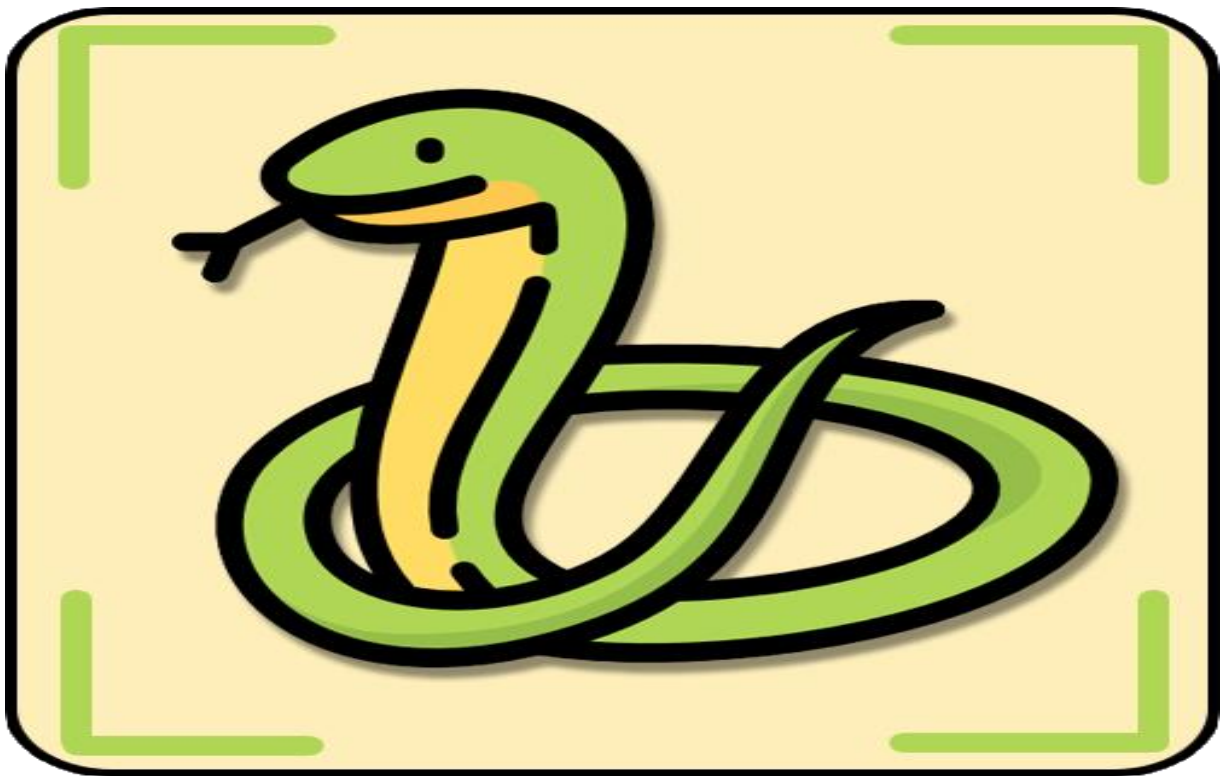


ARTIFICIAL INTELLIGENCE FOR IDENTIFICATION OF INDIAN SNAKES USING IMAGES

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Source: <https://rb.gy/2iqkox>

“People are not going to care about animal conservation unless they think that animals are worthwhile” — Sir David Attenborough

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Abstract

Animal conservation is quickly becoming a critical problem in the fight to preserve the planet's biodiversity. Artificial Intelligence (AI), one of the leading technologies which strive to simulate human intelligence, can be a possible solution to this problem. In this report, I have put forth an idea using AI to build such a system that can help identify the snakes of India by means of images. The system will be important in not only identifying the animals but also in saving humans from snakes and vice versa and will hopefully lead to conservation of these misunderstood creatures.

1. Problem Statement

AI is having an impact on most aspects of modern life, from entertainment, commerce to healthcare. The rise in use of AI in the healthcare, medical and associated industries has provided solutions to many problems including cancer detection. However, one fatal problem has plagued the world — **snakebite**. It has been a neglected issue not only in India but also in the entire globe. It is estimated that snakebites cause approximately 81000 to 138000 deaths worldwide with India alone accounting for almost half of the total number of annual deaths [1, 2, 3]. As such, the problem statement is quite simple — to build a system using AI to identify Indian snakes from images to save humans from snakes and vice versa, and also to prevent snakebites.



Fig 1: A snakebite patient
Source: <https://rb.gy/ket25j>



Fig 2: A snake roaming in farm
Source: <https://rb.gy/dbva0m>

2. Market/Customer/Business Need Assessment

Even though the aforementioned figures are daunting, there is (in India) NO way of identifying snakes upon its sighting, there only exist a handful of online sources for identification of snakes (more on it in External Search).

3. Target Specifications/ Target Characterization

The proposed service will be helpful for zoologists, conservationists, forest department officials, nature lovers, trekkers along with farmers, healthcare workers, and also the general public in:

- identifying the type of snake they are up against
- differentiating between venomous and non-venomous snake species
- reducing the number of unnecessary killings of snakes, *how?* A vast majority of snakes killed are non-venomous as there are more non-venomous snakes in India than venomous counterparts [4].
- helping the healthcare system to tackle snakebites effectively, *how?* No matter what you say, even today there are plenty of misconceptions regarding snakes in India. Sometimes, particularly in rural parts, people bring the snake to the hospital along with the patient. In that case, if the snake is identified, it will be useful for the doctor during treatment.

4. External Search

4.1 Brief Summary

Similar attempts have been made to identify snakes with the help of images such as [Snake Snap](#), [Criterpedia](#), [ALnature](#). Sadly in India, there has been NO attempt at developing such a tool but there exists some websites and mobile applications created with the aim of imparting information on Indian snakes. Let's have a look at them.

4.2 Dedicated Websites for Indian Snake Identification:

4.2.1 [Indian Snakes](#): The website was launched in 2010 to provide taxonomic (scientific) information on Indian snakes and is constantly developed and maintained by volunteers. It contains images of more than 250 species of Indian snakes. They have also developed an android app, [SERPENT](#), to handle emergencies related to the creatures.

4.2.2 [iNaturalist](#): This website, originally a joint initiative of the California Academy of Sciences and the National Geographic Society, has pictures of ~45 common snakes of India except for those found in the Himalayas, North East India & the Andaman & Nicobar islands.

4.3 Dedicated Mobile Applications for Snake Identification:

4.3.1 Snakepedia: The app covers ~100 species of snakes found in Kerala. Additionally, It has other useful features including a checklist of Kerala snakes, a list of nearby hospitals and snake rescuers, first-aid tips etc. It is free to use but the downside is it is in Malayalam [5].

4.3.2 SERPENT: Developed by the [Indian Snakes](#) team, the app contains a lot of scientific information on Indian snakes along with nearby hospitals and rescuers details.

4.3.3 SARPA: This application was launched in 2020 by Kerala Forest Department to handle snake rescue calls and is heavily used by people of Kerala [6].

5. Benchmarking

There are only a handful of online resources available which utilize the kind of technology similar to the proposed one. A brief comparison of these is as follows:

| Name | Type | Developed In | Features |
|-----------------------------|-------------------|--------------|---|
| Snake Snap | Application (iOS) | USA | subscription based, photo-based identification, provide information |
| Criterpedia | Application | Australia | to be launched in 2023, photo-based identification |
| AI.nature | Web Application | France | free, photo-based identification, snakebite treatment tips |

6. Applicable Constraints

- Continuous data collection from websites and databases
- Quality of collected images for correct identification
- Knowledge of the herpetologist involved

7. Applicable Regulations

- Laws related to Indian Copyright Act, 1957
- Permits for collecting data from websites/ databases

8. Business Model

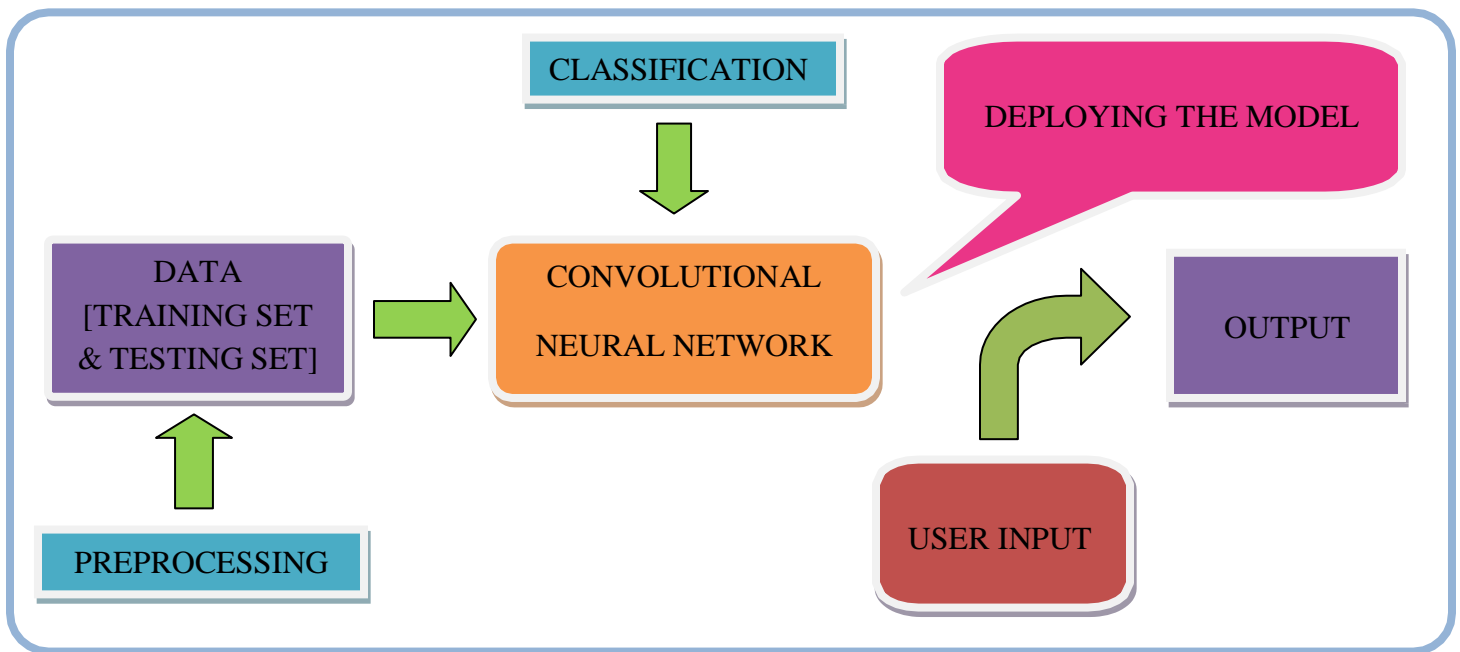
Though AI is capable enough to help build the type of service proposed, NO similar service is in place in India to identify snakes from images. Therefore, it is highly likely that the service will make a difference in life and death scenarios, transform the healthcare system one way or the other and benefit the ones mentioned elsewhere (refer to Target Specifications).

9. Concept Generation

Concept is simple that in order to iron out the problem we need to come up with a product/model which can take images as input and classify them as output.

10. Final Product Prototype

The final product will be a web-based or android-based service which will classify the input image provided by the user with the help of what is known as **Convolutional Neural Network**.



11. Product Details

It's a model which will be trained by using collected images from the available sources, converted into a web or android app, and then it will be used to classify the input image to identify the snake species in that image.

11.1 Data Sources

Along with the online sources mentioned below to gather images and scientific information regarding Indian snakes, Indian herpetologists can also be consulted for help. Moreover, there are some dedicated Facebook groups which could be another potential source of data.

| Data Sources | Active Indian Herpetologists | Facebook Groups |
|--|--|--|
| indiansnakes.org | Mr. Romulus Whitaker [kingcobra@gmail.com] | Snakes of India |
| indianreptiles.org | Mr. Ashok Captain [ashokcaptain@hotmail.com] | Reptiles & Amphibians Of India |
| reptile-database | Mr. Varad Giri [varadgiri@gmail.com] | Snakes of the Himalayas |

11.2 Algorithms

The workhorse algorithm that will be used at the core of the proposed system is **Convolutional Neural Network**, generally abbreviated as **CNN**.

Key points of CNN:

- It is a type of **Artificial Neural Network** (ANN) heavily used in the field of computer vision.
- The building blocks of CNNs are called **Filters** whose job is to extract features (information) present in the input data.
- Architecture of CNN:
 - **Convolutional Layer:** These layers are made up of a set of filters (also called **Kernels**) that are applied to an input image. The output of the convolutional layer is called **Convolved Layer** or **Feature Map**, which is a representation of the input image with the filters applied.
 - **Pooling Layer:** This type of layer is responsible for lowering the computational load required to process the data by reducing the size (dimensions) of the convolved layer.
 - **Fully-Connected Layer:** FC layers are used towards the end of CNNs to take the features learned by the previous layers and use them to make predictions.

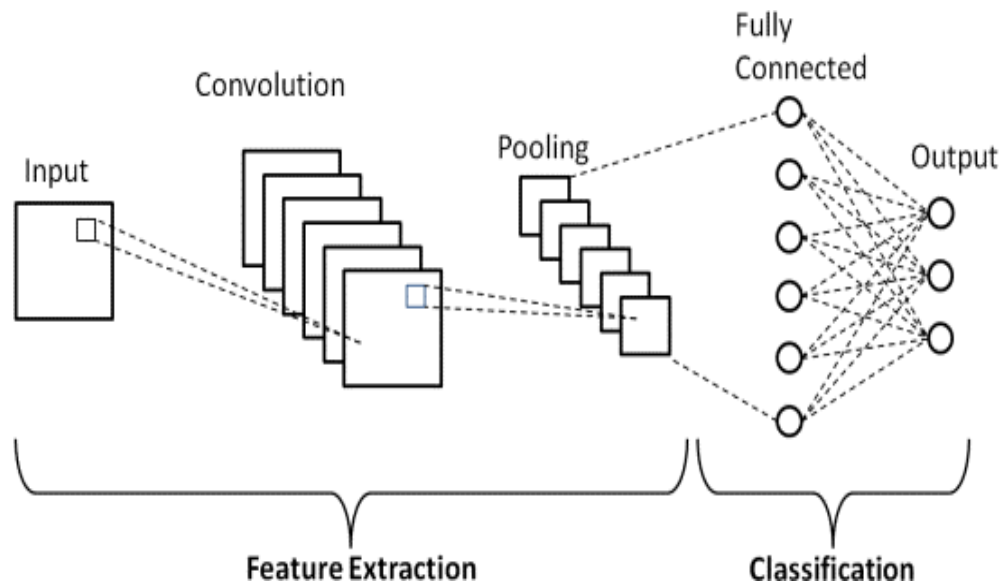


Fig 3: Architecture of CNN

Source: <https://rb.gy/iqcyaba>

11.3 Frameworks

The following Python frameworks will play a crucial role in creating the desired system.

- **Pandas**: Pandas is a feature-rich library mainly used for handling, manipulating and transforming data.
- **BeautifulSoup** : BeautifulSoup (BS4) is a web-scraping library which allows for easy fetch of data from webpages.
- **Scikit-learn**: It is the gold standard library for machine learning which comes with plenty of algorithms for regression, classification, clustering, and also for feature engineering tasks.
- **Keras**: Keras is a deep learning framework built on top of **TensorFlow**. It facilitates easy creation of Artificial Neural Networks.
- **Matplotlib** and **Seaborn**: Both of these libraries are used for visualization purposes and are totally free to install and use just like the above ones.

11.4 Team Required To Develop

- 1 Data Scientist
- 1 Software Developer/ Android Developer
- 1 Herpetologist

12. Conclusion

Artificial intelligence is on the rise as it is being integrated into an array of fields such as agriculture, commerce, healthcare, finance, banking, research etc. It is also leading the way to new innovations to protect animal species by providing information to wildlife researchers [7]. This model/service, if implemented successfully on large scale, will be a major step towards snake identification, snakebite prevention and snake conservation as well. It will also prove a valuable tool for almost everyone.

References

- [1] <https://www.who.int/news-room/fact-sheets/detail/snakebite-envenoming>
- [2] <https://doi.org/10.7554/eLife.54076>
- [3] <https://indianexpress.com/article/india/at-1-2-million-india-has-highest-number-of-snakebites-in-the-world-heres-why-its-dangerous-7442747/>
- [4] http://indiansnakes.org/sites/default/files/Downloads/Indian_Snakes_Checklist.pdf
- [5] <https://www.aninews.in/news/national/general-news/snakepedia-mobile-app-launched-in-kerala-to-help-people-doctors-treat-snake-bites20210214181305/>
- [6] <https://www.newindianexpress.com/cities/kochi/2022/feb/05/sarpa-app-helps-forest-dept-rescue-6851-snakes-2415452.html>
- [7] <https://www.analyticssteps.com/blogs/how-ai-revolutionizing-wildlife-conservation>