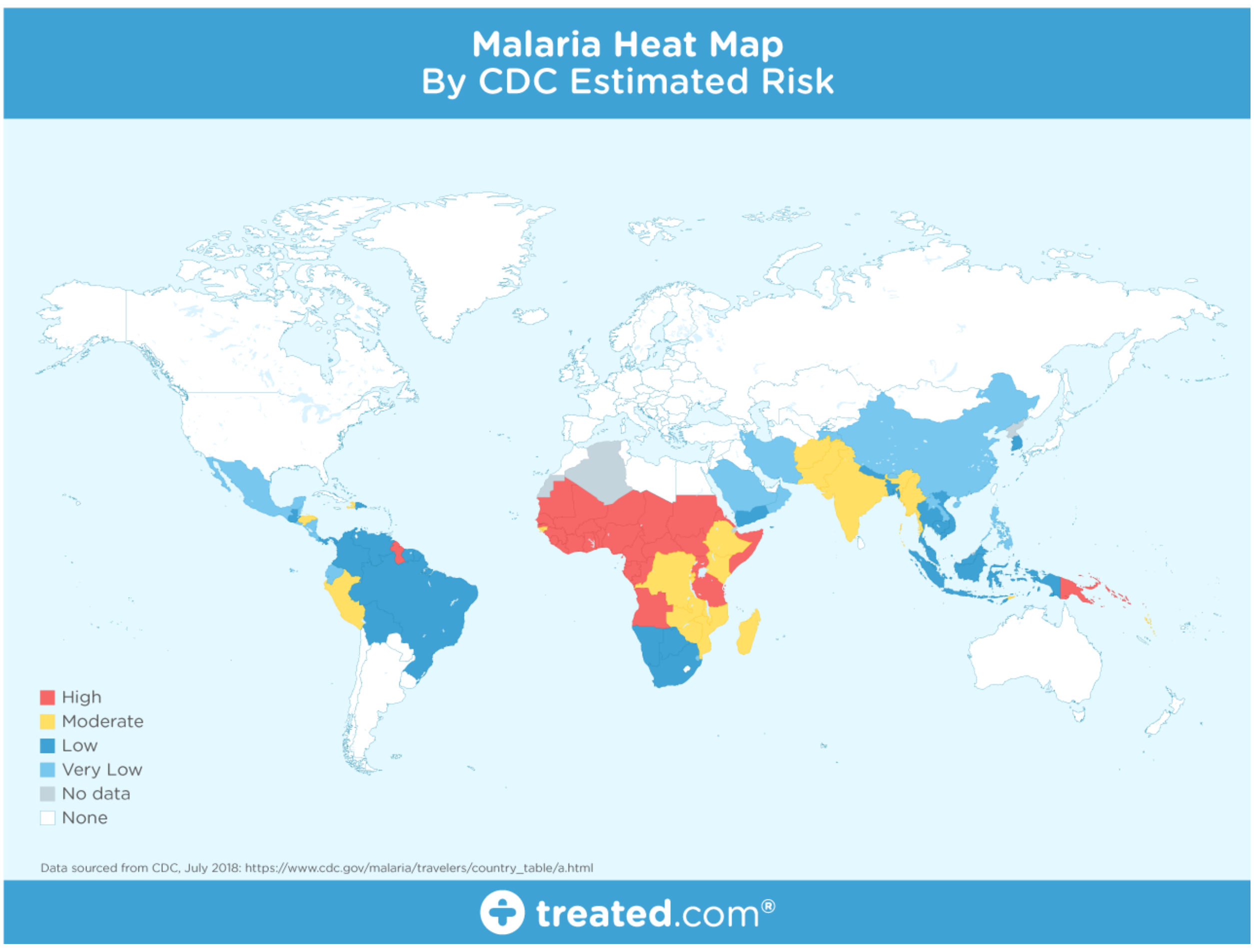
Aim: **Malaria with Deep Learning**

Abstarct : Malaria is a deadly, infectious mosquito-borne disease caused by Plasmodium parasites. These parasites are transmitted by the bites of infected female Anopheles mosquitoes. While we won't get into details about the disease, there are five main types of malaria. Let's now look at the significance of how deadly this disease can be in the following plot.

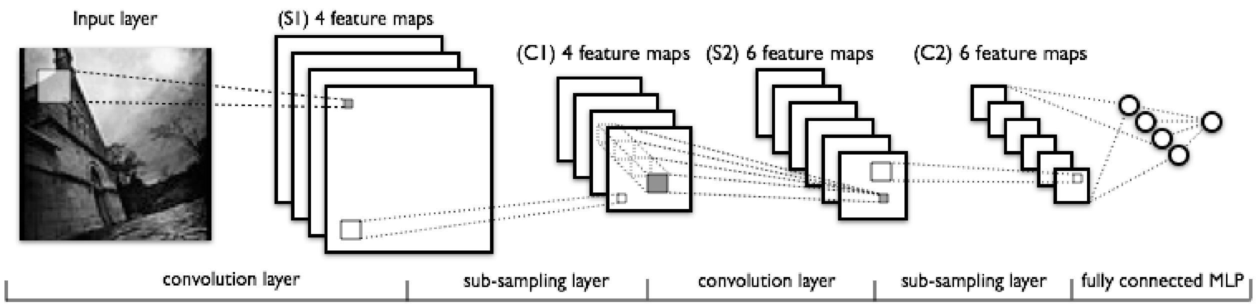


It is pretty clear that malaria is prevalent across the globe especially in tropical regions. The motivation for this project is however based on the nature and fatality of this disease. Initially if an infected mosquito bites you, parasites carried by the mosquito will get in your blood and start destroying oxygen-carrying RBCs (red blood cells). Typically the first symptoms of malaria are similar to the flu or a virus when you usually start feeling sick within a few days or weeks after the mosquito bite. However these deadly parasites can live in your body for over a year without any problems! Thus, a delay in the right treatment can lead to complications and even death. Hence early and effective testing and detection of malaria can save lives. In short, nearly half the world's population is at risk from malaria and there are over 200 million malaria cases and approximately 400,000 deaths due to malaria every year. This gives us all the more motivation to make malaria detection and diagnosis fast, easy and effective.

Deep Learning for Malaria Detection

With regular manual diagnosis of blood smears, it is an intensive manual process requiring proper expertise in classifying and counting the parasitized and uninfected cells. Typically this may not scale well and might cause problems if we do not have the right expertise in specific regions around the world.

Deep Learning models, or to be more specific, Convolutional Neural Networks (CNNs) have proven to be really effective in a wide variety of computer vision tasks.



Convolution layers learn spatial hierarchical patterns from the data, which are also translation invariant. Thus they are able to learn different aspects of images. For example, the first convolution layer will learn small and local patterns such as edges and corners, a second convolution layer will learn larger patterns based on the features from the first layers, and so on. This allows CNNs to automate feature engineering and learn effective features which generalize well on new data points. Pooling layers help with downsampling and dimension reduction.

Thus, CNNs help us with automated and scalable feature engineering. Also, plugging in dense layers at the end of our model enables us to perform tasks like image classification. Automated malaria detection using deep learning models like CNNs could be very effective, cheap and scalable especially with the advent of transfer learning and pre-trained models which work quite well even with constraints like less data.

Conclusion

We looked at an interesting real-world medical imaging case study of malaria detection in this article. Malaria detection by itself is not an easy procedure and the availability of the right personnel across the globe is also a serious concern. We looked at easy to build open-source techniques leveraging AI which can give us state-of-the-art accuracy in detecting malaria thus enabling AI for social good. I encourage everyone to check out the articles and research papers mentioned in this article, without which it would have been impossible for me to conceptualize and write this article. Let’s hope for more adoption of open-source AI capabilities across healthcare making it cheaper and accessible for everyone across the world!