Malaria Detection using CNN

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Introduction:

Malaria is a disease transmitted by mosquitoes that generally causes high fever and chills, headache, vomiting and sometimes death. It is caused by protozoan parasites which live in the red blood cells of the human host. Symptoms often include night sweats, fevers above 101° Fahrenheit (39°C), shaking chills, and nonspecific symptoms such as malaise and fatigue. The average life expectancy after diagnosis is around one year with some patients surviving up to three years from initial diagnosis. In this project, CNN will be used to detect/predict a parasitized cell from an uninfected based on image of cells uploaded by the user.

Problem Statement:

Implement Deep Learning Techniques to detect Malaria using IBM Cloud

Solution:
Use a deep learning model called Convolutional Neural Network to predict whether a cell is infected or not by training the model on many images of both categories (infected/uninfected).

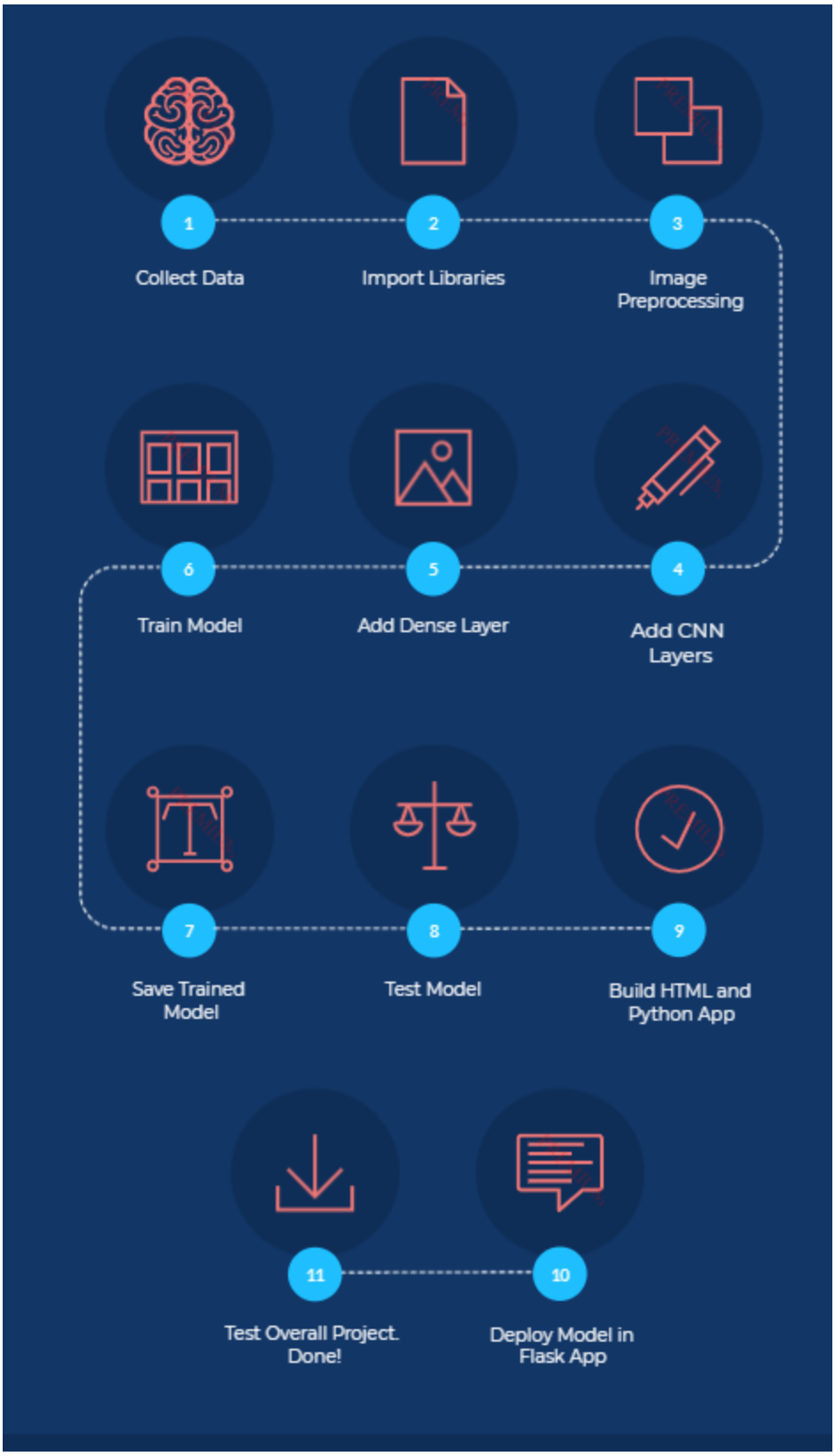
Investigation:
Artificial Intelligence (AI) is a broad category of computer programs that try to imitate the human mind. It is able to perform tasks such as perception, recognition, learning and planning. AI takes in information through sensors and can use this data to make predictions or react accordingly.

However, there are also many different types of AI which vary in how they are used and the input they require. Some types of AI use natural language processing to understand human input, making them able to converse in natural language. Others are based on scientific algorithms and can produce results based on mathematical calculations.

The most prominent types of AI include:
1. Knowledge-based AI
2. Rule-based AI
3. Supervised learning AI
4. Unsupervised learning
5. Reinforcement learning AGIs
6. Expert system hacks

A Convolutional Neural Network is essentially an artificial neural network inspired by the organization of animal brains. As such, it employs a "convolution" - or mathematically defined cross-correlation - of the input data against cell assemblies in order to extract localized patterns from the larger whole. One can think of this process as one that takes the "sense" or more superficial aspects of objects and organizes them into logical representations.

Project Flow Chart:


1
Collect Data
2
Import Libraries
3
Image Preprocessing
4
Add CNN Layers
5
Add Dense Layer
6
Train Model
7
Save Trained Model
8
Test Model
9
Build HTML and Python App
10
Deploy Model in Flask App
11
Test Overall Project. Done!

Conclusion:

Finally, I was able to build a complete CNN model to detect malaria with an accuracy of 89.1% and validation accuracy of 92%. The model was sucessfully integrated in the flask app and the app is ready to be used.

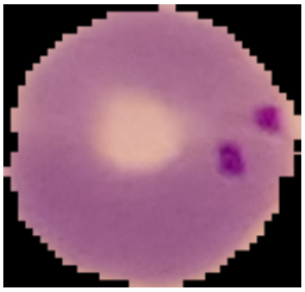
Model Results:

```
Epoch 35/40
47/47 [==============================] - 7s 139ms/step - loss: 0.2447 - accuracy: 0.9089 - val_loss: 0.2004 - val_accuracy:
0.9297
Epoch 36/40
47/47 [==============================] - 6s 137ms/step - loss: 0.2881 - accuracy: 0.8996 - val_loss: 0.2218 - val_accuracy:
0.9344
Epoch 37/40
47/47 [==============================] - 6s 137ms/step - loss: 0.2537 - accuracy: 0.9136 - val_loss: 0.2574 - val_accuracy:
0.9141
Epoch 38/40
47/47 [==============================] - 6s 137ms/step - loss: 0.2852 - accuracy: 0.8903 - val_loss: 0.2382 - val_accuracy:
0.9187
Epoch 39/40
47/47 [==============================] - 6s 137ms/step - loss: 0.2816 - accuracy: 0.8989 - val_loss: 0.2941 - val_accuracy:
0.9141
Epoch 40/40
47/47 [==============================] - 7s 141ms/step - loss: 0.2580 - accuracy: 0.8910 - val_loss: 0.2135 - val_accuracy:
0.9234

[35]: <tensorflow.python.keras.callbacks.History at 0x1872fe68748>
```

Flask Web application prediction:

Upload Image To Test For Malaria



Result : Parasitized

Future Scope:

CNN technique of image classification is a valuable tool for the future. It can be implemented in different industries and sectors. With our example related to malaria detection, CNN could be also used to detect cancerous cells within an organ in hosptials with high accuracy.