

## ABSTRACT

Identity manipulation using facial images, such as spoofing attacks based on printed photos or digital screen displays, remained a challenge in face-based biometric authentication systems because many implementations performed face verification without incorporating reliable face liveness detection mechanisms. This study proposed a deep learning-based facial authentication approach that integrated liveness detection and face verification within a layered inference pipeline. The liveness detection module employed the YOLOv8 architecture to classify three facial conditions, namely live face, spoof print, and spoof screen, while three YOLOv8 variants (Nano, Small, and Medium) were compared to analyze the trade-off between detection accuracy and computational efficiency. Experimental results showed that YOLOv8-Nano achieved the best performance with an mAP50 of 0,990 and an mAP50-95 of 0,799 while maintaining lower inference latency compared to the other variants. The face verification stage used a face embedding approach with the ArcFace model and was evaluated comparatively against FaceNet512 and VGG-Face using an all-to-all comparison scheme. The evaluation results indicated that ArcFace achieved the best performance with a Balanced Accuracy of 93,06%, an Equal Error Rate (EER) of 9,11%, and an ROC-AUC of 0,9527 on a dataset containing 16 subjects. The integration of these modules formed a facial authentication pipeline capable of filtering presentation attacks before the face verification process was executed. The system implementation on a serverless architecture using Google Cloud Run produced an average warm-start latency of approximately  $\pm 1,55$  seconds with high stability (P95 of 1,61 seconds), while the initial cold-start latency reached 34,72 seconds and was mitigated through a scheduled warm-up mechanism. Overall, the integration of YOLOv8-Nano and ArcFace improved the security of facial authentication against spoofing attacks while maintaining efficient inference performance in a web-based biometric attendance system.

**Keywords** : E-Attendance, Deep Learning, Liveness Detection, YOLOv8-Nano, ArcFace, Biometrics.