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Birds Species Recognition

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Abstract: ***Birds species recognition holds a huge importance in the various fields such as ecology, education, conversation, ornithology and citizen science. Many of us like to do bird watching as its gives several health benefits which we get by enjoying nature and many of us get a satisfying feeling. There are several bird species which we aren't aware of their color, shape, size and orientation. Knowing birds by their genies is a very difficult task for common people and it is also time-consuming work. Without any specific technology this work is as compared to impossible but by using deep machine learning all the tasks have become simpler. All the challenges are getting better with technology used, as we are using deep learning algorithms, with the help of it we can recognize different bird species using mobile application. The purpose of this mobile application is to recognize the bird images clicked by the user using CNN and give appropriate information about the bird to the user. This user-friendly application allows the user to upload an image of a bird and provides the user with real time species identification results. In this study, a total of 25 species are included.***

Keywords: Birds species recognition, Convolutional Neural Network, Transfer Learning, Kaggle.

I. INTRODUCTION

Many people love to watch birds, are mesmerized by the sounds of birds, and sometimes try to make sounds like birds. Birds are observed by the Pahadi people. But we do not have any idea about to which species the bird belongs? or what is the name of that bird? Bird identification is a different process that frequently produces unclear labels. Even seasoned bird watchers have personal preferences for particular bird species. Testing the visual skills of humans and computers is difficult [7]

In a few years, the advancement in artificial intelligence particularly in the domain of deep learning , has brought great progress in image recognition tasks. A CNN is a deep learning algorithm that specializes in the analysis and classification of visual data. CNNs outperform humans in many areas.

Researchers and technologists have worked to create automated systems for bird species recognition by utilizing deep learning. The goals of these efforts are to increase identification accuracy, expedite the identification process, and enable more people to participate in ecological research and bird watching.

Inspired by deep learning's potential to revolutionize conservation and bird watching, we introduce a new mobile application for identifying different species of birds. This application offers a smooth and user-friendly platform for bird enthusiasts of all skill levels by fusing cutting-edge technology, scientific knowledge, and user-centered design.

Our application aims to empower citizen scientists, encourage environmental stewardship, and democratize bird identification by integrating cutting-edge deep learning models with user-friendly interfaces.

We give a thorough rundown of the planning, creation, and assessment of the app for identifying bird species in this paper. We go over the application's main features, user interface design considerations, data collection and annotation procedures, and underlying deep learning architecture. We also provide the outcomes of user feedback, performance evaluation, and usability testing, which show the app's effectiveness and usability in actual situations.

II. LITERATURE SURVEY

Machine learning has made so much progress in this field; the system detects different features from raw data and helps to classify them. The output of the machine learning mechanism depends on the quality of the input received by the user. There are many categories in machine learning mechanisms, and this mechanism helps to study related to bird identification.

According to this literature review, numerous studies have been done related to bird species recognition, but they have used different algorithms and methods: There are numerous studies whose identification has been done from the image of the bird (1, 3, 4) while some studies have been done from the audio and video of the bird (2, 5, 2, 6). In the field of avian identification systems, one of the researchers (1) designed a study using transfer learning as well as MATLAB.MATLAB is used by him for using suitable advanced algorithms and for numerical precision accuracy. They achieved an accuracy of 80% - 85%.

On a dataset, researcher (5) employed algorithms such as Google Net, VGG19, and AlexaNet. Compared to previous research using the same dataset, this study's accuracy rate was 81.91%. Another was held (2) of the bird identification system. Their study aims to identify bird species using a video clip. He has created a dataset using approximately 950 video clips. To increase the accuracy of the system, the researcher has used two features namely appearance and motion feature. Their system has achieved 90% accuracy using a random forest classifier.

III. METHODOLOGY

To reach the goal of the study, an advanced machine learning model called s CNN is used. It identifies and categorizes bird images. The following methodology is used in the existing paper to achieve the goals of the proper functioning of the machine learning model.

1) *Data Collection:* The first step is collecting data. The dataset is collected from resources available on the internet. This dataset contains high-quality images of birds that need to be trained and validated the performance.
2) *Data Pre-processing:* After collecting the dataset, the next step is data preprocessing. Images present in the dataset are different in size. In this stage, data is clean and pre-processed to enhance the performance of the system. The median filter is used to process the image pixel by pixel, and it will reduce the noise. This will enhance a few features of images for further processing.
3) *Feature Extraction:* All the images are resized to 224 x 224. The resized images are then normalized to get a range of [0, 1]. In feature extraction object-based approach is used, where an object is a group of pixels with similar spectral information. Transfer learning is used. By applying transfer learning, effective and efficient analysis of the dataset is allowed due to deep learning model capacity.
4) *Model Training:* CNN is used, as it is suitable for image recognition and processing. Convolutional layers are the main building block of CNN, where filters are applied to extract features of images. The output of this layer is then passed through the pooling layer which is used to sub-sample the feature maps, which reduces the size of the image by preserving the important information. The output of the pooling layer is used to recognize the image.
5) *Model Training:* The models trained on recorded data of bird species. Training includes modulating the weights of the network to increase the performance of the model. This model is then validated to evaluate its performance.
6) *Model evaluation:* The performance of the training model is evaluated using accuracy, and precision recall. The model can be worked based on evaluation to improve performance.

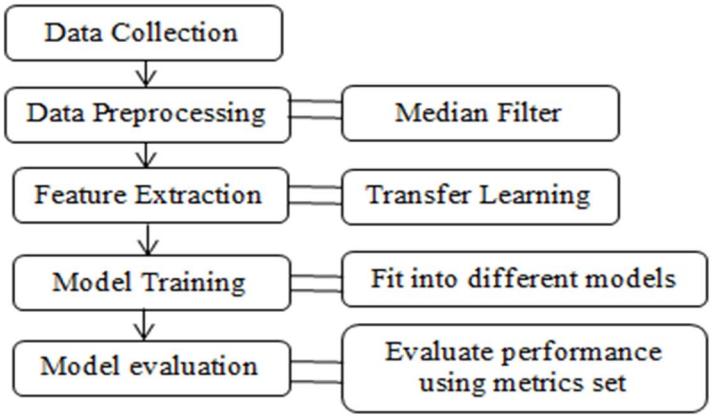

Figure 1: Methodology

IV. WORKFLOW

First, we have to open the application by running the code. As soon as the application gets opened, the login page will display. If used is already registered then the sign in page will appear otherwise new users have to register, so they can sign in after registration. After login into the application, the home page will be displayed. There will be two options in the home page a) search b) upload (image). When we upload text or image to search/upload, data will start preprocessing as per user requested. If you search for a specific name, then the system will check for that name in the database and output will be shown to the user. If you upload an image of the bird, then the system will extract the features of the image & it will be compared with the dataset which is present in the system. The CNN (convolutional neural network) algorithm is used in this process. After this process, the image will get classified, and the desired output.

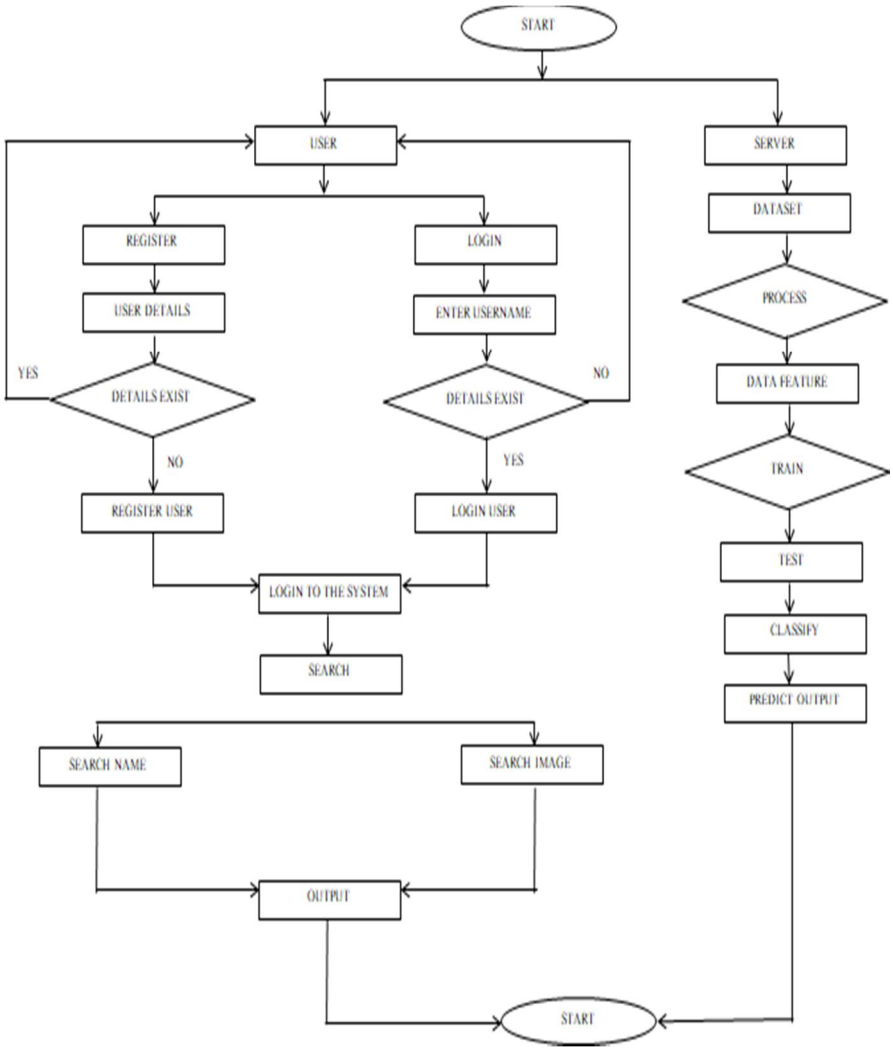

Figure 2: Workflow

A. Libraries Used

1) *PyMySql:* It is a pure Python MySQL client library, which means it is a Python package that creates an API interface that allows us to access the MySQL relational database. The documentation page says PyMySQL is built on top of PEP 249.
2) *Cv2:* It is a powerful library for working with images in Python. In this article, we've covered some of the most commonly used functions and methods in CV2, including loading and displaying images, manipulating images, and filtering images.
3) *Numpy:* NumPy is a Python library. It is open-source software. It is used to work with an array. It also has the functionality to work in the areas of linear algebra, Fourier transforms and matrices.
4) *TensorFlow:* TensorFlow is a free and open-source library. This library is built for several machine learning tasks, while Keras is a high-level neural network library that runs on TensorFlow. Both TensorFlow and Keras provide high-level APIs used to easily build and train models, but Keras is more user-friendly because of its built-in Python.
5) *Pandas:* Pandas is a python library. It is used for working with datasets. It is an open-source software library. It is built specifically for data manipulation and analysis. Pandas provide data structures and operations for powerful, flexible, and easy-to-use data analysis and manipulation.

B. Database

The Bird Images database comes from Kaggle and includes more than 2500 images of various bird species. Every picture is different because it was taken under various lighting, shadow, and weather conditions, and some of them had different objects in the background. This has made it much harder for us to extract features and deliver the highest level of accuracy.

V. RESULTS

1) *Login Page:* This is the first interface after opening the application. If the user is already registered he/she can login with the help of Username and Password. As show in figure 3

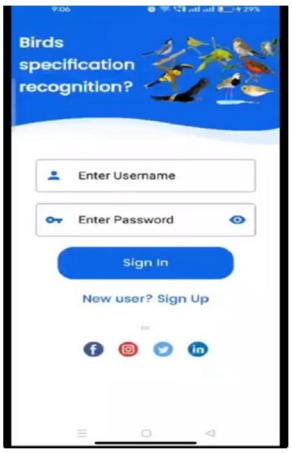

Figure 3: Login Page

2) *Register Page:* If he/she is using the application first time they should signup up with following details like Username, Email-Id, mobile number, password. As show in figure 4

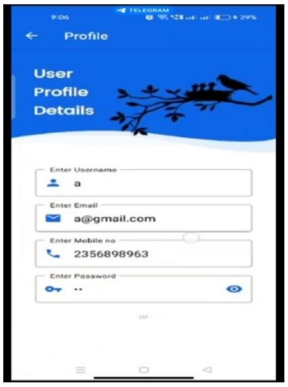

Figure 4: Register Page

3) *Upload Image:* After the login/sign up work user will be redirected to home page where they can search the bird species using upload from gallery or capture live photo. As show in figure 5

Figure 5: Upload Image

4) *Search Option:* The next feature is where user can search the bird information using search option which is present in navigation bar. As show in figure 6

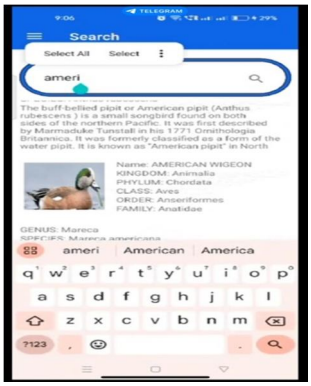

Figure 6:Search Option

5) *Navigation Bar:* In navigation bar there is about section in which user can download the the birds related information pdf which can be used for educational purpose and in profile section user details are been present. The last Logout bar is used to logout from the application.

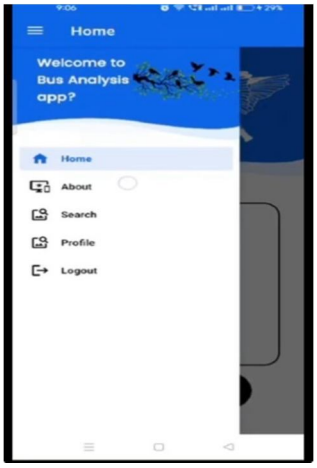

Figure 7: Home Page

6) *Output:* Output image. As shown in Figure 8

Figure 8: Output image

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VI. CONCLUSIONS

Finally, we have discussed a study that used deep learning methods to recognize different species of birds. All the features of user-centered design, mobile computing, and deep learning algorithms are combined to create this mobile application. The problem of identifying different species of birds is solved by this application.

Many obstacles had to be overcome to develop this software, including finding a variety of datasets, building strong models, designing an easy-to-use interface, and handling moral dilemmas. But through teamwork, ingenuity, and persistence, these problems have been addressed with solutions that have the potential to completely change how people interact with birds and their habits.

A potential app for bird watchers is the recognition of bird species. Furthermore, it advances our knowledge of the biodiversity of birds. We must keep enhancing and modifying the app in light of user input, technical developments, and scientific discoveries as we proceed.

Fostering collaborations with academic institutions, environmental advocacy groups, and nearby communities is also essential to ensuring that the app's advantages are shared fairly and that its impact is maximized.

To sum up, the app for identifying bird species is not only a technological marvel but also evidence of our common goal of comprehending, valuing, and safeguarding the natural world. We can significantly contribute to the conservation of avian biodiversity and the preservation of our planet for future generations by utilizing technology and group efforts.

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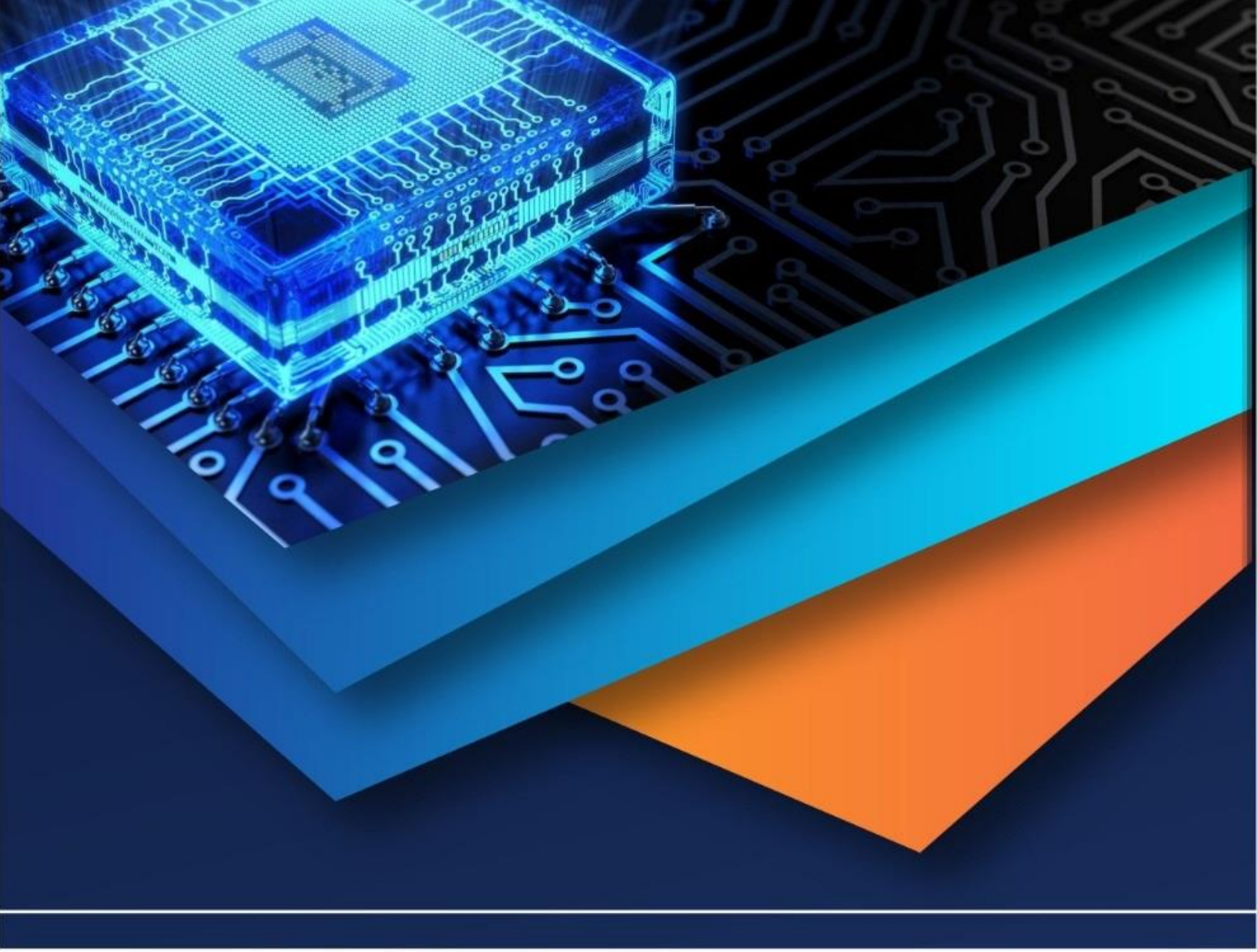

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