Image Analysis for Detection of Potential Mosquitoes Breeding Sites

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Final project due the **Digital Images Processing** topic,
from **Prof. PhD. Tiago Vieira**.

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Computer Engineering, 2017.1.

Summary

1. Scenario
2. Motivation
3. Our Purpose
4. Related Work
5. Deadlines
6. References

1. Scenario

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“Pregnancy with Chikungunya causes damage to the central nervous system, heart and skin of newborns.”

“Congenital malformation in babies, particularly microcephaly, is associated to Zika virus infection in pregnant women.”

[1] Portal de Periódicos Fiocruz, November 2015.

“From January to July, there were registered 1.4M cases of Dengue, 170K cases of Chikungunya and 174K cases of Zika.”

[2] Ministério da Saúde, July 2016.

“Microcephaly associated with Zika will cost up to US $ 10 billion for Brazil.”

[3] ONU BR, August 2017.

1. Scenario

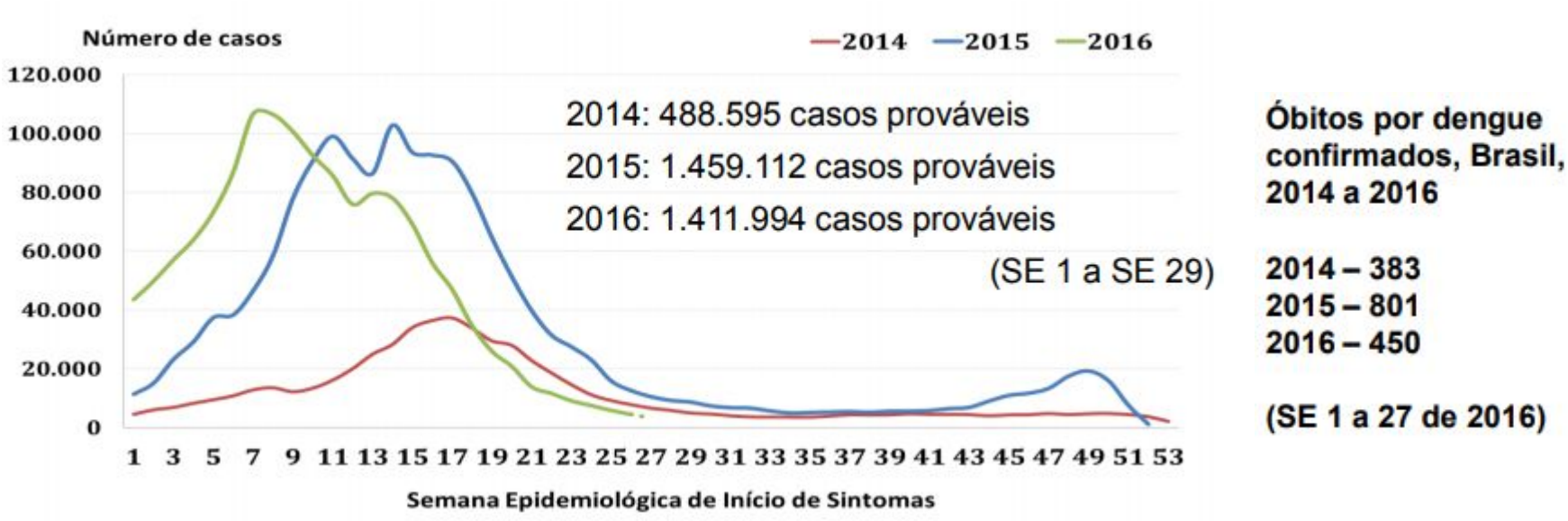

Image 01: Epidemiological situation of Dengue.
Weeks 1 to 27 from 2016.
Source: Sinan-NET, July 2016.

1. Scenario

REGIÕES	Casos notificados de Microcefalia e/ou Alterações do SNC[2], sugestivos de infecção congênita, em fetos, abortamentos, natimortos ou recém-nascidos			TOTAL	
	2015-2016				
	em investigação	confirmados	descartados	Nº	%
Brasil	2978	1806	4106	8890	100
NORDESTE	1803	1517	2983	6303	70,9
SUDESTE	828	146	570	1544	17,4
CENTRO-OESTE	149	78	289	516	5,8
REGIÃO NORTE	163	52	154	369	4,2
SUL	35	13	110	158	1,8

Image 02: Epidemiological situation of Dengue.
Weeks 1 to 27 from 2016.
Source: Secretaria de Saúde dos Estados e Distrito Federal, August 2016.

1. Scenario

Image 03: Aedes aegypti

Phylum - Arthropoda

Class - Hexapoda

Order - Diptera

Family - Culicidae

Genus - Aedes

Species - Aedes aegypti

1. Scenario

Aedes aegypti is the main vector for:

- Dengue fever
- Chikungunya
- Urban yellow fever
- Zika

Proper from tropical and subtropical regions, does not resist to cold or high altitudes. Their life cycle have about 30 days.

The male mosquito eats nectar and plant sap.

The **female**, however, **needs blood** for the eggs maturation.

These eggs are placed close to clean still water - optimal condition for their survival. In a life cycle, a female generate between **150 and 200 eggs** [4].

What does Vertical Transmission mean?

Can a female insect get rid of the virus?

2. Motivation

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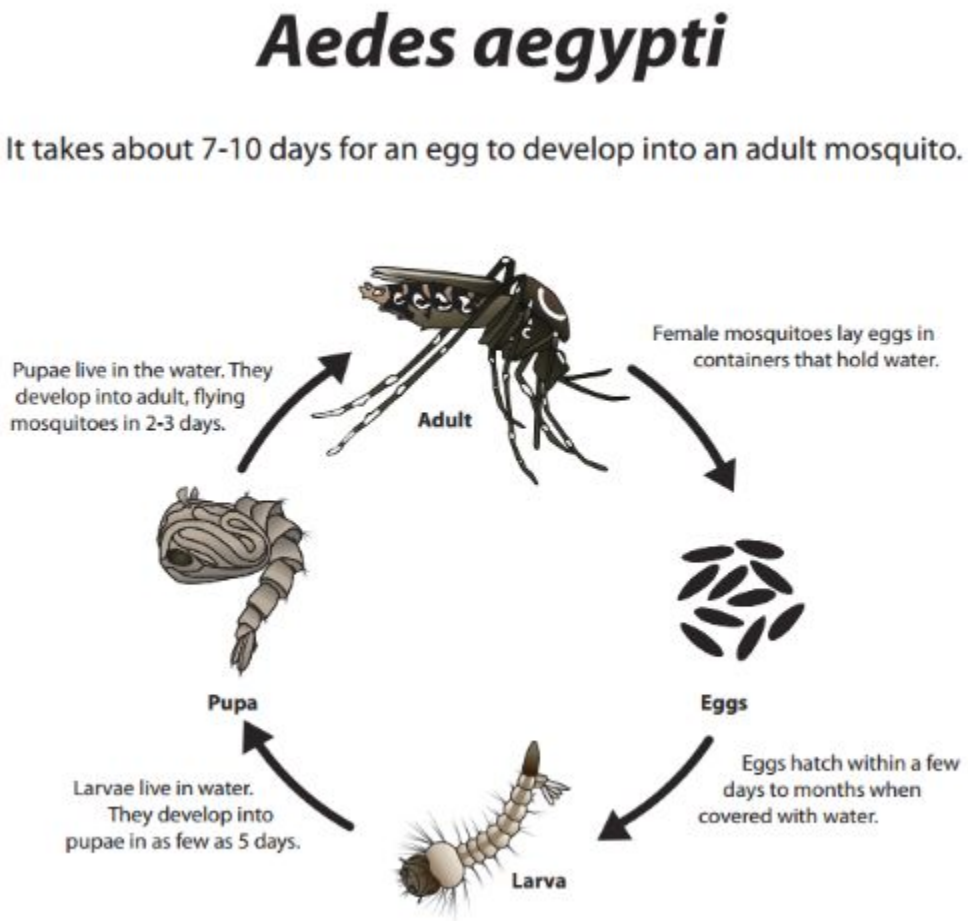


Image 02: Life cycle of Aedes aegypti.
Centre on Climate Change and Public Health [5]

2. Motivation

The Aedes mosquito has four phases in life cycle (egg, larva, pupa and mosquito).

The first 3 phases are aquatic, depending on stagnant water to complete.

One way of combating the virus transmission is neutralizing mosquito breeding sites (preventing the vector reproduction).

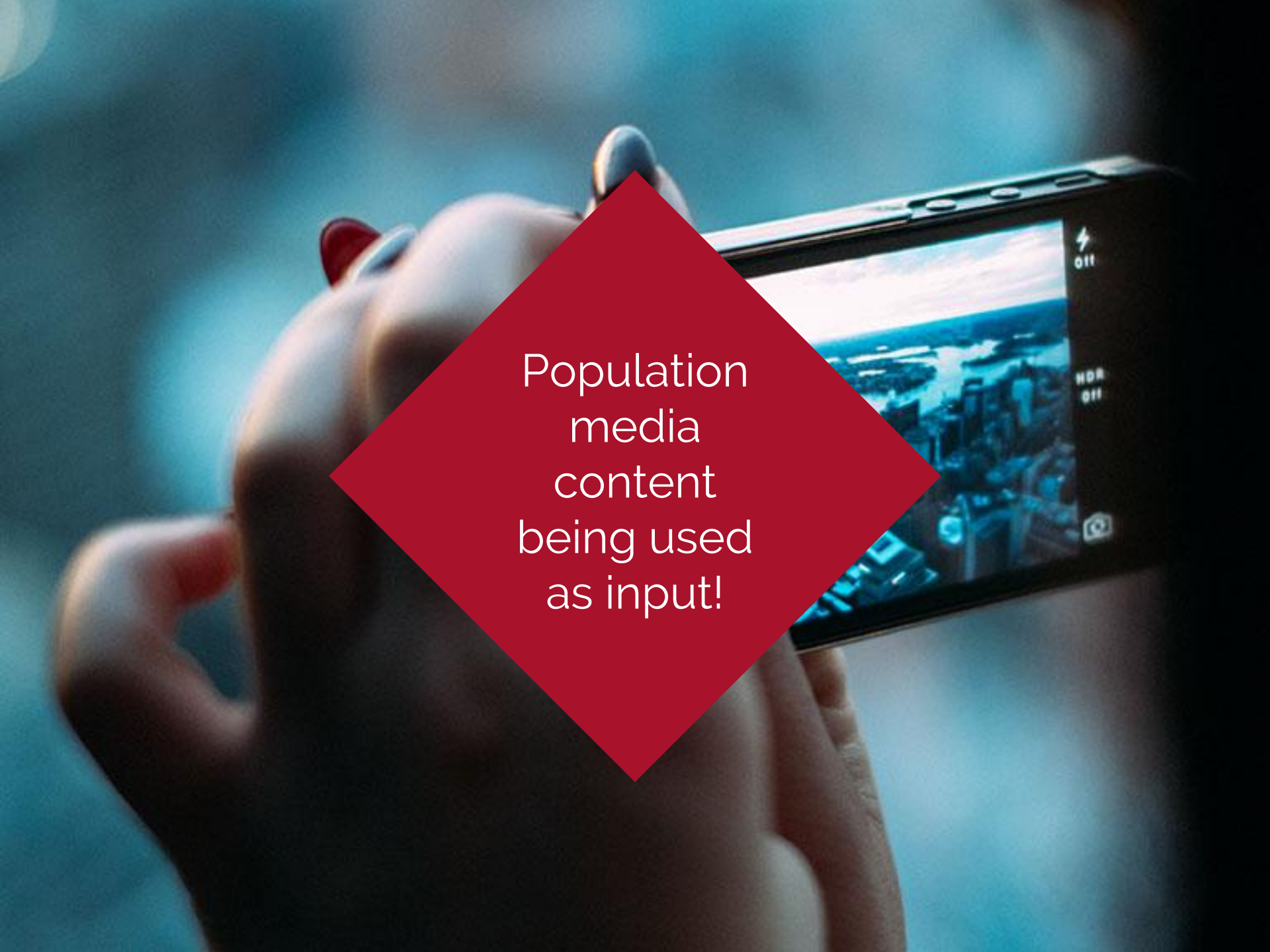
We already try to do it. However, finding all the places with still water is hard.

CNNs CAN HELP!

What if computers were able to identify possible breeding sites analyzing images?

A picture is worth a thousand words

It would be possible to crawl images from different sources and automatically search for dangerous locations.


Population
media
content
being used
as input!

3. Our purpose

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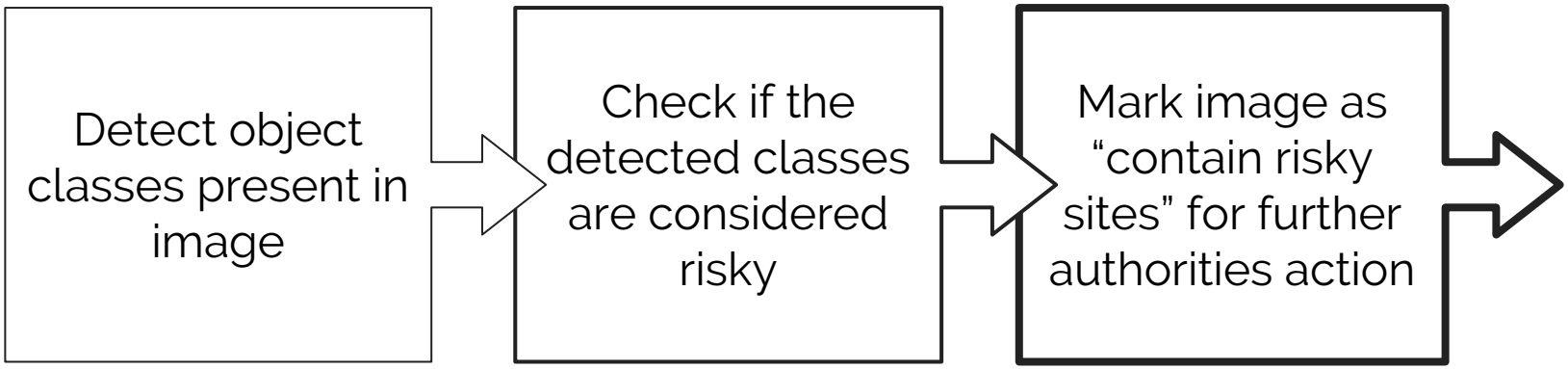
We propose train a Deep Neural Network for detecting objects that are potential sites for mosquito breeding.

Classes that will be looked for are five: water tanks, plant pots, empty bottles, car tires and rubble areas. Future works can include more classes.

We aim to use [7] Intel Distribution for Caffe*, that supports Single Shot MultiBox Detector to detect objects in images using a single deep neural network.

The network we intend to use is the MobileNet model, which is optimized to be used in limited resources devices.

3. Our purpose



4. Related work

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- (2016) Image Analysis for Identifying Mosquito Breeding Grounds

“Presents an automated technique using pipeline of binary classifiers that is resilient to picture quality, lighting and scene color mixtures. The system detects whether or not each the image has a puddle.”

It differs from our purpose by the fact of using a classifier. A classifier can only detect the most probable class of the whole image.

Object detectors can detect many objects of many classes at the same image, instead.

4. Related work

- (2017) Mosquito larva classification method based on convolutional neural networks

"We propose an efficient method to identify larva of Aedes mosquitos using convolutional neural networks (CNN) applied to the larva's images captured by mobile devices."

The paper proposes a method to identify if there is Aedes larva into an image. The idea is that people can automatically know in the moment the picture is taken from the local (the picture need to be from a close spot).

Our work can be used as a prior tool for this paper. Before getting close to the larvas site, we need to know where can larva be placed.

4. Related work

- (2017) Identifying Mosquito Breeding Sites via Drone Images

“The proposed approach processes images captured from a drone to identify possible sites where stagnant water may retain and highlights if such areas are apparent within the image. ”

This paper goal is the similar to ours. The difference is their use of Drones. Our work goal is the use images from the internet or other sources (as population social media content).

By the way, the prediction phase is intended to futurely run in a mobile device (such as a Raspberry or smartphone).

5. Deadlines

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- From 10/29 to 11/03: Installation of Intel Distribution components for Neural Networks; Definition of tools and models that will be used.

- From 11/06 to 11/10: Dataset preparation; Learning of how to train a object detection model.

- From 11/13 to 11/17: Train our model and check the results; Check how can the model be improved.

- From 11/20 to 11/24: Try to improve our model. And compare results with previous ones.
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- From 11/27 to 12/01: Presentation week.

Thanks!

ANY QUESTIONS?

You can find me at:
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References

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- [2] Epidemiological situation about Dengue, Chikungunya and Zika 2016

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- [3] Microcephaly associated with Zika will cost up to $ 10 bi

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- [9] How to train your own Object Detector with TensorFlow's Object Detector API

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