Image-Based Identification of Snake Species Using Machine Learning

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Abstract— Since there is thousands type for snakes. Conducting manual identification for the snake becomes more tiresome since it takes a long time and required an expert person. As a result, the snake identification app will be used to identify the snake type based on the snake picture using the machine learning algorithm. To reduce the identification process time and effort and to make it available to everyone. The user of the app will take the snake picture the system will provide the user with snake type and information. Additionally, the app will provide the user with the snake catcher numbers to catch the snake.

Keywords— Snake Identification App, Machine Learning Algorithm, Image Classification.

I. INTRODUCTION

Snakes are a reptile that falls into two categories; non-venomous and venomous. Every year millions of people got bitten by Snakes. Snakes kill Around 80,000 people annually[1]. Apart from Antarctica snakes exist in every continent with more than 3,000 types, 600 types of them considered venomous [2].

The huge variety of snakes leads to make the identification process a tiresome task. To treat the envenoming person from the snake bites, the important task is to identify the snake type correctly. Not to mention it is important to the education and safety field. Nowadays, to identify the snake type, the snake has to be killed then bring to an expert to identify it. Which may lead to hurt the people who do this task. In the case of snake escape, the snake type is identified based on the person's condition, clinical and laboratory test results. This process can delay patient treatment since it takes a long time[3].

As a result, introducing the snake identification app that can help to recognize the snake type correctly in less time. The app will process the snake picture using the machine learning approach to classify them. Additionally, the system will include a conveying system to connect the user to the nearest snake catcher or emergency center.

The main problem for the snake identification app is to recognize the snake type based on the Snake picture. Since the normal classifying process for the snake is done based on the skin colour, head shape, eye shape and body shape, and to successfully clarify the type, it requires an expert which knows the snake features. Furthermore, the manual process takes a long time; therefore, it may endanger the patient life.

The goal is to develop AI-based application to identify species of snakes that support healthcare and public communities affected by snakebite. Supervised Machine Learning is used for efficient classification so the app able to provide the user animal information of the animal type based on the taken pictures.

II. RELATED WORKS

This section is aimed to present some the Existing System that used for Snake identification.

In the literature there are many studies and application for Snake identification however most of these studies and applications have some limitations either focusing on some species or require high computation.

iNaturalist is a mobile app that develops by the iNaturalist company with the cooperation of National Geographic and the California Academy of science. The app is designed to allow the scientist to collect the animal's data also to allow the people to identify the animal types. The app provides a feature to allow the user to record the observer animal information and location with the suggestion to the animal type based on the taken pictures. The app also provides guides for the animals. The app uses the Google account, Facebook, and user and password authentication. The system compatible with iOS 9.3 and later, Android 6.0 (Marshmallow)and up[4].

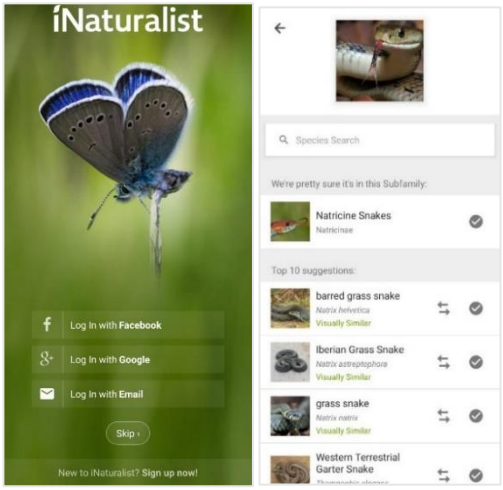

Fig. 1: Screenshots from iNaturalist app

Identify Indian Snakes mobile app is developed by Niraj Munot. The app is allowing the user to take a picture of the snake and the system will provide the user with the possibility of the snake type. Furthermore, it also provides the user with a field guide to increase the user knowledge regarding the snake type in India. Moreover, the app can run with phones that run Android 4.1(Jellybean) and later. Lastly, the app doesn't require any authentication in order to use the app[5].

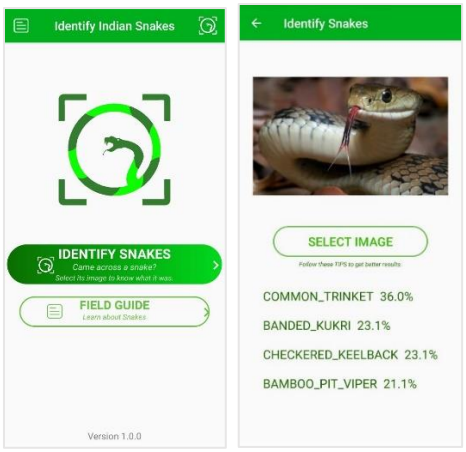

Fig. 2: Screenshots from Identify Indian Snakes app

SnakeSnap is a mobile app developed by the Snake Snap Inc. SnakeSnap provides the user with the functionality to identify the snakes based on the picture. The user has to take or upload the snake image and the system will send the result to the user via E-mail or SMS. The system also provides user with a learning function that allows the user to know more about the snakes and it is sorted based on the states of the United States America. The app can run on the mobile phone with Android 5.0(Lollipop) or newer, IOS 11 and later. Lastly, the mobile app doesn't require any authentication to access the system[6].

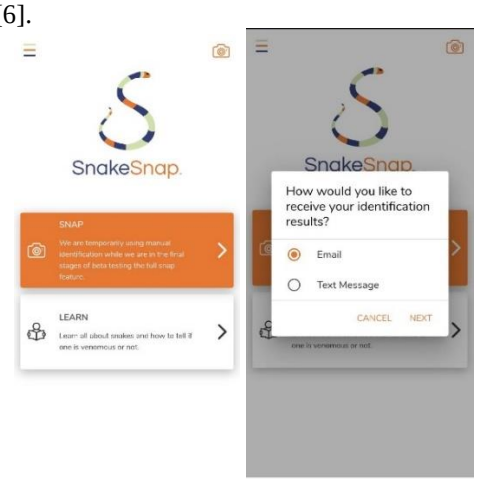

Fig. 3: Screenshots from SnakeSnap application

As already mentioned in the existing system the iNaturalist mobile app provides a lot of important functions such as: recording the animal location and give the top 10 suggestions for the animal spices based on the image and using AI and machine learning algorithm. As well as sharing data between thee scientist which allow them to collect a large number of data in order to finish their projects. However, since the app is not a specialized type of animal the algorithm to identify the snakes is still needs more data which leads to a decrease in the level of accuracy. Another drawback is the system is easy to lose because of a large number of functions which is considered hard for the users, especially the new user to use the system.

Identify Indian Snakes (IIS) the app uses the Ai in order to identify the probability of the snake type. Another advantage of the app is that it provides the field guide function which gives the user the basic information regarding the snakes. Despite this, the App only gives the names for the identified snake without any other information regarding the snake for example if it is venomous or not. Moreover, the accuracy for identifying the snake is low.

The strong point for SnakeSnap is the accuracy for recognizing the snake type since the identification is done by the experts. Another strong feature of the app is it divides the snakes based on the states which provides an easy way to find the snakes based on the living area. However, the app doesn't use Ai or any machine learning instead is used to identify the snakes manually then sent the snake result e-mail or via SMS. This process takes a long time to complete.

III. PROPOSED DESIGN

This section presents the proposed Design which is involved the model design and the application design. The app was developed mainly through android studio platform. It is allowed to create different applications on window, Mac, and Linux system. It builds with multiple development tools with virtual android environment that emulates the android application. One of the android studio plugins is flutter plugin which allow the user to create a new flutter app

A. Model Design

Teachable Machine v2 is used for developing this application. It is a web-based tools that is used to train the model and converting it to tensor flow file format in easy and fast way. TensorFlow.js library allows models to be trained and run-in web browser. It includes higher level library which is an API layers that used to build machine learning models using core, additionally it includes tools that automatically porting TensorFlow savedmodel, tflite and keras hdf5 model. The teachable machine is uses a supervised machine learning algorithm which is mobileNet to train the model.[8][9]

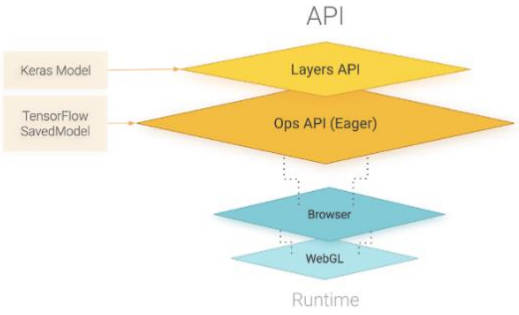

Fig. 4: TensorFlow.js API

To create a model first we have to prepare our data in a different folder as shown from figure 6.

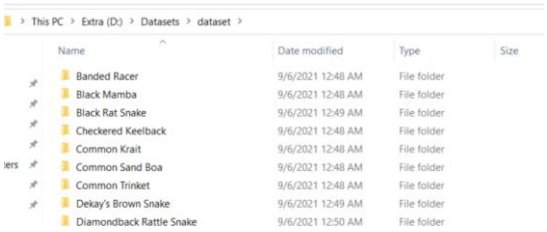

Fig. 5: Dataset Folder

Then we have to upload our data to teachable machine after finishing labelling and upload our data we have to choose the number of training epochs and choose the training rate after that click train model button.

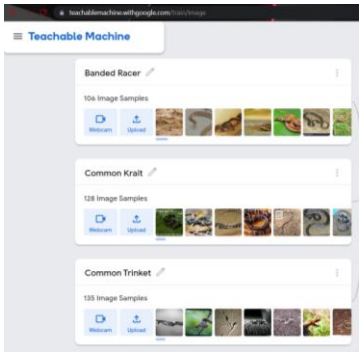

Fig. 6: Uploding the data set and training the model

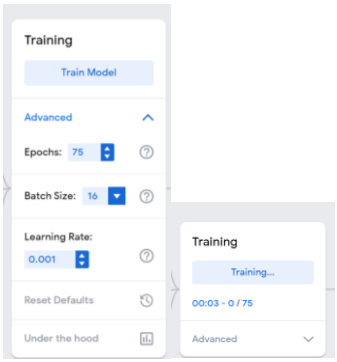

Fig. 7: Training the model

After finishing the train of the model we have to export the model with the desired format which is on our case tflite model .Tflite is a lite model that designed to implement on the mobile application because it is smaller, faster and doesn't use much resources [10] [11].

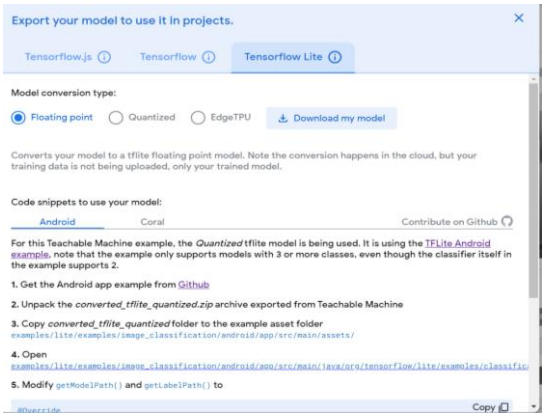

Fig. 8: Exporting the model

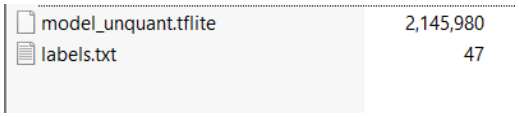

Fig. 9: Trained model folder

Then we have to add the trained model and labels t to our app assets in order to perform the training.

B. Appalication Design

This part describes the application main interfaces and their uses.

A. Welcome interface.

This Interface is used to welcome the user and to navigate them to the login or registration page

Fig. 100: Welcome Interface

B. Registration interface/ login interface

The Register page is to allow the user to register a new account to login to the system via saving their information to the firebase. The Login interface allows the user to enter the to the system by entering the email and password.

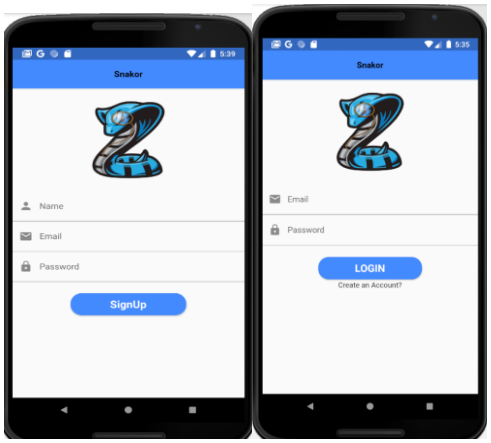

Fig. 111: Registeration and Login Interfaces

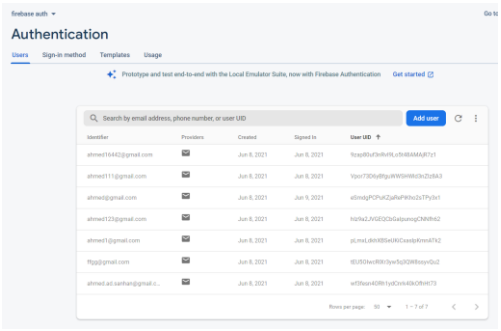

Fig. 12: Firebase Authentication page

C. *Homepage interface*

In this page the user can choose to either identify the app or to snake guide page. The user can also choose to call the Malaysia national poison centre via call button to report the founded snake. The user can logout from the system by clicking the sign out button.

Fig. 13: Home Page Interface

D. *Snake Classification interface*

In this interface the user can choose to identify the snake either by taking a photo via the camera or uploading a phot from the gallery after that the app will give the snake result to the user with the confident percentage. as shown from the figure. After that the user can share the result via the share button.

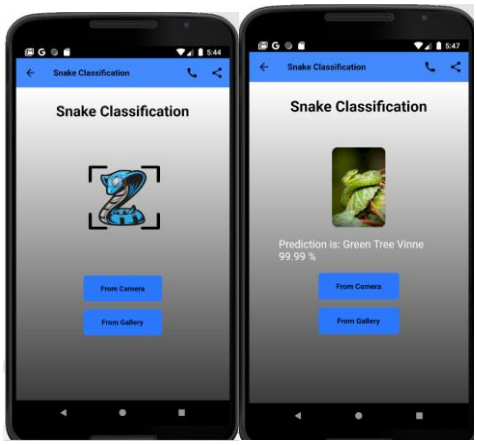

Fig. 14: Identification Interface

E. *Snake Guide interface*

This interface shows different snake image with their name and scientific name. The user can know more about the snake by clicking on the snake image or name.

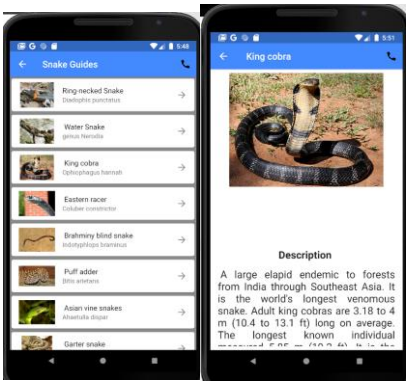

Fig. 15: Snake Guide and Sanake Detail Interfaces

IV. Model Result

The application's model uses online dataset. The dataset consists of 18 snake types, the lowest class have 106 images. The data set is a combination between Pre-processed Snake Images which the has been retrieved from Kaggle website, and the Indian snake data set that has been retrieved from the git hub.

Teachable machine is used to train the model based on the snake dataset and converting it into the suitable TensorFlow format. The result shows snakor app is very good at detecting the snake's type.

The figure shows the number of samples is used to test each class. The results show that the system is able to identify snake automatically without the needing of external human interferes.

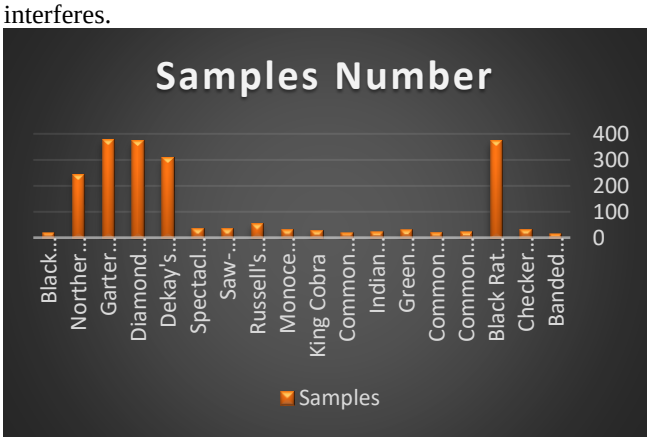

Fig. 16: Number of samples chart

This figure shows the accuracy percentage for each class.

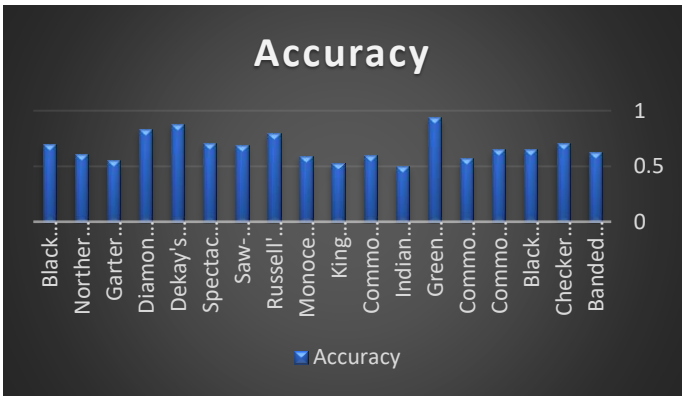

Fig. 17: Accuracy percentage chart

The below figures show an example of the identifying a real snake.

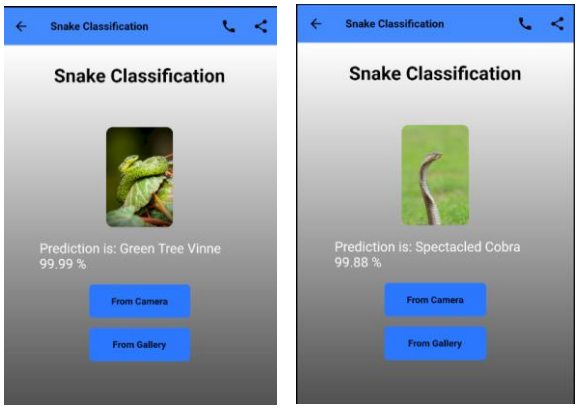

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Fig. 18: result examples Interface

As part of this project, and since the main goal of the project is developing an application-based AI model, it is necessary to conduct another type of experiment which is User Acceptance Testing (UAT). UAT is used to test the usiablty of the application. The below table shows the results of the User Acceptance Testing (UAT) from the targeted users. The application is design to be friendly and easy to use, therefore UAT study show that the applications met all the uses' requirements

Table 4.3.2.1 user acceptance test result

Interface	*Test data*	*Expected result*	*Actual result*	*Pass/Fail*
Splash screen	Click on the Snakor app.	The splash screen will appear when opening the system	Same as the expected result.	Pass
Shows the welcome page.	Wait for 5 second.	After finishing splash screen, the welcome page will appear.	Same as the expected result	Pass
	Click on register button.	The app will navigate to register interface.	Same as the expected result	Pass
	Click on Login button.	The app will navigate to login interface.	Same as the expected result	Pass
Register Interface.	Insert the name, email and password then click sign up button.	The user account will be created and will able to login to the system.	Same as the expected result.	Pass
	Let the email to be in wrong format.	The system will display badly formatted email to the user.	Same as the expected result.	Pass
	Let the password be less than 6 characters.	The system will show provide minimum of 6 character.	Same as the expected result.	Pass
Login interface.	Insert the correct email and associated password then click sign in button.	The user will be able to login to the system.	Same as the expected result	Pass
	Let the email to be in wrong format.	The system will display badly formatted email to the user.	Same as the expected result	Pass
	Let the password be less than 6 characters.	The system will show provide minimum of 6 character.	Same as the expected result	Pass

	Insert the correct email and associated with wrong password then click sign in button.	The system will show invalid user or password.	Same as the expected result	Pass
Home page interface.	The user will click Identify snake button.	The system will navigate the user to identify snake page.	Same as the expected result	Pass
	The user will click snake Guide button.	The system will navigate the user to snake guide page.	Same as the expected result	Pass
	The user will click sign out button.	The system will let the user exit from the system.	Same as the expected result	Pass
Identify snake classification.	The user will click From camera button.	The system will let the user take a snake picture then provide the identify result.	Same as the expected result	Pass
	The user will click From gallery button.	The system will let the user upload a snake picture from the gallery then provide the identify result	Same as the expected result	Pass
	The user will click share button.	The system will share the result to the chosen app.	Same as the expected result	Pass
Snake guides interface.	Once you click on snake guides.	The system will show list of the snake's image with the associated names and scientific names.	Same as the expected result	Pass
Snake Details interface.	Once you click on snake image or name.	The system will show the snake name, image and wither it venomous or not.	Same as the expected result	Pass

I. CONCLUSIONS

The system is used to identify snake automatically without the needing of external human interferes. This project is developed using flutter to extend the users of the application. Teachable machine is used to train the model based on the snake dataset and converting it into the suitable TensorFlow format.The result shows snakor app is very good at detecting the snake's type.

As a future work, the main improvement to the project is to add more dataset to increase the accuracy and the identified snake type. The second improvement is to add location feature to identify snakes more accuracy since the snake type different between different places. Next improvement is to add the captured snake to customer history. The last improvement is adding search in the snake guide so the user can search for the specific snake type.

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