Manila Zoo Animal Classifier

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Abstract— Manila Zoo Animal Classifier is an image recognition system aiming to recognize and categorize six (6) species from Manila Zoo, namely, African Lion, Bengal Tiger, Black Ape, Capybara, Ostrich, Sail Fin Lizard. Convolutional Neural Networks (CNNs) were used to construct the system, which was then made available as a web application. The system's goal is to correctly classify pictures and images of animals to highlight Manila Zoo as one of the city's top tourist destinations.

Keywords—CNN, image recognition, animal classifier

I. INTRODUCTION

In the information age, image has become a medium and carrier to convey information and is widely used in various fields [1][2]. Animal image classification is used in forests to classify animals in real time with profound research significance. In the past, many computer vision technologies were introduced, but due to the lack of accuracy, these technologies failed to meet the requirements [3]. Convolutional neural network (CNN) is a typical algorithm for realizing deep learning with its deep structure and good learning representation ability, which has been widely used in computer vision and other fields.

The Animal Zoo Classifier holds significant importance in modern zoo management and visitor engagement. In an era where technology seamlessly integrates with education and conservation efforts, this innovative tool emerges as a crucial asset. By harnessing advanced image recognition algorithms, the classifier not only provides visitors with instant and accurate identifications of zoo animals but also contributes to educational outreach.

Moreover, the Manila Zoo Animal Classifier aligns with contemporary conservation goals by promoting awareness about endangered species and their conservation status. Beyond its educational value, enhances the overall visitor experience, making trips to the Manila Zoo more interactive, engaging, and technologically relevant. In essence, this serves as a bridge between technology and wildlife conservation, emphasizing the pivotal role of innovation in fostering a sense of responsibility and connection with the animal kingdom.

II. RELATED LITERATURE

Convolutional Neural Network

A convolutional neural network (CNN) is a category of machine learning model, namely a type of deep learning algorithm well suited to analyzing visual data. CNNs -- sometimes referred to as convnets -- use principles from linear algebra, particularly convolution operations, to extract features and identify patterns within images. Although CNNs are predominantly used to process images, they can also be adapted to work with audio and other signal data.

Convolutional Network CNN architecture is inspired by the connectivity patterns of the human brain -- particularly the visual cortex, which plays an essential role in perceiving and processing visual stimuli. The artificial neurons in a CNN are arranged to efficiently interpret visual information, enabling these models to process entire images. Because CNNs are so effective at identifying objects, they are frequently used for computer vision tasks such as image recognition and object detection, with common use cases including self-driving cars, facial recognition and medical image analysis.

Tensorflow

One of the libraries used in deep learning to recognize images is Tensorflow. Google developed the open source

Tensorflow software library for numerical computing in 2015. A neural network library created in Python called Keras may be used with MxNet, Deep Learning, Tensorflow, and Theano. It was created to make it simple to test deep neural networks (Divya, B. et al, 2020). It is a scalable and adaptable software toolkit for dataflow graph-based numerical computations. Users can quickly develop, test, and deploy neural network and other machine learning models using this library and related tools. TensorFlow's core algorithms are written in CUDA (Compute Unified Device Architecture), a parallel computing platform and API developed by NVIDIA, and highly optimized C++. It offers APIs in a variety of languages. The most comprehensive and reliable API is the Python one. The official list of languages that are also supported includes JavaScript, C, Java, Go, and Swift. For additional languages like C# and Ruby, third-party packages are accessible (Pang, B., et al, 2019).

Image Classification

As per Abu, M.A. et al., (2019)'s research, image classification has become a major challenge in machine vision with a broad range of intra-class images due to factors such as color, size, environmental conditions, and shape. The preparation of large amounts of labeled training images for this task is time-consuming and costly. The fundamental task of image classification is to categorize images into specific sectors or groups. Although humans find this task easy, it presents major challenges for machines, as it involves identifying patterns and properly classifying images into the right categories. Applications such as vehicle navigation, robot navigation, and remote sensing use image classification technology, but improvement is still needed due to the challenges involved and limited resources. For image classification, machine learning models are only designed to use linear classifiers on a given feature set (Ramasubramanian, K., & Singh, A. 2018).

III. Methods

A. Dataset Acquisition and Pre-Processing

The dataset was compiled through a comprehensive process involving the acquisition of images through web scraping and direct capture during visits to the Manila Zoo. Rigorous efforts were undertaken to ensure the inclusion of high-quality images representing all six (6) designated classes. The dataset comprises a total of two thousand nine hundred seventy-five (2975) meticulously curated images.

No. of Classes	Classes	Image Size	Split
6	Sailfin Lizard, Bengal Tiger, Black Ape, Capybara, Ostrich	320 Sailfin Lizard 729 African Lion 702 Bengal Tiger 471 Black Ape 451 Capybara 302 Ostrich	Training: 75% Testing: 25%

B. Tensorflow Keras

Utilizing TensorFlow, the Manila Zoo Animal Classifier exemplifies the synergy between cutting-edge technology and zoological exploration. TensorFlow, an open-source machine learning framework, powers the robust image recognition capabilities of this innovative application, enabling seamless identification and categorization of diverse animal species found within the Manila Zoo.

By leveraging deep learning algorithms, TensorFlow ensures the classifier's adaptability to a myriad of species, offering visitors an immersive and educational experience. The model's continuous learning capacity enhances its precision over time, aligning with the dynamic nature of zoo populations. With TensorFlow at its core, the Manila Zoo Animal Classifier stands as a testament to the transformative potential of artificial intelligence in reshaping traditional zoo interactions and fostering a deeper understanding of the animal kingdom.

C. Training

The training pipeline consisted of several key stages, beginning with the preparation and augmentation of the acquired dataset to enhance model generalization. Subsequently, the dataset was partitioned into training and validation sets to facilitate model evaluation. The training process started with iterations involving forward and backward passes to compute gradients and update the model weights to optimize the model parameters.

In every epoch, the model acquired the ability to recognize characteristics and trends in the pictures, thereby enhancing its capacity to precisely identify items associated with the six (6) designated classes. The Manila Zoo Classifier was developed successfully when the training procedure was iteratively improved until obtaining acceptable performance on the validation set.

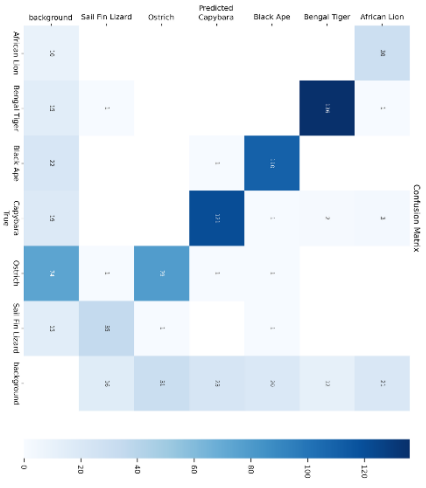


Fig. Animal Dataset

D. Web Application

The finalized model will be seamlessly incorporated into the Python codebase from the Manila Zoo Animal Classifier.

Within the application interface, users will be provided with the functionality to upload images, prompting the system to conduct a comprehensive analysis and generate predictions pertaining to the respective animal classes to which the images belong.

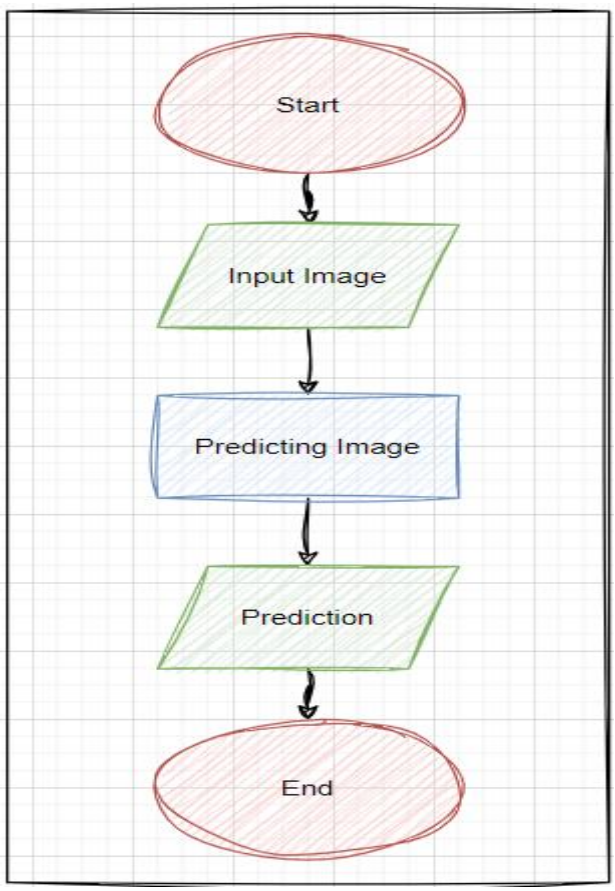
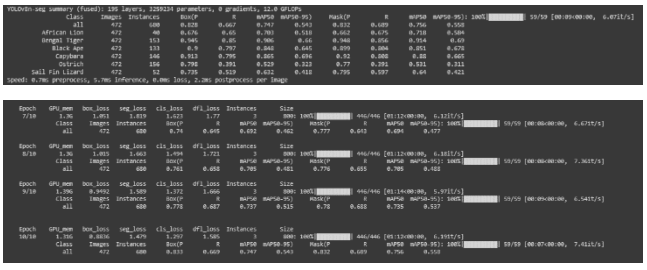


Fig 2. Flowchart of the Web Application

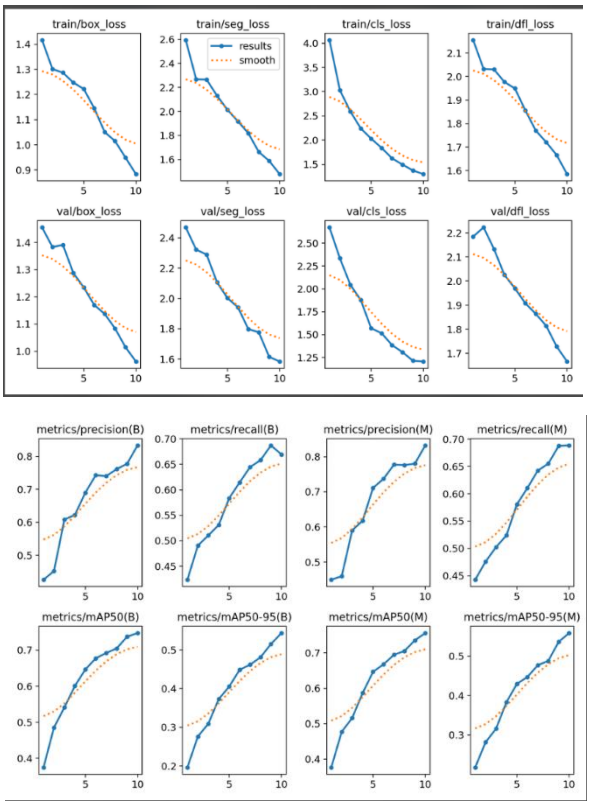
IV. RESULTS AND DISCUSSION

The researchers manually split our data into different parts, each containing classes. The model achieved 100% accuracy after the training period. 320 Sailfin Lizard, 729 African Lion, 702 Bengal Tiger, 471 Black Ape, 451 Capybara, 302 Ostrich



To assist in training the model, we used as our data technique. To spread the findings across the graph and identify inconsistencies between the training and validation processes, we plotted the accuracy and loss.

The training set is used to train the model, whereas the validation set is used to evaluate the model's performance. presents the graph of validation and training accuracy for each epoch as well as its loss.



Our system will make a prediction about the animals that could be found specifically in Manila Zoo that the user will input. And versatile tool designed to identify and categorize various animal species based on advanced image recognition algorithms.

Figure: Web Application Interface

However, in cases where the tool encounters an image that does not correspond to a recognizable animal, it provides a prompt indicating the inability to classify the subject. This feature ensures transparency and accuracy, preventing misidentifications or misinformation.

V. Conclusion

In conclusion, the Animal Zoo Classifier not only represents a technological milestone but also embodies a transformative force in the realm of Manila Zoo experiences. By seamlessly integrating advanced image recognition algorithms into the visitor's journey, this innovative tool enhances educational engagement and fosters a deeper connection between people and wildlife.

The Animal Zoo Classifier is a forward-thinking approach to zoos as they expand into crucial sites for conservation and education. Its continuous learning capabilities and real-time identification help to build a dynamic and ever-expanding knowledge base. Therefore, the widespread adoption and continuous improvement of such classifiers are recommended, as they hold the potential to transform traditional zoo experiences into powerful tools for fostering awareness, appreciation, and a sense of responsibility towards the preservation of our planet's diverse and endangered wildlife.

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