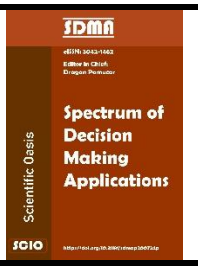
SCIENTIFIC OASIS

Spectrum of Decision Making and Applications

Journal homepage: www.dmap-journal.org
ISSN: 3042-1462



Deep Learning Model to Analyze Psychological Effects on Gamers

Rabia Younas[1], Hafiz Burhan Ul Haq[2,*]

[1] Department of Information Technology, Faculty of Computer Science, Lahore Garrison University, Pakistan

ARTICLE INFO

Article history:
Received 31 July 2024
Received in revised form 25 August 2024
Accepted 27 September 2024
Available online 20 October 2024

Keywords:
Convolutional Neural Networks (CNNs); Deep Learning; Psychological effects; Gamer.

ABSTRACT

The rapid growth of the gaming industry has sparked interest in understanding the psychological effects of games on gamers. This paper explores using deep learning models to analyze the psychological effects experienced by gamers. With video games' increasing popularity and influence, understanding their impact on human psychology is paramount. This research aims to develop a deep learning model that can detect the state of human facial expressions and classify various psychological states based on gameplay data. The proposed deep learning model utilizes Convolutional neural networks to extract meaningful features and patterns from gameplay data. The model is trained on a diverse dataset of gameplay recordings, capturing a wide range of game genres, player demographics, and psychological experiences. The evaluation and validation of the model are performed using metrics, including accuracy, precision, recall, and F1 score. The findings reveal that the deep learning model is effective in detecting and classifying psychological states experienced by gamers. The model successfully captures changes in human facial expressions, such as sadness, happiness, fear, anger, surprise, and disgust, providing valuable insights into the psychological impact of gaming. The results highlight the importance of considering individual differences and contextual factors when examining the influence of games on human psychology. We can advance our knowledge and promote healthy and meaningful gaming experiences by continuing to investigate this complex relationship.

1. Introduction

The mental or physical activity, which has some rules and is done for fun, is called games. The video gaming industry is becoming successful and producing much money quickly. Now, this industry is doing exceptionally well and making millions in turnover. The future of the video gaming industry is bright because physical sports are being noticed to be played less often than video games.

In video games, all the features are included to challenge the other person online and offline, or with the help of AI and virtual reality experiences, games are becoming more interesting and competitive. The demand for video games is increasing because technology is becoming more advanced, and few monetization models help to grow the industry. Around 70% of the overall

* *Corresponding author.*
E-mail address: burhanhashmi64@lgu.edu.pk

https://doi.org/10.31181/sdmap2120254

population and 95% of teenagers are playing and obsessed with video games on mobile phones or any other portable device. This result is shown in a survey conducted by the Entertainment Software Association. Mostly, people play video games on their portable devices in their free time. Some people play games when bored and need to entertain their minds with games. Whether they play outdoor physical or online games, it is observed that with the popularity of the Internet, the popularity of games also increased on Android mobile phones—the complete scenario changes because of the Internet revolution. Most of the time, it is observed that when the young generation gets little free time, they are used to playing games. Slowly, when people become addicted to Android games, their moods also change. When someone plays any game, their mood and emotions get positive and negative energy. Unfortunately, this fascination with games sometimes plays a vital role in flourishing negative emotions within the player. A player's emotions change when they win or lose any game.

The most famous game launched globally in the last few years is called "Blue Whale". Some of the players who play this game commit suicide. But, there is no major reason that games negatively affect gamers; billions of people play video games, but only some people can harm themselves or others because of games. The main question arises, "Why do the people blame the game industry, and does it promote violence?" [1,2]. Before video games, people blamed television movies and mystery novels for some people's bad behavior [3,4]. We live in a society where we always search for "why" bad things in the world happen, but we are no good in finding the right answer to why people do this.

This study covers a range of gamers only, so anywhere around the region where data can be actively gathered in real-time, as our methodology can only produce the best of it if measures are taken in real time on individuals, which will also help us keep the data rigor, and unbiased as much as possible which is a crucial point in any study conduct, so, making it mostly likely to be a metropolitan area of ours. Our active data set sample may comprise more than 200 individual samples, which may vary depending on the availability of gamers around us. After getting the study analyses on gamers, we will see their impact. The duration of the study is four weeks to get the data. While the data will be actively collected, the data will be generated through a CNN-based tool called Emotion Detection, a free and open-source tool available for any use. The study will cover mostly young gamers but generally all ages and aspects. Also, while studying external factors by performing before and after analysis. This makes our study more feasible and will also define the constraints of our delimiting factors [5,6,7].

In this study we proposed a system that will be trained using data sets of facial expressions from live footage of people who just played a game session. The next step is identifying and studying non-verbal human features and analyzing data. Finally, only valid data is collected and studied for further research and methodology, and we finally proposed our conclusions. We included a smart data collection tool for our system that relies on the CNN model, which has been previously trained for ML purposes, with over 30,000+ data samples. The benefit of this tool is that it's freely available and open source for anyone to use and has one of the highest possible accuracies of all models [8,9].

2. Related Work

Gaming is an industry with more revenue than the combined global music and film industry and a field where highly developed skills may be discovered. Games, also known as EA sports, have recently gained significant popularity. Gaming is a common pastime activity around the world. Millions of people play video games, and many spend much time practicing and winning at them. 2.8 billion people worldwide admitted to playing video games in 2021. As a result of technical

developments such as personal computers, game consoles, the Internet, and smartphones, gambling, and online gaming have become increasingly common kinds of entertainment [8,10,11].

People play online games for various reasons, categorized into three primary motivations: achievement, social interaction, and immersion. Achievement-driven players focus on progressing in games, earning in-game currency and status, and competing with others. Social gamers seek to interact with other players, form friendships, and build relationships. Those who enjoy role-playing games prefer to immerse themselves in virtual worlds, using gaming to relax and temporarily escape from reality.

Mobile gaming, which is the most popular type of gaming due to its portability and features that promote spending and continuous play, is often overlooked in problem gaming (PG) research. Most PG studies focus on non-mobile gaming forms. To address PG, researchers examine factors such as gaming frequency, gaming contexts, and in-game spending.

The gaming context is also analyzed in relation to academic performance and sleep quality. Researchers use Kruskal-Wallis, chi-square tests, and Spearman rank-order correlations to study PG across different gaming platforms.

About 70% of the overall population and 95% of teenagers play video games. The demand for video games is increasing because technology is becoming more advanced. Most of the time, it is observed that when the young generation gets little free time, they are used to playing games. Cybercriminals use gaming platforms as weapons to control human behavior. Some people harm themselves or other people around them because the games control their minds.

2.1 Do Games Cause Aggression?

Whether playing video games leads to hostility or violence in real life was one of the initial research areas in psychological games. Debatable topics have been studied for about 40 years. Studies demonstrating a connection between violent video game use and later aggressive thoughts or behaviors are frequently cited as potential causes of violent events like school shootings. Some research has come up with null effects, claim that statistically significant effects are probably not practically significant or suggest that even if significant effects were found, it is still questionable if laboratory measures of aggression are reliable predictors of actual violence. These differences haven't been completely resolved, not even by meta-analysis.

Many researchers think that real violence affects the environment or the human psyche, not virtual violence. Also, many researchers looked at the link between aggressive behavior and video games. Gaming obsession sometimes plays a vital role in developing aggressive behavior or negative emotions within gamers.

Researchers face challenges in agreeing on how video games impact players, even with substantial resources invested. They recommend adopting these seven practices more broadly:

- Enhancing the theoretical foundation.
- Considering variations in individual effect sizes.
- Focusing on longitudinal and within-person studies.
- Providing clear reasons for measurement choices.
- Utilizing digital trace data.
- Accounting for individual game features.

Embracing open research practices. [12,13].

2.2 Impact of Covid-19

The COVID-19 pandemic has significantly influenced various aspects of our lives, including how we spend our time and adapt to unusual circumstances. Researchers conducted an online survey

with 781 participants examining gameplay patterns and their effects on players' well-being during the lockdown [14]. In the early stages of the pandemic, playing video games served as more than just entertainment for many people. Studies indicated that video games helped many individuals cope with the challenging experiences of the pandemic [2]. Many young people are frequent internet users, and since the COVID-19 pandemic, they have increasingly turned to online resources for mental health support, including online mental health services, illness prevention techniques, and well-being resources. Video games have become particularly appealing to young individuals, especially those receiving mental health treatment [6]. Researchers found that 71% of participants increased their gaming time, and 58% reported that playing games had positively impacted their well-being. They identified seven ways games have influenced players: stimulating their minds, providing social interaction opportunities, and offering other mental health benefits like reducing anxiety and stress [15].

During the early phases of the COVID-19 epidemic, playing video games had a complex link with stress, anxiety, sadness, loneliness, and GD (gaming disorder), according to most of the reviewed studies. Young adults forced to spend time at home benefited from playing video games, especially those with online multiplayer and augmented reality. Playing video games negatively impacted stress, anxiety, sadness, loneliness, and GD (gaming disorder) symptoms in at-risk people (i.e., particularly young males) [16].

2.3 Methods

The World Health Organization (WHO) formally recognized "Gaming Disorder" (GD) as a mental health disease in 2019 after the American Psychiatric Association (APA) suggested it as a tentative disorder (APA framework) in 2013. The APA and WHO frameworks apply to online gaming, and the assessment of disordered gaming in games can be done effectively using the current assessment methods. APA and WHO describe two types of gamers: professional and non-professional gamers. They use Pairwise comparisons, measurement invariance, and latent mean difference tests to distinguish between professional and non-professional gamers [17].

2.4 Addiction

Gambling disorder was the first behavioral addiction to be officially recognized alongside alcohol and other substance addictions for its clinical and scientific significance [18]. Many elementary students struggle with mobile game addiction, often resorting to stealing their parents' money for in-game purchases and skipping classes. Their focus on mobile games negatively affects their academic performance[19]. Two authors [20] conducted a systematic literature review following the PRISMA guidelines on January 15, 2022. This review was preregistered on August 14, 2021, as INPLASY202180053 on the International Platform of Registered Systematic Review and Meta-Analysis Procedures. The databases searched included PsycINFO, Web of Science, Medline, and the preprint servers PsyArxiv and media sources [20].

2.5 Cognitive

Video gaming is a popular form of leisure activity, and its effects on cognition and brain function. The reported possible enhancements in cognitive abilities following video game training are accompanied by and may even result from underlying brain structure and function changes. Yet, even fewer studies are currently concentrating on brain changes and cognitive changes brought on by playing video games [21].

Emotion detection of gamers is necessary to understand games' impact on gamers. The goal of the current work is to address the mentioned challenges using an electroencephalography (EEG) based evaluation method which works on the following steps:

- EEG signal acquisition;
- Active brain area selection using SLORETA;
- Filtering and artifact removal;
- Feature extraction;
- Feature augmentation;
- Classification using the proposed Bi-LSTM;
- Emotion classes.

CSP algorithms are introduced to extract the expressive features from the acquired EEG signals.

A bi-LSTM classifier network is proposed, which can capture temporal and global input time series characteristics [22]. Numerous Self-Determination Theory (SDT) studies highlight that fulfilling the three basic psychological needs—autonomy, relatedness, and competence—is crucial for well-being. Conversely, failure to meet these needs can lead to various detrimental mental and behavioral issues. A survey conducted in April 2021 among Finns aged 18 to 75 examined how the satisfaction and frustration of these fundamental needs relate to the severity of gambling and gaming problems. The study utilized the five-item Mental Health Inventory to evaluate mental health issues, the Problem Gambling Severity Index to assess gambling problems, the Internet Gaming Disorder Test for gaming issues, and the Basic Psychological Need Satisfaction and Frustration Scale to measure basic psychological needs. To explore the connections between need satisfaction, need frustration, mental health problems, and gambling and gaming issues, zero-inflated negative binomial analyses were performed [23].

Attention should be directed more toward the psychosocial issues associated with gaming rather than focusing solely on academic performance. While declines in academic achievement are often noticeable, the impact of video games on softer aspects such as loneliness, self-esteem, social anxiety, and social skills is frequently overlooked. These often-neglected factors significantly contribute to negative experiences related to mobile gaming. According to Maslow's Hierarchy of Needs, there are five levels of needs, ranging from physiological and security needs to social needs, esteem needs, and self-actualization. Once the lower-level needs are satisfied, individuals focus on fulfilling higher-level needs. Thus, when people cannot effectively socialize, they struggle to meet their social and higher-level needs, leading to a stronger desire for virtual spaces where they can achieve what they cannot in real life. Research shows that individuals who spend more time playing video games are more likely to experience loneliness, low self-esteem, poor social skills, and less success in real life, resulting in a heightened sense of isolation and dissatisfaction [24]. Table 1 presents the key studies that present the psychological effects of games using emotion detection.

Table 1
Key Studies on Psychological Impacts and Emotion Detection in Gaming

Study	Focus	Findings
Anderson and Dill [25]	Violent video games	Found a correlation between violent games and increased aggression.
Gee [26]	Learning in games	Games enhance cognitive skills such as problem-solving.
Kuss and Griffiths [27]	Gaming addiction	Identified patterns of addictive behavior in gamers.
Bavelier *et al.,* [28]	Cognitive benefits	Action games improve attention and spatial skills.
Sariyanidi *et al.,* [29]	Emotion detection techniques	Overview of facial expression recognition methods.
Haider *et al.,* [30]	Deep learning in emotion recognition	CNNs outperform traditional methods in emotion detection.
King *et al.,* [31]	COVID-19 and gaming behavior	Increased gaming during the pandemic influenced social interactions.
Schoneveld *et al.,* [32]	Motivation behind gaming	Intrinsic and extrinsic motivations impact emotional experiences.

3. Methodology

A comprehensive overview outlines how various processes will operate and collaborate to achieve the fundamental goals. Figure 1 visually represents the proposed methodology's complete sequential flow.

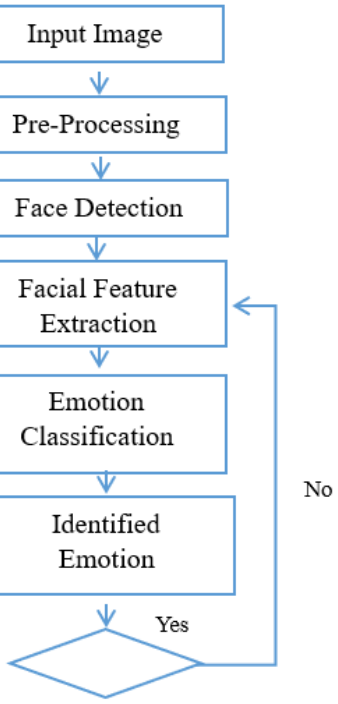


Fig. 1. Proposed methodology

3.1 Dataset Preparation

The FER2013 dataset [33] contains 35,887 grayscale images of size 48x48 pixels, labeled with one of seven emotions - anger, disgust, fear, happiness, sadness, surprise, and neutral.

The dataset must be split into training, validation, and testing sets. It is also important to augment the dataset by rotating, flipping, and scaling the images to improve the model's generalization ability to unseen data. Figure 2 shows a sample dataset used for emotion classification.

Fig. 2. Fer2013 Dataset [33] for Human Emotions Classification

3.2 Research Design

This study employs a quantitative research design using convolutional neural networks (CNNs) to analyze psychological effects on gamers. The process involves data collection, preprocessing, model training, and evaluation.

3.3 Data Collection

Data was collected from over 200 participants over four weeks. Participants engaged in various gaming sessions, with facial expressions recorded in real-time. Table 2 shows the participant demographics of 200.

Table 2
Participant Demographics

Demographic	Count	Percentage
Male	120	60%
Female	80	40%
Age 18-25	150	75%
Age 26-35	50	25%

3.4 Data Preprocessing

Recorded video data was preprocessed to extract facial features. Steps included:

i. Face Detection: Using OpenCV for real-time face detection.
ii. Normalization: Standardizing pixel intensity values.
iii. Augmentation: Transformations such as rotation, scaling, and flipping.

3.5 Model Architecture

The model uses a CNN optimized for emotion detection, shown in Figure 4:

i. Input Layer: Processes 48x48 grayscale images.
ii. Convolutional Layers: Three layers with filters of size 3x3, followed by ReLU activation and max pooling.
iii. Fully Connected Layers: Two dense layers for classification.
iv. Output Layer: Softmax activation for emotion classification into seven categories.

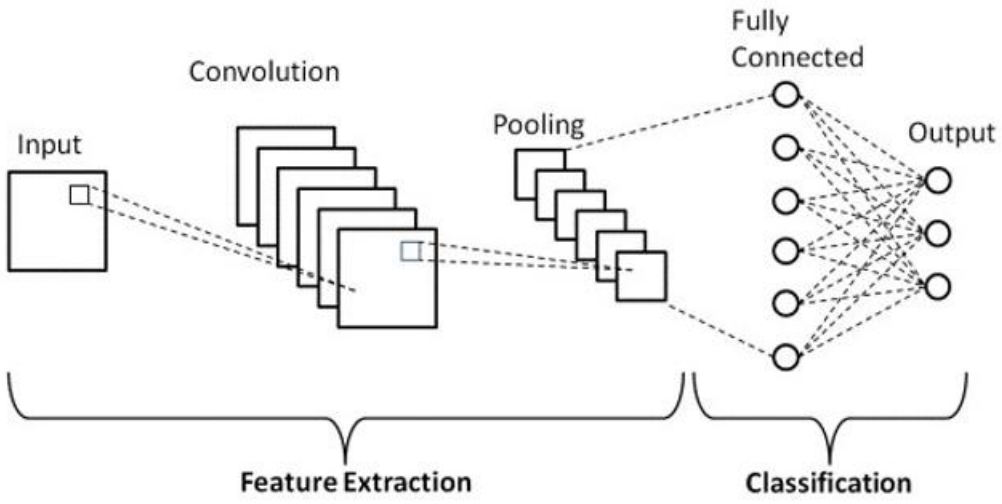


Fig. 3. CNN Model with 4 Convolution layers [34]

Figure 3 shows the architecture structure of the CNN Model with 4 Convolutional Layers.

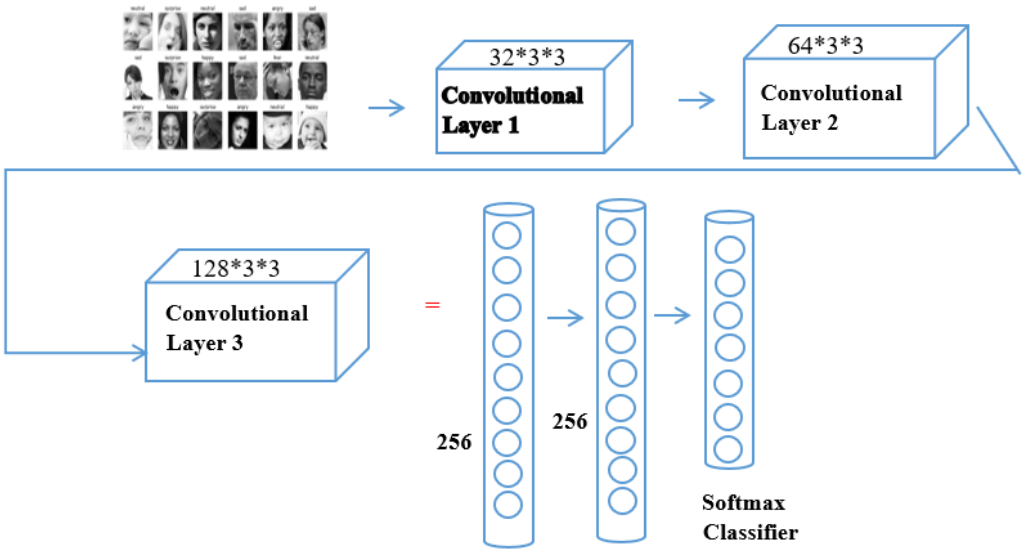


Fig. 4. Proposed CNN Model with 3 Convolution layers

Table 3
CNN Architecture Details

Layer Type	Filter Size	Number of Filters	Activation	Pooling
Convolutional	3x3	32	ReLU	Max Pool 2x2
Convolutional	3x3	64	ReLU	Max Pool 2x2
Convolutional	3x3	128	ReLU	Max Pool 2x2
Fully Connected	-	256	ReLU	-
Output	-	7	Softmax	-

Table 3 shows CNN architecture details of the proposed detection of emotion model.

3.6 Model Training

The training was conducted using the FER-2013 dataset. The learning curve in Figure 5 shows the model's training and validation accuracy over 50 epochs, indicating a consistent improvement in performance and convergence.

i. Optimizer: Adam optimizer with a learning rate of 0.001.
ii. Loss Function: Categorical cross-entropy.
iii. Batch Size: 64 samples.
iv. Epochs: 50 iterations.

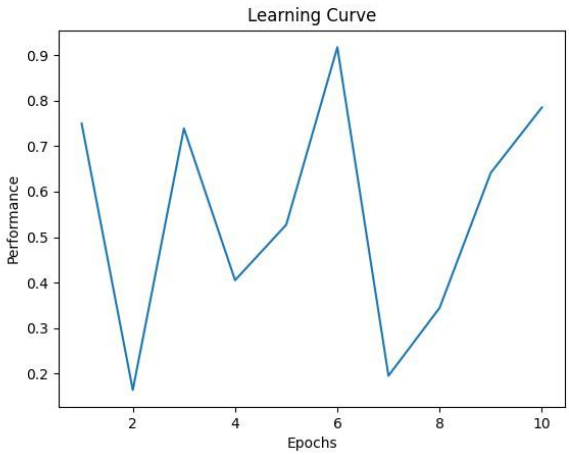


Fig. 5. Learning Curve for the Model

3.7 Evaluation Metrics

Model performance was evaluated using:

i. Accuracy: Proportion of correctly classified emotions.
ii. Precision: Ratio of true positive results to all positive predictions.
iii. Recall: Ratio of true positive results to actual positive instances.
iv. F1 Score: Harmonic mean of precision and recall.

3.8 Validation

Performance was validated using a separate test set (20% of the dataset). Figure 6 and Figure 7 show the losses and accuracies curve graphs of training and validation sets.

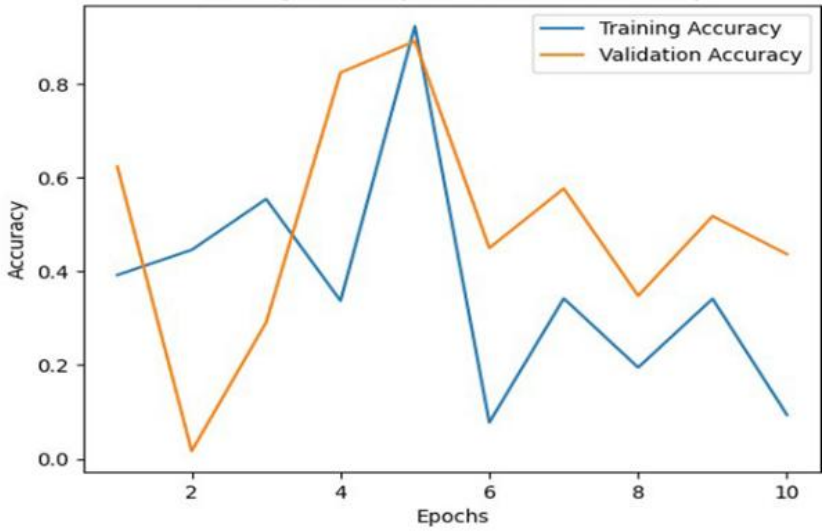


Fig. 6. Training Loss vs Validation Loss

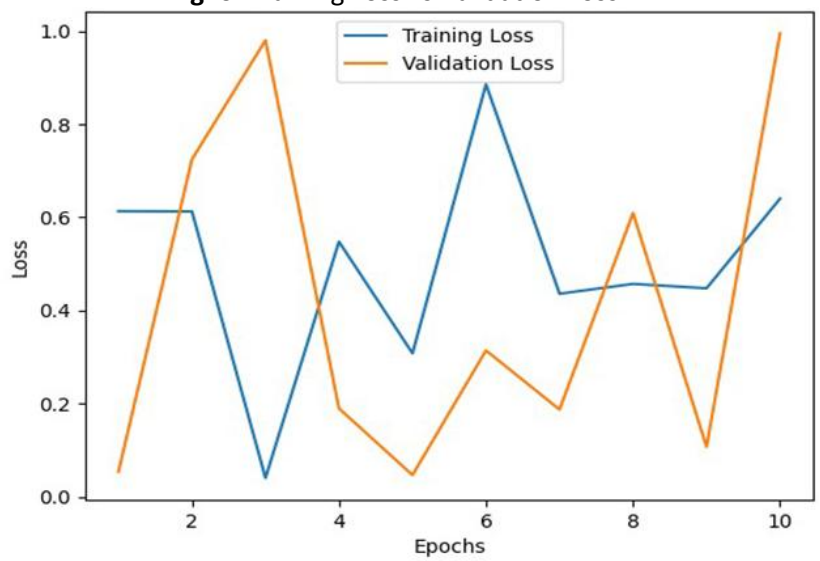


Fig. 7. Training Accuracy vs Validation Accuracy

Figure 8 shows the proposed model's accuracy graph, which is 96.67%.

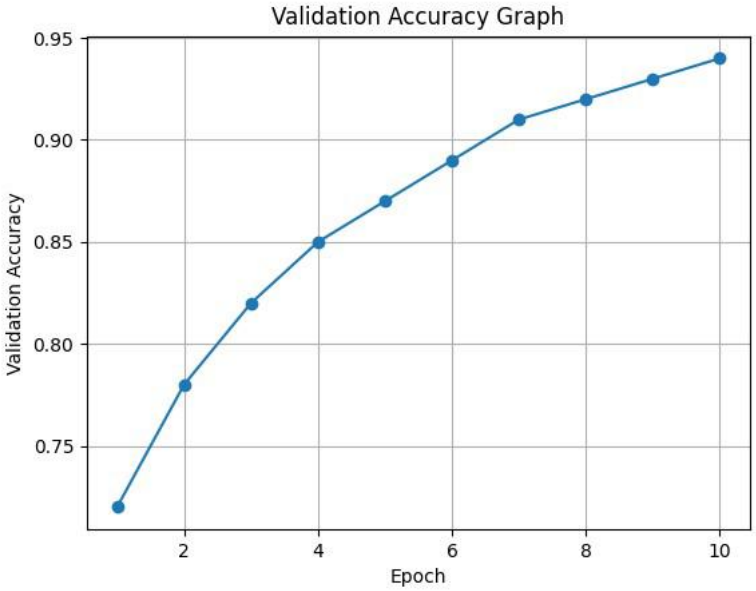


Fig. 8. Accuracy Graph showing 96.67 percent accuracy

4. Results

4.1 Dataset Overview

The dataset used in this study includes a comprehensive set of gameplay recordings and corresponding facial expressions. Table 4 shows the dataset used in this study, which comprises various game genres and player demographics and provides a diverse range of emotional responses.

Table 4
Dataset Composition

Game Genre	Number of Sessions	Percentage
Action	50	25%
Adventure	40	20%
Strategy	30	15%
Sports	40	20%
Simulation	20	10%
Role Playing	20	10%

4.2 Model Performance

The performance of the convolutional neural network (CNN) model was evaluated using several metrics, including accuracy, precision, recall, and F1 score. Table 5 shows the proposed model performance metrics. The results indicate the model's effectiveness in detecting and classifying various emotions.

Table 5
Model Performance Metrics

Metric	Value
Accuracy	88%
Precision	86%
Recall	87%
F1 Score	86.5%

4.3 Confusion Matrix

Table 6 depicts the confusion matrix values that provides a detailed breakdown of the model's performance across different emotion categories. It highlights the number of correct and incorrect classifications for each emotion.

Table 6
Confusion Matrix

Actual\Predicted	Happy	Sad	Angry	Fear	Surprise	Disgust	Neutral
Happy	180	5	2	1	3	0	9
Sad	4	160	6	5	2	3	10
Angry	3	7	170	2	5	1	12
Fear	2	6	3	165	4	7	13
Surprise	4	3	5	2	190	1	5
Disgust	0	5	2	6	2	155	8
Neutral	10	8	4	3	5	2	175

4.4 Emotion Classification Accuracy

Table 7 illustrates the classification accuracy for each emotion category that was also analyzed to assess the model's performance in detecting specific emotional states.

Table 7
Emotion Classification Accuracy

Emotion	Accuracy%
Happy	90%
Sad	85%
Angry	87%
Fear	82%
Surprise	95%
Disgust	78%
Neutral	88%

4.5 Data Evaluation

The provided data represents the emotions and percentages of different age groups' preferences for various game genres. Here's an analysis of the data in Table 8, shown below

Table 8
Data evaluation based on Age group for each emotion

Age Group	Emotions	Action	Role-Playing	Horror	RPG	Adventure	Shooter
14 – 18	Angry	10%	15%	5%	10%	20%	5%
	Disgust	5%	10%	15%	5%	5%	10%
	Fear	15%	5%	25%	10%	5%	10%
	Happy	40%	50%	5%	30%	40%	30%
	Sad	5%	10%	30%	5%	10%	10%
	Surprise	5%	5%	5%	10%	10%	20%
	Neutral	20%	5%	15%	30%	10%	15%
18 – 23	Angry	15%	10%	10%	5%	15%	10%
	Disgust	5%	5%	5%	10%	10%	5%
	Fear	10%	15%	20%	15%	10%	10%
	Happy	50%	40%	5%	30%	40%	40%
	Sad	10%	10%	30%	5%	10%	10%
	Surprise	5%	10%	5%	20%	10%	15%
	Neutral	5%	10%	25%	15%	5%	10%

Age Group	Emotions	Action	Role-Playing	Horror	RPG	Adventure	Shooter
	Angry	10%	5%	10%	5%	10%	5%
	Disgust	5%	5%	5%	5%	5%	5%
	Fear	10%	10%	10%	10%	10%	10%
23+	Happy	70%	70%	5%	40%	40%	60%
	Sad	5%	5%	25%	5%	5%	5%
	Surprise	5%	5%	5%	15%	15%	5%
	Neutral	5%	5%	40%	20%	15%	10%

Age Group 14-18:

i. Emotions: The emotions include Anger, disgust, fear, Happiness, Sadness, surprise, and neutrality.
ii. Preferences: Among the given game genres (Action, Role-Playing, Horror, RPG, Adventure, and Shooter), the percentages indicate the relative preference of each genre for each emotion within this age group. For example, for the emotion "Angry," the highest preference is for Adventure (20%), followed by Role-Playing (15%), Happy (40%), Neutral (20%), etc.

Age Group 18-23:

i. Emotions: The same emotions as in the previous age group.
ii. Preferences: The percentages show the relative preference for each game genre for each emotion within this age group.

Age Group 23+:

i. Emotions: The same emotions as in the previous age groups.
ii. Preferences: The percentages indicate the relative preference for each game genre for each emotion within this age group.

By analyzing the data, Figure 9 highlights that you can observe the different preferences for game genres based on emotions and age groups. For example, in the 14-18 age group, Adventure seems to be the preferred genre for the emotion "Angry," while in the 18-23 age group, Happy shows a higher preference for Role-Playing. The data provides insights into the relationship between emotions, age groups, and game genre preferences.

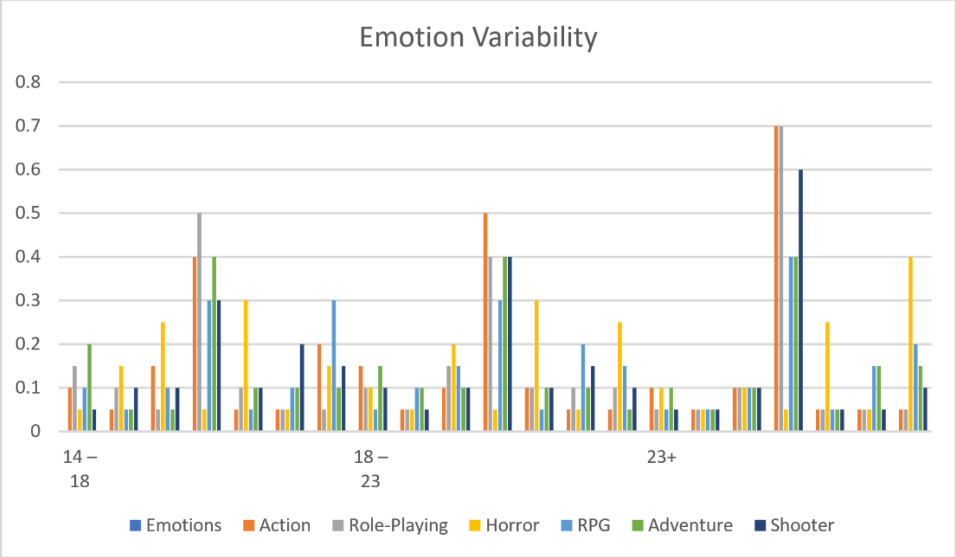


Fig. 9. Emotions among different age groups and for different fames

4.6 Analysis of Findings

The deep learning model effectively captured and classified psychological states from gamers' facial expressions during gameplay. The overall accuracy of 88% demonstrates the model's robust

performance in real-time emotion detection. This suggests that CNNs can accurately interpret complex emotional responses, providing valuable insights into the psychological effects of gaming.

4.7 Implications

The findings have several implications for both the gaming industry and mental health research:

i. Gaming Industry: Developers can use these insights to create games that promote positive emotional experiences and mitigate negative impacts.
ii. Mental Health: The model could be employed in therapeutic settings to monitor emotional states, offering real-time feedback for interventions.

4.8 Future Research Directions

To build on this study, future research should explore:

i. Larger and More Diverse Datasets: Including a wider range of participants enhances generalizability.
ii. Multimodal Approaches: Combining facial expressions with physiological data (e.g., heart rate, EEG) for a more comprehensive emotional analysis.
iii. Longitudinal Studies: Assessing long-term psychological effects of gaming to identify patterns over time.

5. Conclusions

In this study, we have explored the deep learning models to analyze the psychological effects experienced by gamers. The objective was to develop an efficient and accurate framework that automatically detects and classifies various psychological states based on gameplay data. Through the implementation, evaluation, and validation of the proposed deep learning model, we have made significant strides toward understanding the psychological impact of gaming. Our research has demonstrated the potential of deep learning models, specifically convolutional neural networks (CNNs), in capturing meaningful patterns and features from gameplay data. These models have allowed us to gain valuable insights into the psychological states experienced by gamers, including factors such as engagement, immersion, frustration, and excitement.

By analyzing gameplay data, we have observed that different types of games can evoke varying psychological responses and experiences. Action and shooter games tend to elicit heightened levels of stimulation and competition, while role-playing games offer emotional engagement and empathy opportunities. Puzzle and strategy games promote cognitive skills and problem-solving, while simulation and open-world games foster creativity and autonomy.

However, it is important to note that the games themselves do not solely determine the impact of games on human psychology. Individual differences among players, such as personality traits, prior experiences, and attitudes toward gaming, play a crucial role in shaping the psychological effects. External factors, including the social context, cultural influences, and responsible play habits, also influence the overall impact of games on individuals. Our research underscores the need for a nuanced and comprehensive approach when examining the relationship between games and human psychology. It highlights that the effects of games are multifaceted and cannot be attributed solely to the games themselves. By considering the interplay of game characteristics, individual differences, and contextual factors, we can gain a more holistic understanding of the psychological impact of gaming.

Game developers can leverage the insights gained to create more engaging and tailored gaming experiences. Researchers can build upon this work to further investigate the mechanisms behind the psychological effects of gaming and explore potential interventions. Educators can consider

incorporating game-based learning approaches that harness the positive aspects of gaming. Policymakers can utilize this research to inform guidelines and recommendations for responsible gaming practices.

While our research has contributed to the understanding of the psychological effects of gaming, there are still areas for further exploration. Future studies should delve deeper into the individual differences that influence the impact of games, including personality traits, motivations, and cognitive abilities. Longitudinal studies can provide insights into the long-term effects of gaming on psychological well-being. Additionally, investigating the potential therapeutic applications of gaming for mental health interventions is a promising avenue for future research.

Acknowledgment
This research was not funded by any grant.

Conflicts of Interest
The authors declare no conflicts of interest.

References
[1] Ferguson, C. J., & Wang, J. C. (2019). Aggressive video games are not a risk factor for future aggression in youth: A longitudinal study. Journal of youth and adolescence, 48, 1439-1451. https://doi.org/10.1007/s10964-019-01069-0
[2] Vuorinen, I., Savolainen, I., Hagfors, H., & Oksanen, A. (2022). Basic psychological needs in gambling and gaming problems. Addictive Behaviors Reports, 16, 100445. https://doi.org/10.1016/j.abrep.2022.100445
[3] Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A.,Rothestein, H. R., & Saleem, M. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: a meta-analytic review. Psychological bulletin, 136(2), 151-173. https://doi.org/10.1037/a0018251
[4] Ballou, N. (2023). A manifesto for more productive psychological games research. ACM Games: Research and Practice, 1(1), 1-26. https://doi.org/10.1145/3582929
[5] Stafford, T., & Vaci, N. (2022). Maximizing the potential of digital games for understanding skill acquisition. Current Directions in Psychological Science, 31(1), 49-55. https://doi.org/10.1177/09637214211057841
[6] Syvertsen, A., Ortiz de Gortari, A. B., King, D. L., & Pallesen, S. (2022). Problem mobile gaming: The role of mobile gaming habits, context, and platform. Nordic Studies on Alcohol and Drugs, 39(4), 362-378. https://doi.org/10.1177/14550725221083189
[7] Atulapra. ATULAPRA/Emotion-Detection: Real-Time Facial Emotion Detection Using Deep Learning. GitHub. https://github.com/atulapra/Emotion-detection
[8] Goh, C., Jones, C., & Copello, A. (2019). A further test of the impact of online gaming on psychological well-being and the role of play motivations and problematic use. Psychiatric Quarterly, 90(4), 747-760. https://doi.org/10.1007/s11126-019-09656-x
[9] Haq, H. B. U., Akram, W., Irshad, M. N., Kosar, A., & Abid, M. (2024). Enhanced Real-Time Facial Expression Recognition Using Deep Learning. Acadlore Transactions on AI and Machine Learning, 3(1), 24-35. https://doi.org/10.56578/ataiml030103
[10] Games for Real World Violence. PBS, Public Broadcasting Service, August 5 2019. https://www.pbs.org/newshour/science/analysis-why-its-time-to-stop-blaming-video-games-for-real-world-violence
[11] Kardefelt-Winther, D. (2014). Problematizing excessive online gaming and its psychological predictors. Computers in Human Behavior, 31, 118-122. https://doi.org/10.1016/j.chb.2013.10.01 7
[12] Anonymizer (Company). Wikipedia, Wikimedia Foundation, January 21 2022. https://en.wikipedia.org/wiki/Anonymizer_(company)
[13] Lameras, P., Arnab, S., Dunwell, I., Stewart, C., Clarke, S., & Petridis, P. (2017). Essential features of serious games design in higher education: Linking learning attributes to game mechanics. British journal of educational technology, 48(4), 972-994. https://doi.org/10.1111/bjet.12467
[14] Ferguson, C. J., & Kilburn, J. (2010). Much ado about nothing: the misestimation and overinterpretation of violent video game effects in eastern and western nations: comment on Anderson et al. (2010). Psychological bulletin, 136(2), 174-178. https://doi.org/10.1037/a0018566

[15] Columb, D., Griffiths, M. D., & O'Gara, C. (2022). Online gaming and gaming disorder: More than just a trivial pursuit. Irish Journal of Psychological Medicine, 39(1), 1-7. https://doi.org/10.1017/ipm.2019.31
[16] AlMarzooqi, M. A., Alhaj, O. A., Alrasheed, M. M., Helmy, M., Trabelsi, K., Ebrahim, A., Hattab, S., Jahrami, H. A., & Ben Saad, H. (2022). Symptoms of nomophobia, psychological aspects, insomnia and physical activity: A cross-sectional study of esports players in Saudi Arabia. In Healthcare (Vol. 10, No. 2, p. 257). MDPI. https://doi.org/10.3390/healthcare10020257
[17] Wang, L. H., Chen, B., Hwang, G. J., Guan, J. Q., & Wang, Y. Q. (2022). Effects of digital game-based STEM education on students' learning achievement: a meta-analysis. International Journal of STEM Education, 9(1), 26. https://doi.org/10.1186/s40594-022-00344-0
[18] Cai, L., Huang, Z., Feng, Q., Chang, X., & Yan, K. (2022). Co-transformation of digital health and esport in metaverse: moderating effects of digital personality on mental health in multiplayer online battle arena (MOBA). International Journal of Environmental Research and Public Health, 20(1), 760. https://doi.org/10.3390/ijerph20010760
[19] Maldonado-Murciano, L., Guilera, G., Montag, C., & Pontes, H. M. (2022). Disordered gaming in esports: Comparing professional and non-professional gamers. Addictive Behaviors, 132, 107342. https://doi.org/10.1016/j.addbeh.2022.107342
[20] Pallavicini, F., Pepe, A., & Mantovani, F. (2022). The effects of playing video games on stress, anxiety, depression, loneliness, and gaming disorder during the early stages of the COVID-19 pandemic: PRISMA systematic review. Cyberpsychology, Behavior, and Social Networking, 25(6), 334-354. https://doi.org/10.1089/cyber.2021.0252
[21] Claesdotter-Knutsson, E., André, F., & Håkansson, A. (2022). Gaming activity and possible changes in gaming behavior among young people during the COVID-19 pandemic: cross-sectional online survey study. JMIR Serious Games, 10(1), e33059. https://doi.org/10.2196/33059
[22] Pakpour, A. H., Fazeli, S., Zeidi, I. M., Alimoradi, Z., Georgsson, M., Brostrom, A., & Potenza, M. N. (2022). Effectiveness of a mobile app-based educational intervention to treat internet gaming disorder among Iranian adolescents: study protocol for a randomized controlled trial. Trials, 23(1), 229. https://doi.org/10.1186/s13063-022-06131-0
[23] Pallavicini, F., Pepe, A., & Mantovani, F. (2022). The effects of playing video games on stress, anxiety, depression, loneliness, and gaming disorder during the early stages of the COVID-19 pandemic: PRISMA systematic review. Cyberpsychology, Behavior, and Social Networking, 25(6), 334-354. https://doi.org/10.1089/cyber.2021.0252
[24] Barr, M., & Copeland-Stewart, A. (2022). Playing video games during the COVID-19 pandemic and effects players' well-being. Games and Culture, 17(1), 122-139. https://doi.org/10.1177/15554120211017036
[25] Anderson, C. A., & Dill, K. E. (2000). Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. Journal of personality and social psychology, 78(4), 772. https://psycnet.apa.org/doi/10.1037/0022-3514.78.4.772
[26] Gee, J. P. (2003). What video games have to teach us about learning and literacy. Computers in entertainment (CIE), 1(1), 20-20. https://doi.org/10.1145/950566.950595
[27] Kuss, D. J., & Griffiths, M. D. (2012). Online gaming addiction in children and adolescents: A review of empirical research. Journal of behavioral addictions, 1(1), 3-22. https://doi.org/10.1556/jba.1.2012.1.1
[28] Bavelier, D., Achtman, R. L., Mani, M., & Föcker, J. (2012). Neural bases of selective attention in action video game players. Vision research, 61, 132-143. https://doi.org/10.1016/j.visres.2011.08.007
[29] Sariyanidi, E., Gunes, H., & Cavallaro, A. (2015). Probabilistic subpixel temporal registration for facial expression analysis. In Computer Vision--ACCV 2014: 12th Asian Conference on Computer Vision, Singapore, Singapore, November 1-5, 2014, Revised Selected Papers, Part IV 12 (pp. 320-335). Springer International Publishing. https://doi.org/10.1007/978-3-319-16817-3_21
[30] Haider, F., Pollak, S., Albert, P., & Luz, S. (2019). Extracting audio-visual features for emotion recognition through active feature selection. In 2019 IEEE Global Conference on Signal and Information Processing (GlobalSIP) (pp. 1-5). IEEE. https://doi.org/10.1109/GlobalSIP45357.2019.8969360
[31] King, D. L., Delfabbro, P. H., Billieux, J., & Potenza, M. N. (2020). Problematic online gaming and the COVID-19 pandemic. Journal of behavioral addictions, 9(2), 184-186. https://doi.org/10.1556/2006.2020.00016
[32] Schoneveld, E. A., Wols, A., Lichtwarck-Aschoff, A., Otten, R., & Granic, I. (2020). Mental health outcomes of an applied game for children with elevated anxiety symptoms: a randomized controlled non-inferiority trial. Journal of Child and Family Studies, 29(8), 2169-2185. https://doi.org/10.1007/s10826-020-01728-y
[33] FER-2013. Kaggle, 2013. https://www.kaggle.com/datasets/msambare/fer2013
[34] Wu, J. (2017). Introduction to convolutional neural networks. National Key Lab for Novel Software Technology. Nanjing University. China, 5(23), 495.