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A NOVEL APPROACH FOR ROBUST IDENTIFICATION OF TICKS RELATED TO LYME DISEASE

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ABSTRACT: The motivation of how humans can benefit from modern deep learning technology in the domain of biology, especially in distinguishing ticks from mites, spiders, and other small bugs by using an artificial intelligence system. Deep neural networks are becoming powerful, encroaching on many tasks in computer vision system areas previously seen as the unique domain of humans, such as image classification, object detection, semantic segmentation, and instance segmentation. The success of a deep learning model at a specific application is determined by a sequence of choices, like what kind of deep neural network will be used, what data to be fed into the deep model, and what manners will be adopted to train a deep model.

The goal of this work is to design a practical, lightweight image classification model built and trained from scratch which serves as an assistant to researchers and users to recognize if a small bug is a tick.

INTRODUCTION

Lyme is a disease that is caused by Borrelia burgdorferi, a bacterium that is spread by ticks. The prevalence of Lyme disease has made it a major public health problem. Immediate identification of the bacteria-carrying parasites is important in preventing the epidemic. This research suggests an alternative approach which uses computer vision to identify Lyme diseases related to ticks. A dataset containing images of ticks was used to create and train a Convolutional Neural Network (CNN) model. Preprocessing and augmentation were done on the dataset with split data into training and testing sets prior to boosting model generalization. A brief introduction to various ticks in their different life stages is pesented.

PROPOSED SYSTEM

Existing system Drawbacks

- Strict Regulations
- Difficult to work with for non-technical users
- Restrictive to resources
- Constantly needs Patching
- Constantly being attacked

Proposed System:

Important steps of the algorithm are given in below.

1) Normalization of every dataset.

2) Convert that dataset into the testing and training.

3) Form IDS models with the help of using RF, ANN, CNN and SVM algorithms.

4) Evaluate every model's performances.

Advantages

- Protection from malicious attacks on your network.
- Deletion and/or guaranteeing malicious elements within a pre-existing network.
- Prevents users from unauthorized access to the network.
- Deny's programs from certain resources that could be infected.
- Securing confidential information

LITERATURE SURVEY

Tick Ecology, Distribution and Risks to Human Health

Ticks, arachnids of three millimetres to five millimetres long, are external parasites that feed on the blood of humans, dogs, deer, and some amphibians. There are mainly two kinds of ticks worldwide: the Ixodidae (hard ticks) and the Argasidae (soft ticks). There is a beak-like structure at the front mouthparts on hard ticks and a rigid shield on their dorsal surfaces, while soft ticks have their mouthparts on the underside of their bodies.

Tick Ecology

Ticks have four stages to their lifecycle, egg, larva, nymph, and adult. Hard ticks have three hosts, taking at least a year to complete their lifecycle. Soft ticks have up to seven nymphalid stages (instars), each one requiring a blood meal.

Tick Distribution and Risks to Human Health

Ticks prefer to live in a warm and humid environment. The Blacklegged Tick is the vector for Lyme disease caused by Borrelia miyamotoi. Ixodes Scapularis and Ixodes Pacificus ticks are found in about 50% of counties in the United States. The range expansion of ticks is affected by climate

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change, bird migrations, and an increasing population of hosts [16]. Ticks are vectors of many diseases and transmit infections, including African tick bite fever, Rocky Mountain spotted fever, Flinders Island spotted fever, and Queensland tick typhus (Australian tick typhus) [4]. Other tick-borne diseases include Lyme disease and Qfever[5],the Heart land virus[6],etc. Red-meat allergies, known as mammalian meat allergy and Alpha-gal allergy in the United States, are caused by Lone Star Tick bites [7].

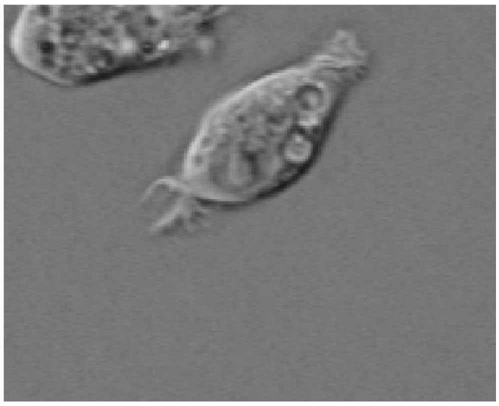
RELATED WORK

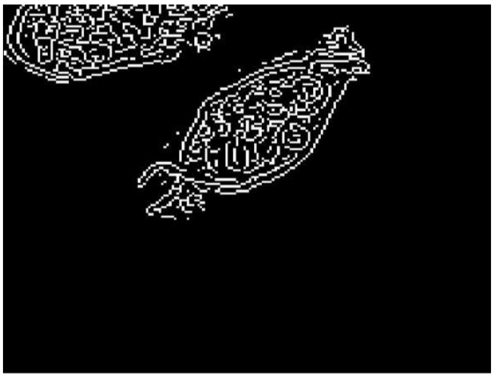
Progress has been made in image classification because of the development of convolutional neural networks (CNNs). Given a computer vision task, the balance among accuracy, speed, and memory is a trade-off work on various frameworks. In this chapter, we give a brief overview of seven convolutional neural networks for the image classification problems.

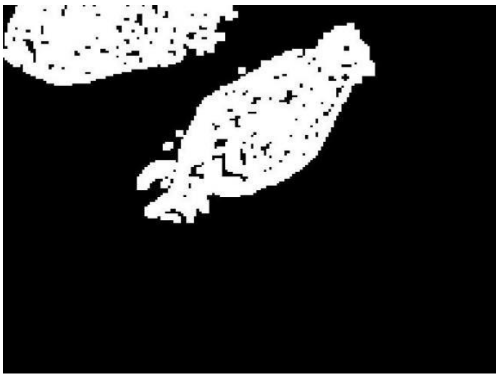
Convolution Neural Networks used in Image Classification

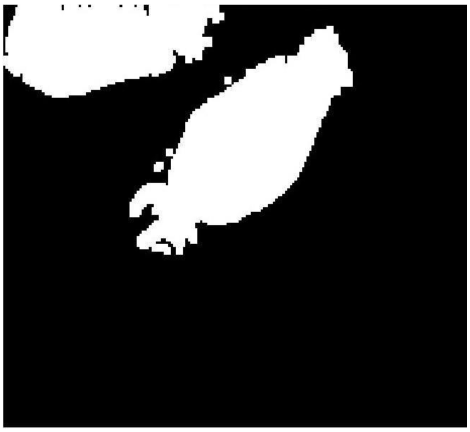
Nowadays, more and more deep neural networks become deeper with more hyperparameters. There are many techniques to address image classification problems. With a given input, deep neural networks process features to allow the computer to understand the input and generate corresponding output. Several classical CNNs are represented below.

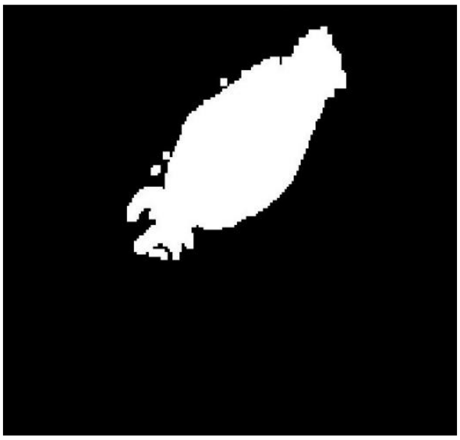
SAMPLE RESULTS

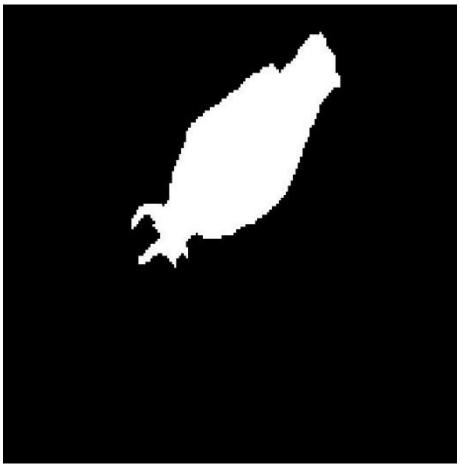


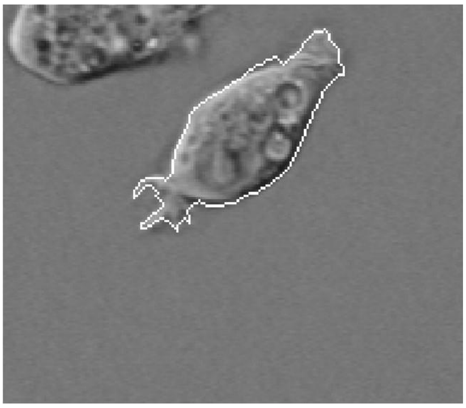












CONCLUSION

In the first phase of this work, we proposed and trained a specific image classifier to recognize and distinguish ticks from mites, spiders, and some other small bugs by using state-of-the-art, incredibly lightweight CNNs. Initially, we proposed five lightweight CNNs, and then we trained these networks on the same dataset and evaluated them on the same validation dataset. After comparing these five architectures, we chose the one with best performance, named Tick Net. Then, we conducted experiments to compare Tick Net with five other classical CNNs. Tick Net beat the five classical CNNs by 1.2M parameters, with a 5ms test speed on a GPU, a33ms test speed on a CPU, and some trade off in Top-1 test accuracy. To deploy the binary classifier on an Android device, we modified Tick Net by changing the number of neurons from one to two in the last fully connected layer. And then we trained the modified network from scratch and converted the saved TensorFlow model into a Tensor Flow Lite model.

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