


# Chapter 7


## Performance Comparison of Python Libraries in Face Recognition Systems

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### ABSTRACT

*This research aims to analyze the applicability and performance of face recognition technologies using different Python-based libraries. Face recognition and comparison tests were performed using the face\_recognition, OpenCV and DeepFace libraries, respectively. First, basic face detection application was successfully implemented with the face\_recognition library. Then, face recognition was performed using traditional methods using OpenCV. But limited accuracy results were obtained. Finally, deep learning-based face recognition was performed with the DeepFace library, high accuracy rates were achieved, but high processing power was required. All three methods were systematically compared in terms of hardware requirements, ease of use, processing time and accuracy rates. The findings revealed that each library has advantages and limitations for certain application scenarios. In this context, it was emphasized that the selection of the appropriate algorithm for the needs in the design of face recognition systems is critical.*

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## INTRODUCTION

In recent years, the rapid developments in artificial intelligence and machine learning technologies have made a strong impact in the field of facial recognition (Kutlugün, 2023; Tuna, 2022). Facial recognition technologies have a wide range of applications in human identification and verification processes; therefore, they are actively used in many sectors such as security, health, and education (İlkbahar, Ünal, & Karakaya, 2021; Qasim, 2023).

Facial recognition systems are based on extracting certain features from human face images, algorithmically modeling these features, and then performing the authentication or recognition process (Alimovski, 2019; Bozik, 2019). Research in this area has mostly focused on deep learning-based methods, especially convolutional neural networks (CNNs). Deep learning-based algorithms and machine learning techniques are widely used in facial recognition (Gündüz & Cedimoğlu, 2019; Tuna, 2022). Python is widely used in face recognition systems thanks to its powerful libraries such as Open Source Computer Vision Library (OpenCV), Dlib, and Sci-kit, but the performance of each library may vary in different application areas (Boyko, Basystiuk, & Shakhovska, 2018; Aliyu, Bomoi, & Maishanu, 2022).

While various libraries and software are used in the development of face recognition systems, libraries developed in the Python language have become particularly popular among researchers due to their ease of use, wide community support, and open source features (Tombak, 2019; Kaplan & Rahman, 2024). In Python-based face recognition systems, OpenCV, Dlib, TensorFlow, and Sci-kit Learn are mostly preferred. Therefore, it is important to comparatively examine the performance differences between these libraries (Hasan & Sallow, 2021; Wang, Zhang, Xiong, & Zhao, 2021; Patil et al., 2023).

The aim of this research is to comparatively analyze the real-time performance of Python-based face recognition libraries. In addition, the effects of GPU and CPU hardware on the performance of these libraries are evaluated. Because, with the increase in real-time face recognition applications, it has become important to examine the factors affecting the performance of such systems (Kutlugün, 2023; Tuna, 2022). As a significant portion of the studies in the literature have focused on specific algorithms or hardware platforms, the comprehensive and applied comparison of Python-based libraries with each other is a relatively less studied area.

This study has the potential of providing a comprehensive assessment by bringing together previously separately studied areas in the literature (Bozik, 2019), ways to improve the performance of algorithms with data augmentation methods (Alimovski, 2019), and comparison of image processing techniques. In addition, it could provide a broad perspective on the literature by considering the potential of

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