Detect Malaria Infected Cells and hotspot areas of Parasitized Cell using Deep Learning

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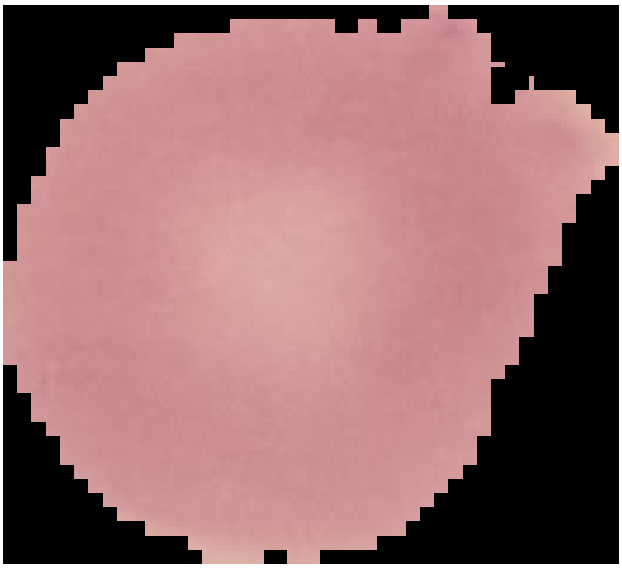
Build a cell-image classification model to detect if the cell is Malaria Infected or Not Infected.

Then highlight the hotspots in the image that influence the prediction.

Infected Cell (Parasitized)



Uninfected Cell

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1. Problem Statement :

The problem is to build a deep learning model that can detect the cell is Malaria Infected or uninfected from cell images. And highlight the hotspot in the image.

2. Build CNN Model :

I used transfer learning technique to build my model.

In transfer learning, there are some pre-trained models that can efficiently classify 1000 classes with high accuracy. I took **VGG19** model and cutdown last Dense layer (this layer is used to classify classes), and add an other Dense layer with 2 neurons (which gives probability of 2 different classes eg: in my case, infected or not).

Then I trained the new hybrid model with my dataset. But I don't need to train the layers taken from VGG19 model because the weights and biases of that layers are trained on millions of data and for 1000 different classes. So, I freeze that layers and trained my model.

The model has been trained on around 1000 cell-images for 10 epochs. (the full dataset is not considered, because of high computational cost).
The model has been tested on around 250 cell-images.

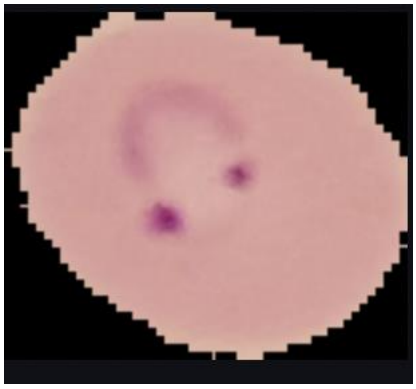
Train accuracy: 91% approx. Test accuracy: 82% approx.

3. Create HEATMAP (Using CAM) :

I highlighted class-specific regions of image to detect the parasitized area of the infected cells.

Procedure of creating the Class Activation Map (CAM) :

1) Compute the model output and last pooling layer output for the image.
2) Find the index of the winning class in the model output.
3) Compute the gradient of the winning class with respect to the last convolutional layer.
4) Average this, then weigh it with the last convolutional layer (multiply them).
5) Normalize between 0 and 1 for visualization
6) Convert to RGB and layer it over the original image.



Input cell-image

Highlited parasitized area

4. Streamlit Application :

Using Streamlit API, an application has been created which runs on local server.

- The application asks the user to specify the location path of the cell image.
- After that, it predicts whether the cell is Parasitized or Uninfected.
- If the cell is found to be Parasitized, then it will highlight the infected areas of that particular cell.

GitHub Repository : https://github.com/NilavoBoral/Malaria_Detection