



Using Deep Learning and Deepfake Techniques in Tourism (Interactive Statues Application)



Essam El-din Sharif, Abdallah Ramadan, Hassan Walid, Amr Mahmoud, Omar Hany, Mohammad Essam, Zeina Rayan, Ayat Mohammed
Computer Science Department, Faculty of Computer & Information Sciences, Ain Shams University

ABSTRACT

The preservation and promotion of ancient civilizations have always been of great importance in the field of cultural heritage. When searching in this field, the main problem is the difficulty of providing a tour guide for each visitor at a historical site who wants information about a specific statue. It is not feasible to have a personal tour guide for every individual, especially considering the cost implications. Therefore, is proposed to use deepfake technology to address this problem by creating fake videos of statues talking about themselves. This approach aims to provide an alternative and easy-to-access way for tourists to obtain information about specific statues without the need for a physical tour guide. The use of deepfake technology, which is typically associated with entertainment purposes, is repurposed to serve as a useful tool and virtual tour guide for visitors. The application aims to provide an interactive and immersive experience for tourists, researchers, and students interested in ancient Egyptian civilization.

INTRODUCTION

This research aims to address the challenges faced by tourists visiting ancient Egyptian sites, including limited tour guide numbers and high costs. With an increasing number of visitors to Egypt in 2022 reaching 12 million. To overcome these challenges, the proposal involves creating a user-friendly mobile application utilizing deep learning techniques. The application will provide comprehensive information about kings and queens, replacing manual guidance with an automated system.[1]

- The primary objective of this research is to develop an efficient tour-guide application for tourists and students and citizens.
- The application will utilize mobile camera technology to detect and recognize statues.
- Once a statue is recognized, the application will generate a faked video where the statue speaks about itself.
- Provide users with detailed information about its history and origins.
- The application aims to serve as a substitute for a physical tour guide, reducing the need for printed brochures and lowering guide costs for tourists.
- This project contributes to the promotion of tourism in Egypt and the expansion of knowledge about its ancient civilization.
- As the number of tourists continues to rise, the demand for such an application is expected to increase.

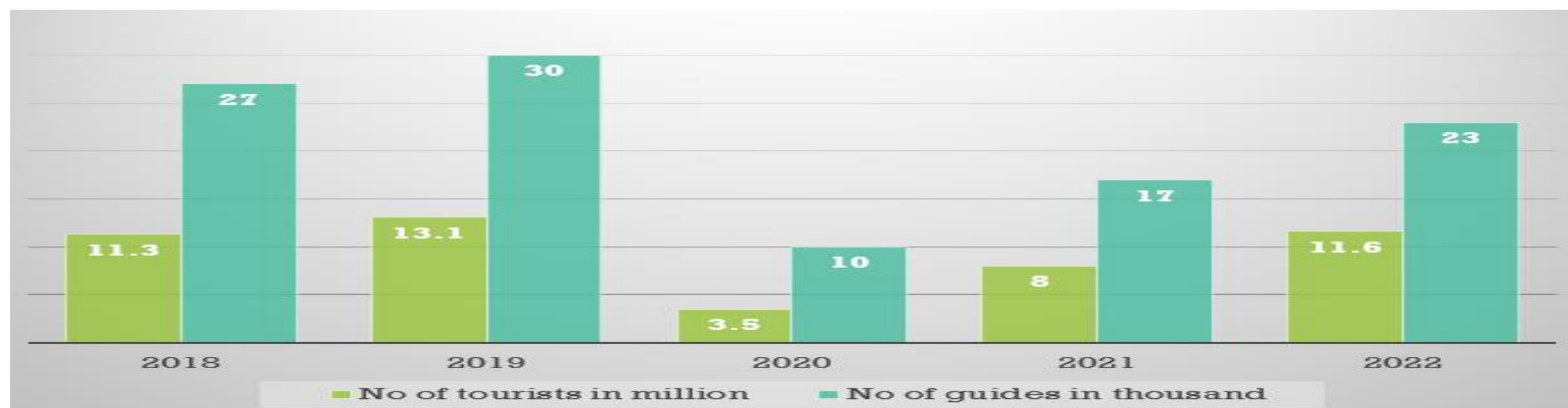


fig.1 Statistics between the number of tourists and tour guides in Egypt

METHODOLOGY

Our system architecture consists of multiple layers, each with its own distinct purpose and contribution to the overall functionality of the system.

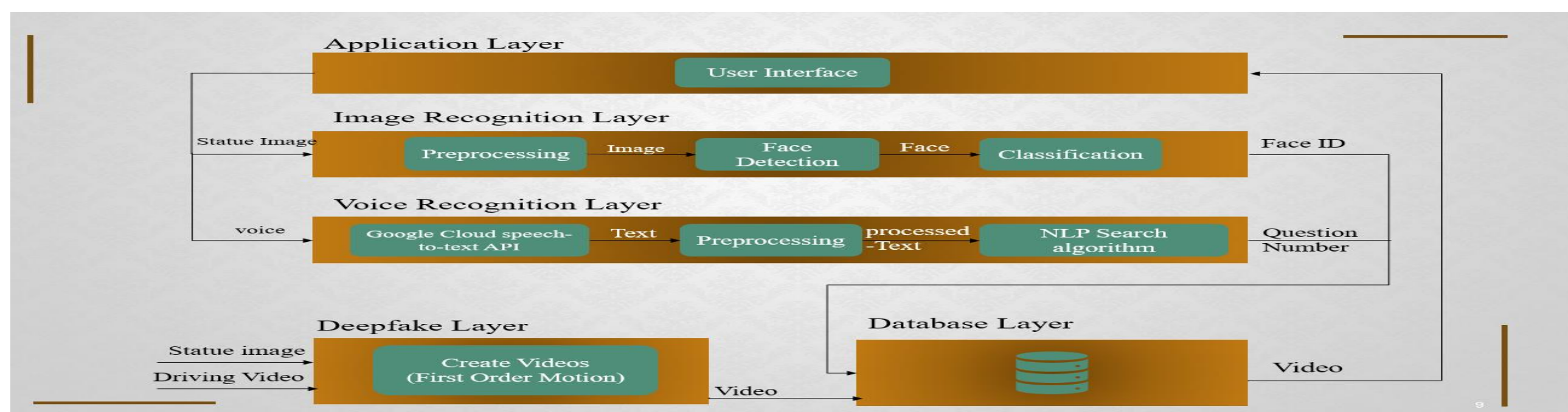


fig.2 System Architecture

- Image Recognition, Classification Layer**
- Deepfake Model Layer**

It utilizes advanced image recognition algorithms and deep learning techniques, such as convolutional neural networks (CNN). find that the best architectural model in terms of results, speed, and accuracy is VGG-19.[2]

- preprocessing techniques:
- By resizing the images
 - By employing noise removal techniques
 - By employing augmentation techniques.

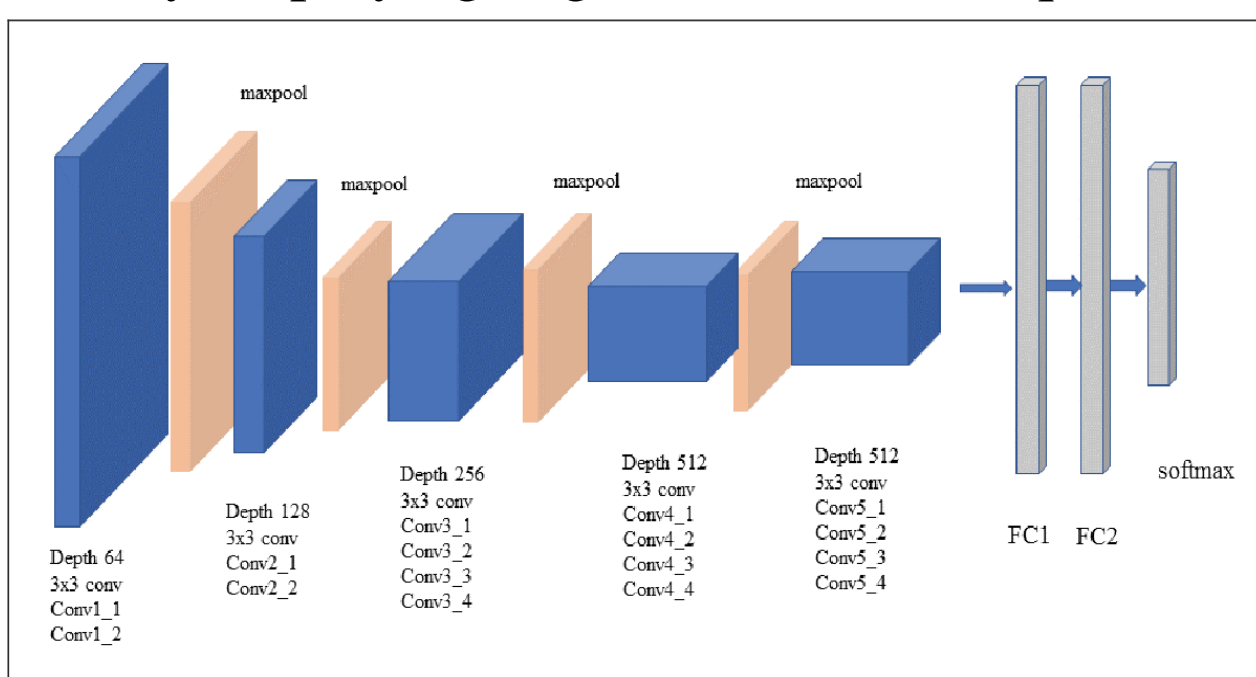


fig.3 VGG-19 Architecture

- Voice Recognition Layer**
- Take the question record then analyze it and extract the question number.
 - Use Google Cloud API.
 - Use the NLP technique. [4]

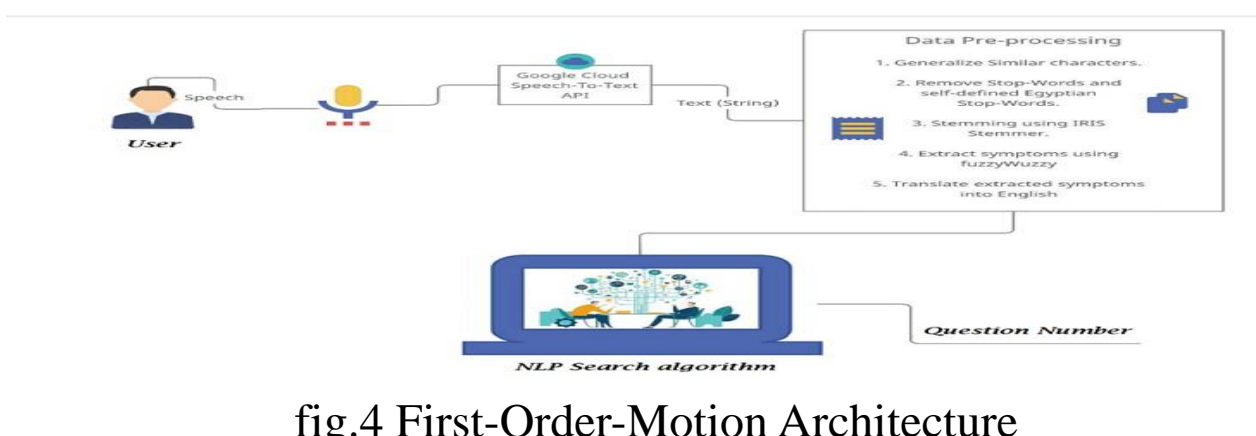


fig.4 First-Order-Motion Architecture

responsible for creating realistic and captivating videos. Use The first-order motion model. It consists of two main units.[3]

- The Motion Module
- Image Generation Module

Factors that influence the model Quality:

- Video Processing
- Image Processing

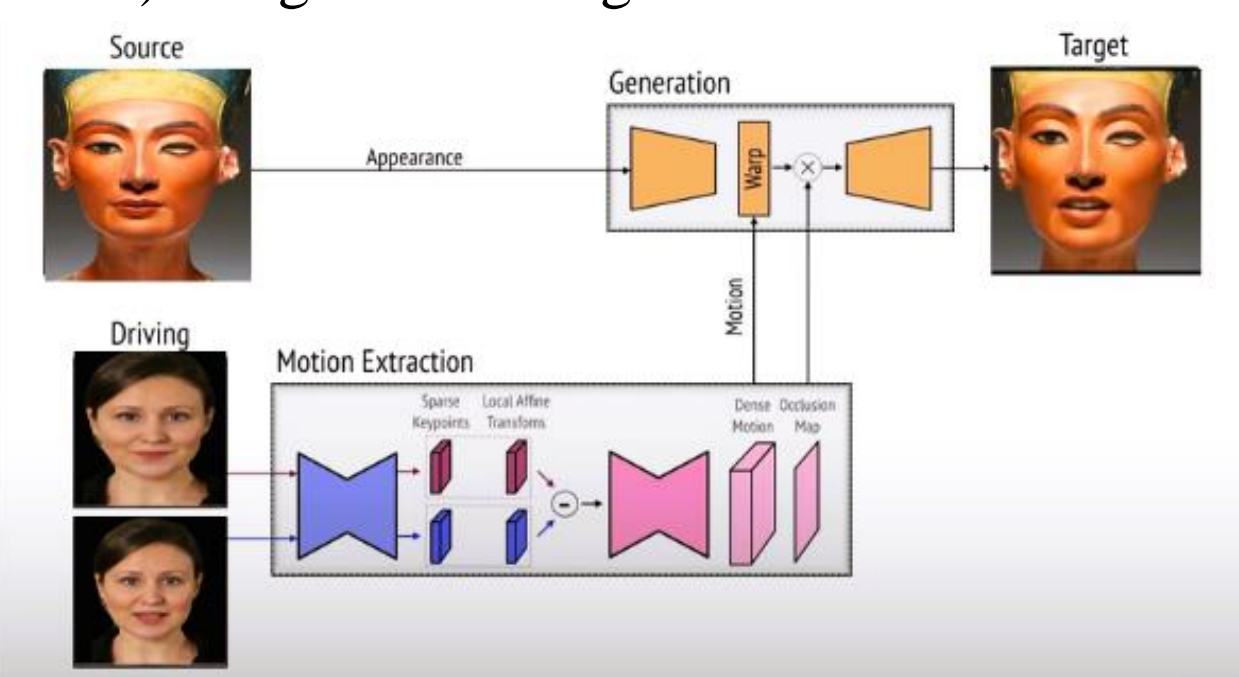


fig.4 First-Order-Motion Architecture

- Database Layer**
- acts as a central repository for storing and managing system data. It provides the infrastructure for administrators and database managers to control and manipulate system resources, the Firebase platform was used.

- Application Layer**
- serving as the user interface of the system, visually appealing, and feature-rich. It consists of two main Applications:

- The Mobile Application
- The Desktop Application

RESULTS

The implementation of the proposed methodology yielded promising outcomes, showcasing the effectiveness and potential of the developed mobile application in revolutionizing the tourist experience.

- Image Recognition and Classification**

Showing the results of using various models in image recognition and classifying them.

Model	Augmentation	Accuracy
SVM	No	41.64%
SVM	Yes	59.09%
LeNet-5	No	37%
Custom CNN	No	52%
Custom CNN	Yes	69.5%
Alex Net	No	46%
Alex Net	Yes	66%
VGG-16	Yes	74%
VGG-19	No	92.76%
VGG-19	Yes	96.78%

TABLE I TRIAL SUMMARY

Conclude that the VGG-19 architecture has achieved a remarkable accuracy rate of 97%.

- User-Friendly Mobile Interface**

built using the Flutter framework, was designed with simplicity, ease of use, quick loading times, and responsiveness across different screen sizes and devices.

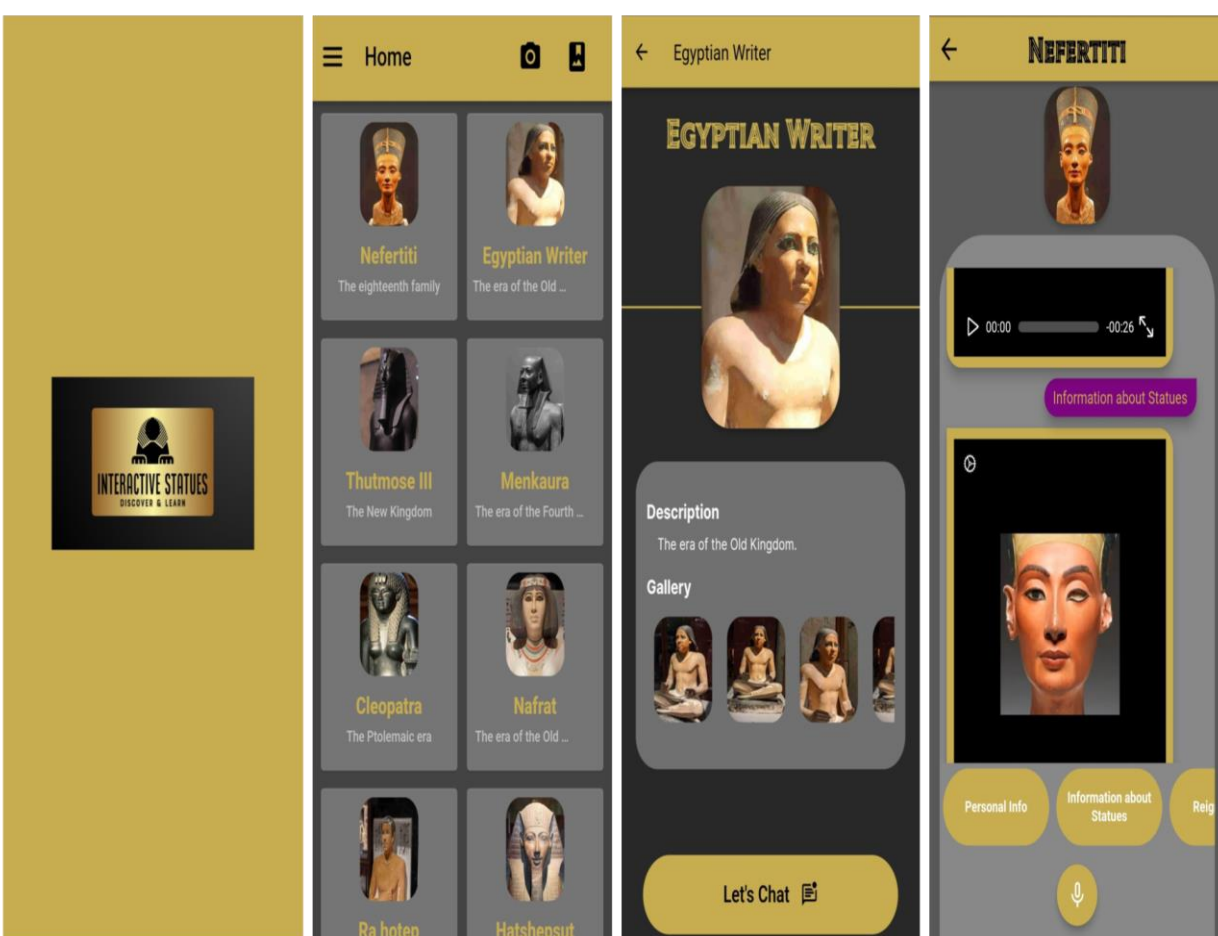


fig.6 Mobile App Screens

- Datasets**

using it to achieve various goals in various fields and applications.

The data set is mainly divided into two parts:

- The Textual dataset: Contains all the information on statues of kings and Queens collected, verified, and reviewed from documented historical sources and references.[5]

fig.8 Textual dataset Sample

- Deepfake Video Generation**

The Model can produce realistic and high-quality results. Measuring the Quality of the model typically involves evaluating the quality of the generated videos and assessing how well they align with the desired outcomes.



fig.5 Deepfake Video Generation

By achieving a remarkable 95% precision in generating videos, exhibiting a high degree of fidelity and reliability.

- Desktop application**

By providing administrators with comprehensive control over the database. They could easily create, edit, delete, and add videos of Talking Statues. develop using the Tkinter library.



fig.7 Desktop App Screens

CONCLUSION

In conclusion, this research has resulted in the development of a groundbreaking mobile application that aims to revolutionize the tourist experience in Egypt and beyond. By leveraging deep learning, and Flutter Framework, We have created an interactive platform that provides easy access to information about ancient Egyptian kings and queens.

The application incorporates advanced deep learning models, including the VGG-19 convolutional neural network for image recognition and classification, as well as the first-order motion model for generating realistic talking statues. Through conversations with the virtual statues, users can gain extensive knowledge, ask questions, and receive video responses, allowing for a deeper understanding of the statues' historical significance.

The proposed methodology encompasses a user-friendly mobile application, a desktop application for administrators and database managers, a comprehensive dataset of historical information, and robust deep-learning models. Each component has been meticulously designed to ensure a seamless and efficient user experience. We are dedicated to pushing the boundaries of technology-enabled tourism and anticipate a future where the application continues to inspire and educate individuals worldwide.

ACKNOWLEDGMENTS

First and foremost, we want to express our gratitude to God for his blessings on the success of this project. The team members put a lot of effort into finishing the project, and we all tried our best to make it the best we could.

We thank our project supervisor, Dr. Ayat Mohammed Naguib, for her advice. Her suggestions and guidance were helpful in getting our project finished.

We also want to extend my gratitude to my moderators, TA. Zeina Rayan and TA. Mohamed Essam who supported us all the time with Our thesis project.

REFERENCES

- S. Galal, "Statista," Travel, Tourism & Hospitality, 28 2 2023. [Online]. Available: <https://www.statista.com/statistics/970638/egypt-tourist-arrivals/>. [Accessed 29 6 2023].
- S. Mittal, S. Srivastava and J. P. Jayanth, "A Survey of Deep Learning Techniques for Underwater Image Classification," *IEEE*, p. 15, 2022.
- A. S. Bahar Uddin Mahmud, "Deep Insights of Deepfake Technology : A Review," *arxiv*, p. 10, 2021.
- A. Gasparetto, M. Marcuzzo, A. Zangari and A. A. Albarelli, "A Survey on Text Classification Algorithms: From Text to Predictions," *mdpi*, vol. 13, no. 2, p. 82, 2022.
- I. F. a. H. al-Laithi, History of Ancient Egypt: Egyptian Civilization from the Early Pharaonic to the Islamic Conquest, Cairo: American University in Cairo, 2012.