ASEC 2025 Conference

The 6th International Electronic Conference on Applied Sciences

09–11 December 2025 | Online

MDPI

Neural Network-Based Emotion Recognition for Student Assessment and Test Readiness

Edward Junior[1], Daniel Guzmán[1], Miguel Postigo[1], Israel Torné[1]

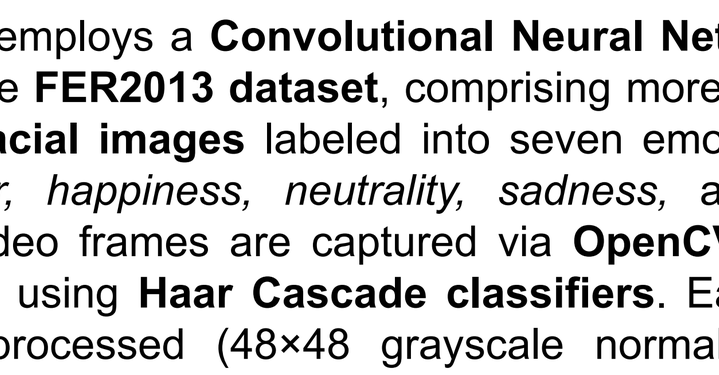
1 PPGEEL- Postgraduate Program in Electrical Engineering, School of Technology, State University of Amazonas (UEA), Manaus 69050-020, Brazil

INTRODUCTION & AIM

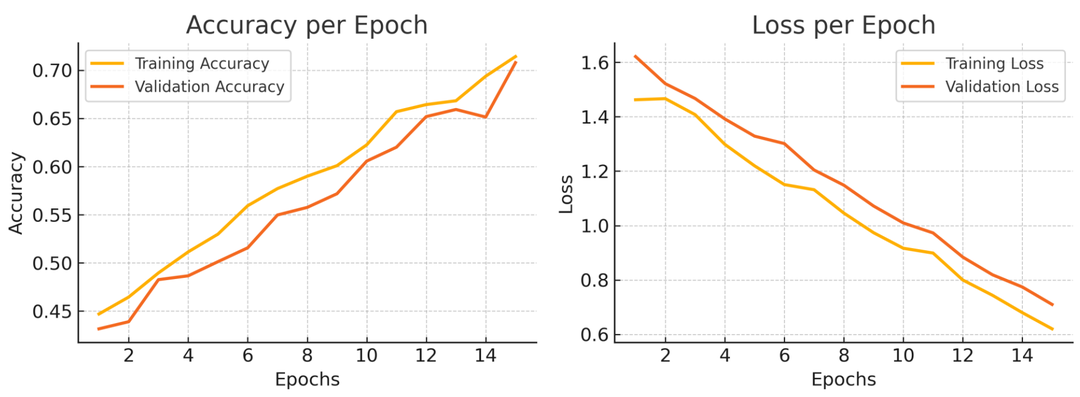
Artificial Intelligence (AI) has emerged as a valuable tool in education, enabling the analysis of behavioral and emotional aspects that influence learning. This work presents an educational support system based on **Convolutional Neural Networks (CNNs)** for **facial emotion recognition** applied to student assessment. The system aims to evaluate **test readiness** by detecting emotional cues related to **concentration** and **nervousness**, which play a critical role in academic performance. Inspired by studies in **affective computing** and **educational psychology**, this approach integrates emotional awareness into the learning process. The main objective is to provide teachers with objective indicators to better understand students' affective states during assessments, supporting more inclusive and humanized evaluation practices.

METHOD

The system employs a **Convolutional Neural Network (CNN)** trained on the **FER2013 dataset**, comprising more than **25,000 grayscale facial images** labeled into seven emotions: *anger, disgust, fear, happiness, neutrality, sadness,* and *surprise.* Real-time video frames are captured via **OpenCV**, and faces are detected using **Haar Cascade classifiers**. Each detected face is preprocessed (48×48 grayscale normalization) and passed through the CNN for emotion prediction. A **weighted mapping** converts the predicted emotion into two quantitative indicators: **concentration** and **nervousness**, both scaled from 0–100. Emotions like *neutral* and *happy* increase concentration, while *fear* and *anger* elevate nervousness. The results are displayed dynamically on-screen with updated values per frame, allowing continuous behavioral observation. This configuration enables a **non-invasive and interpretable analysis** of emotional states during cognitive or evaluative activities.



CNN Model Training Performance on FER2013

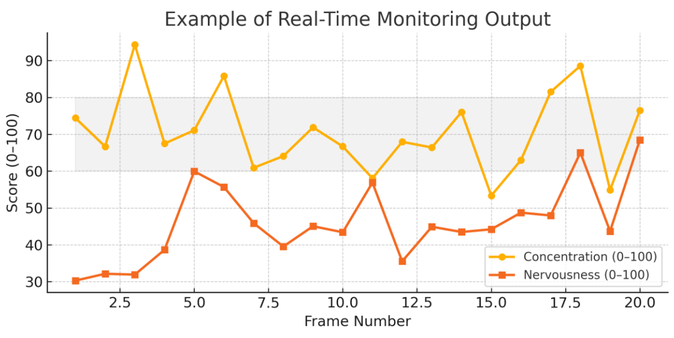


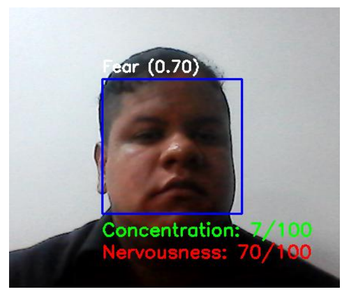
RESULTS & DISCUSSION

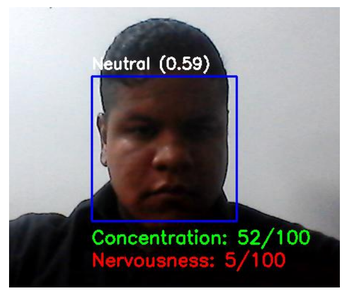
The CNN achieved approximately **70% accuracy** on the FER2013 validation set, demonstrating stable facial emotion recognition across varied conditions. Real-time inference at **15–20 FPS** enabled continuous analysis of students' emotional states before exams. The **weighted scoring model** successfully converted detected emotions into interpretable **concentration** and **nervousness** levels (0–100). Students showing *neutral* or *happy* expressions reached higher concentration averages (**>50/100**), while *fear* and *anger* led to increased nervousness (**>60/100**). These outcomes are consistent with **psychological and educational studies** linking anxiety to reduced focus and performance. The visualization module provided dynamic feedback, helping to track emotional stability over time. Overall, the system proved to be a **non-invasive and efficient tool** for identifying stress patterns and supporting educators in creating more adaptive and empathetic assessment environments.

Weighted Mapping of Emotions to Concentration and Nervousness

Emotion	Concentration Weight	Nervousness Weight
Anger	0.2	0.9
Disgust	0.3	0.7
Fear	0.1	1.0
Happiness	0.6	0.3
Neutral	0.9	0.1
Sadness	0.8	0.2
Surprise	0.5	0.6







CONCLUSION

This research demonstrates that **neural networks** can effectively assess students' emotional readiness by integrating **concentration** and **nervousness** indicators derived from facial expressions. The system provides teachers with actionable insights to support learners who experience test anxiety or attention deficits. By combining objective AI-driven analysis with educational psychology principles, the framework encourages fairer and more empathetic evaluation practices. The results confirm the feasibility of using **emotion recognition** as a complementary tool for adaptive learning and assessment environments, highlighting the potential of AI to enhance both academic outcomes and emotional well-being.

REFERENCES

Goodfellow et al., *Deep Learning*, MIT Press, 2016.
Ekman & Friesen, *Facial Action Coding System*, 1978.
Picard, R., *Affective Computing*, MIT Press, 1997.
Kaggle, *FER2013 Dataset*, 2013.