this plan with no significant changes. The most crucial critique provided- that the validation plan and evaluation metric were not clear- are likewise addressed in the methodology section.

6 Methodology

TODO: what you are doing / planning to do from a data mining perspective. This can include any exploratory or statistical data analysis, visualization, efficient data storage/compression, fitting predictive models, clustering, pattern mining, etc. If you are doing / planning to do a comparative study, discuss the methods you are considering, including any methods being used as baselines. Please include a clear evaluation plan, including train-val-test splits, cross-validation, hyper-parameter tuning, and explain clearly how you will do these. You have to highlight alignment of the project with the course clearly, especially if you have received feedback on concerns regarding limited alignment with the course.

Add methodology here

7 (Current / Preliminary) Results

TODO: what you have so far in terms of initial results and analysis of initial results. Please see comment on figures/tables above, especially the fact that good captions go a long way to making things readable.

Add results here

8 Plan of Work

TODO: what are the next steps before the final report. Please be as precise as possible. Note that you will have about a month to finish the project, so make suitably calibrated plans, e.g., do not over/under promise.

Add plan of work here

9 Conclusions, discussions

add conclusions here

References

- [1] Elias Aboujaoude. Problematic internet use: an overview. *World Psychiatry*, 9(2):85–90, June 2010.
- [2] Hilarie Cash, Cosette D Rae, Ann H Steel, and Alexander Winkler. Internet addiction: A brief summary of research and practice. *Curr. Psychiatry Rev.*, 8(4):292–298, November 2012.
- [3] Mauro Pettorruso, Stephanie Valle, Elizabeth Cavic, Giovanni Martinotti, Massimo di Gianantonio, and Jon E Grant. Problematic internet use (PIU), personality profiles and emotion dysregulation in a cohort of young adults: trajectories from risky behaviors to addiction. *Psychiatry Res.*, 289(113036):113036, July 2020.
- [4] Anita Restrepo, Tohar Scheininger, Jon Clucas, Lindsay Alexander, Giovanni A Salum, Kathy Georgiades, Diana Paksarian, Kathleen R Merikangas, and Michael P Milham. Problematic internet use in children and adolescents: associations with psychiatric disorders and impairment. *BMC Psychiatry*, 20(1):252, May 2020.