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Development of a web system to annotate and verify images for use in a deep learning system to monitor pest control

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Abstract

The goal of this research project is to develop a web system that will be used by an entomologist to annotate images taken of adhesive traps for insects. Those images of traps will be photographed on cell phones and sent to a remote server for further annotation on the individual position of each insect contained in the trap. Those annotations will be fundamental to train a deep learning system that automatically recognizes the pests in the images and, by using those annotations, count them appropriately. The system is part of a bigger project to monitor pest control, and it was developed in partnership by the companies Colly Química and NeuralMind.

Key words:
Deep learning, image processing, smart monitoring.

Introduction

Insect pests can cause great damage to agriculture and livestock. Among the various pests, we have, for example, the stable fly (Stomoxys calcitrans), who feeds on the blood of cattle, propagating diseases, stressing animals, causing up to 20% of weight loss and reducing up to 60% of milk production.[1]

The control of those pests depends on monitoration of their infestation degree, so that measures to contain their population may be chosen in accordance to the level of intensity.

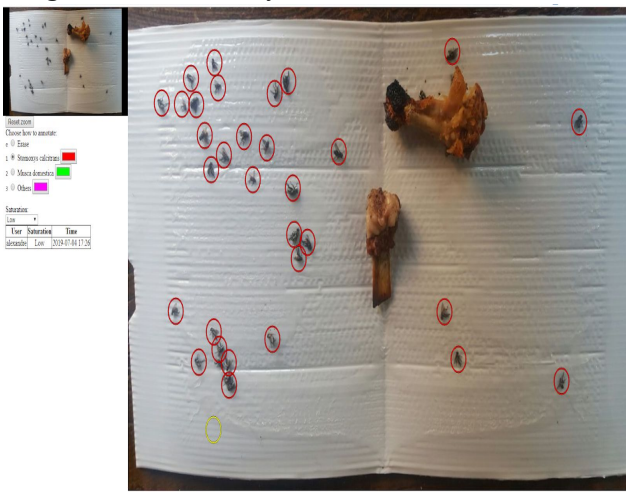
This monitoring can be done using adhesive traps that attract insects (using effects such as attractive colors, pheromones etc.) so they can be counted. These traps should be distributed around the affected areas and their replacement should happen with some frequency. However, counting insects is a laborious task and traditionally requires entomologists who can recognize the target insects and differentiate them from other unwanted specimens caught in the traps. This makes manual counting of insects expensive and not scalable, limiting the potential for monitoring these pests.

It is in this context that the advancement of machine learning, particularly in image recognition in the last six years, can be used to develop a semi-automated method for recognizing and counting target pests. The use of automated methods for image recognition can be used as a means of monitoring and quantifying the potential of effective control of target pests, reducing their negative impact on agriculture and livestock. The deep learning algorithm requires a lot of data, and therefore a web system is needed to collect and prepare the data, initially provided by an annotation interface, used by an entomologist to mark the target pests caught in the traps.

Results and Discussion

The web system consists of a login section, an image management and upload menu, and an annotation system; image 1 shows the annotation system. The web system was fully developed in Django, a python web framework, and the annotation system was also developed in Javascript, so that we can zoom in and draw circle marks.

Image 1. Annotation System



The web system is currently in use to gather the training data needed for the deep learning network. From these results, it becomes clear that the Web system is working properly and is able to prepare the training data for the deep learning algorithm.

Conclusions

The development of the deep learning system to monitor pest control requires training data to be effective. The web system shown serves as a reliable and effective platform for managing and annotating images, and thus, is capable of amassing enough monitoring data to train the deep learning algorithm.

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[1] PESQUISA IDENTIFICA RESISTÊNCIA DA MOSCA-DOS-ESTÁBULOS A INSETICIDA. EMBRAPA. Available in: <https://www.embrapa.br/busca-de-noticias/-/noticia/20420229/pesquisa-identifica-resistencia-da-mosca-dos-estabulos-a-inseticida>. Accessed in: 10 jun. 2018.