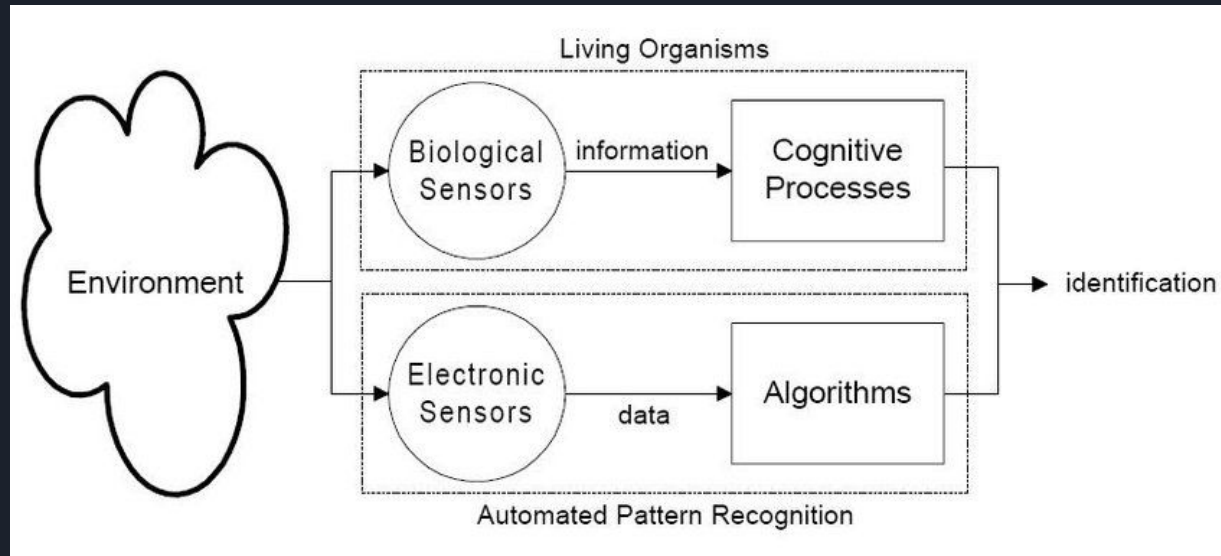


Machine Learning para Reconhecimento de Imagens

Pedro Philippi Araujo

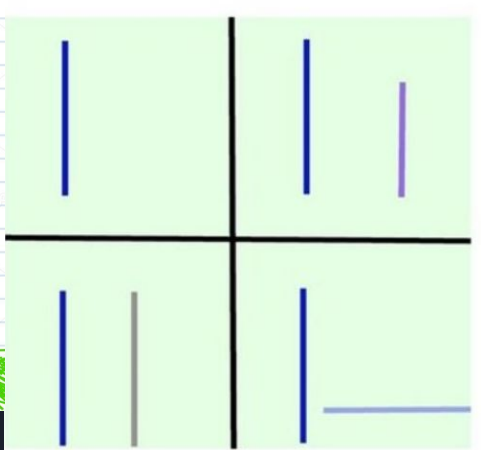
Um pouco sobre Psicologia

Reconhecimento de padrões: Capacidade do cérebro humano de reconhecer aspectos similares de um conjunto de dados apresentado.

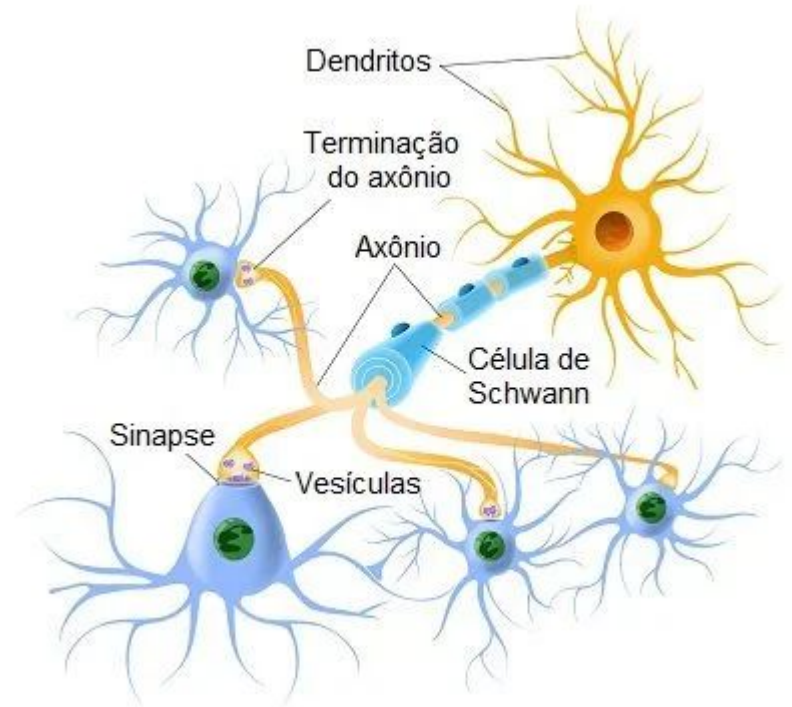
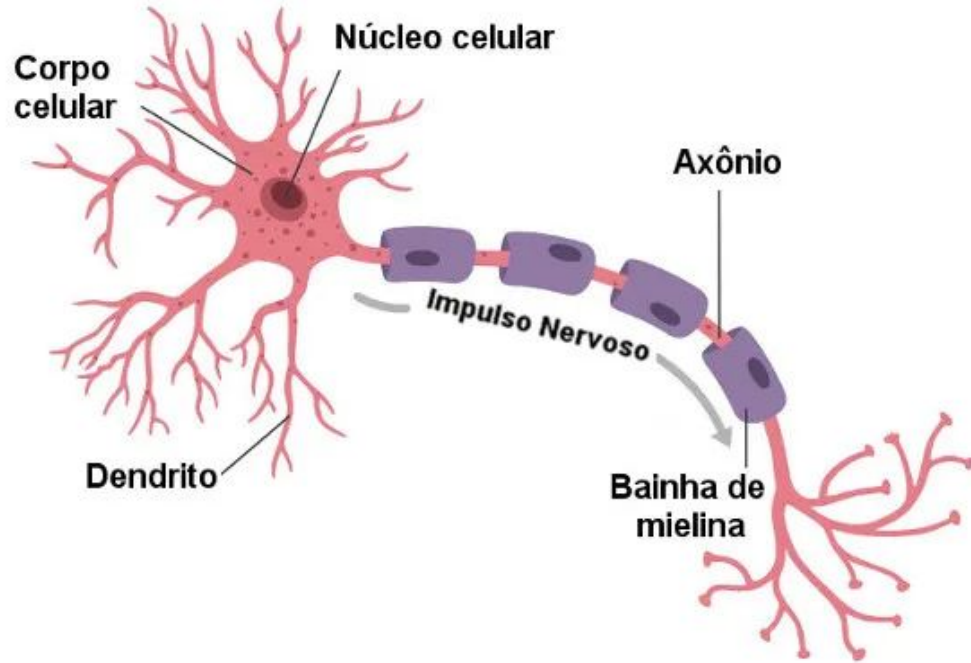


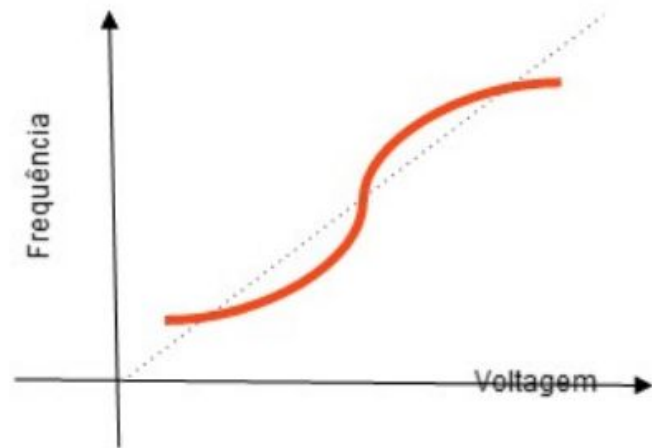
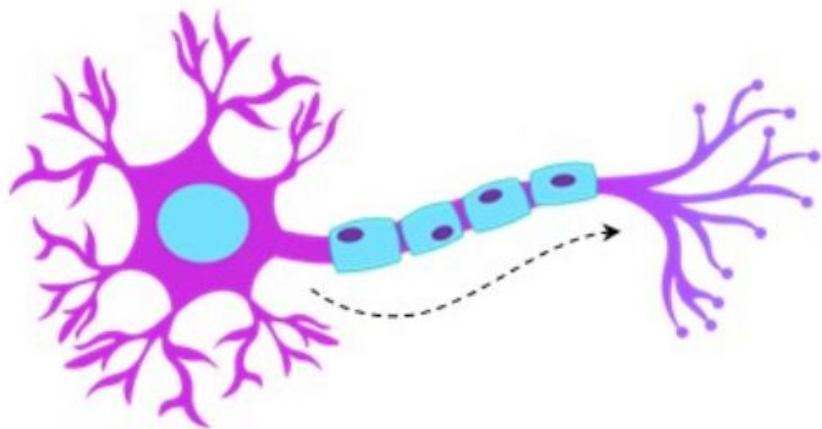






Neurônios e Sinapses







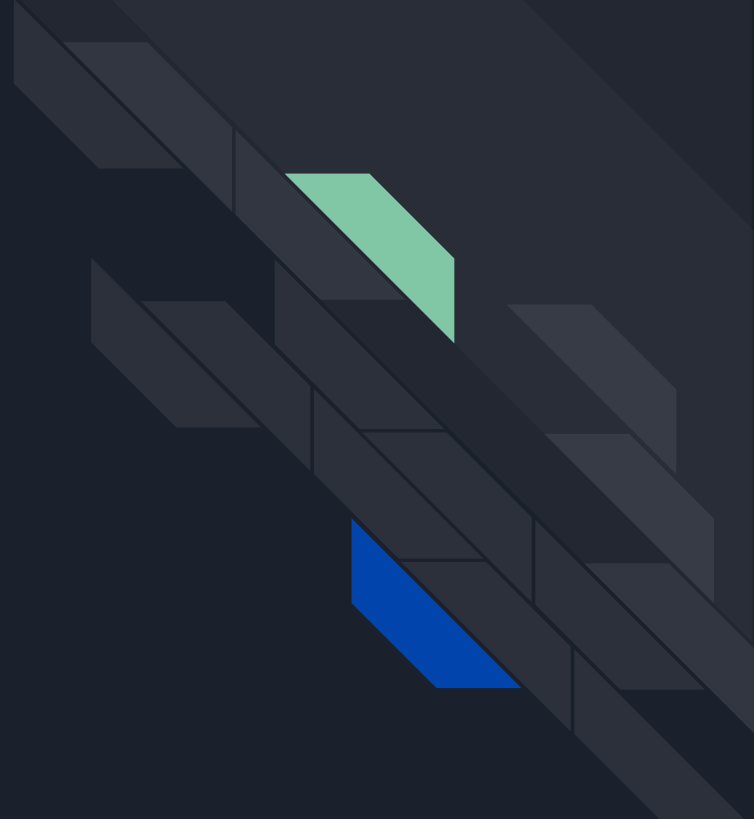
analog signal



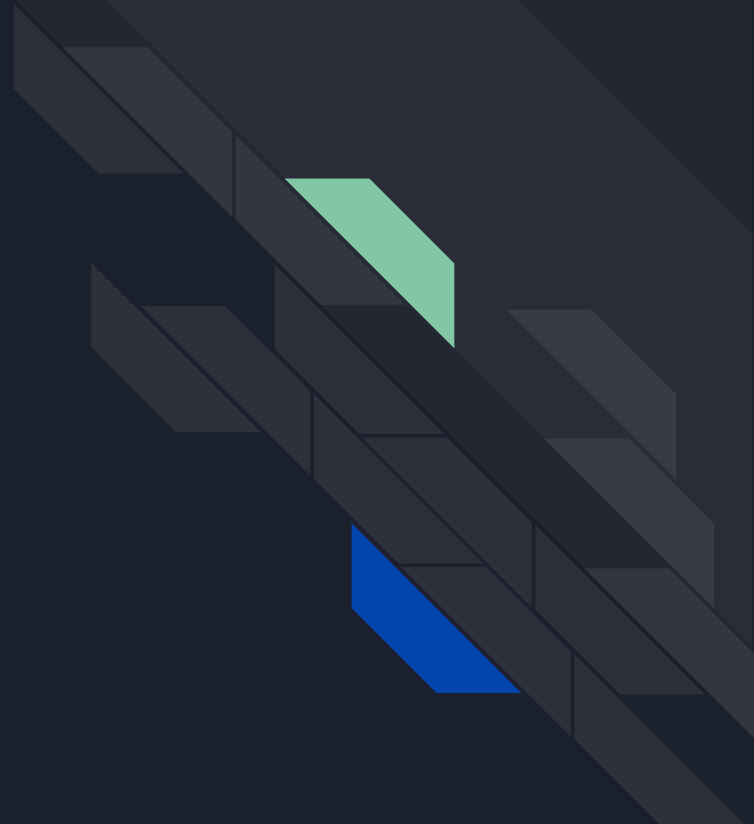
digital signal



Problema: Como ensinar
padrões para o
computador?

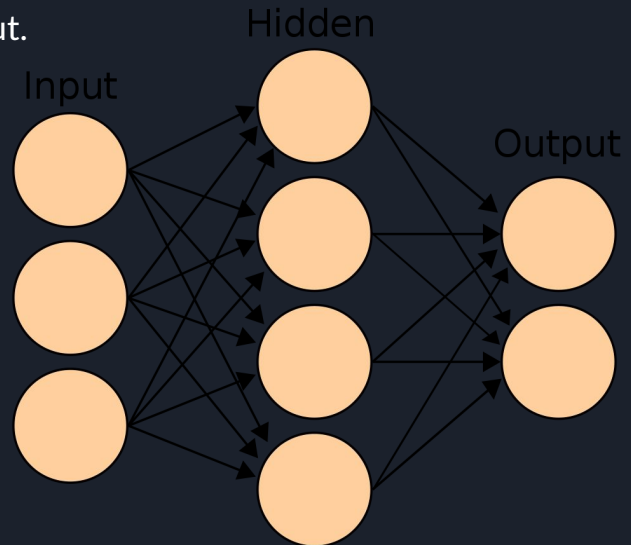


Redes Neurais



Redes Neurais Artificiais (ANN)

- Baseado em uma coleção de nodos conectados, chamados de "neurônios artificiais".
- Conexões entre os nodos são as sinapses.
- Uso de pesos para diferenciar nodos
- Divididos em camadas: Input, Hidden, Output.



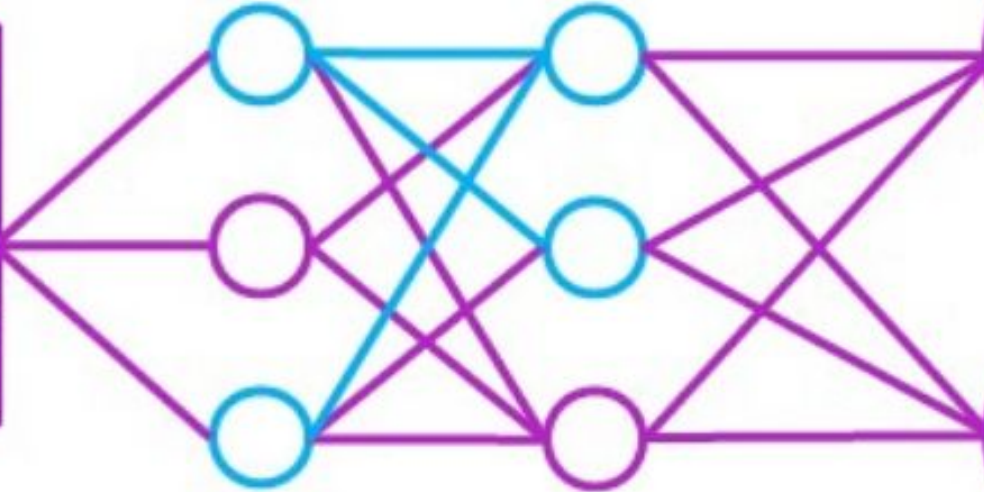


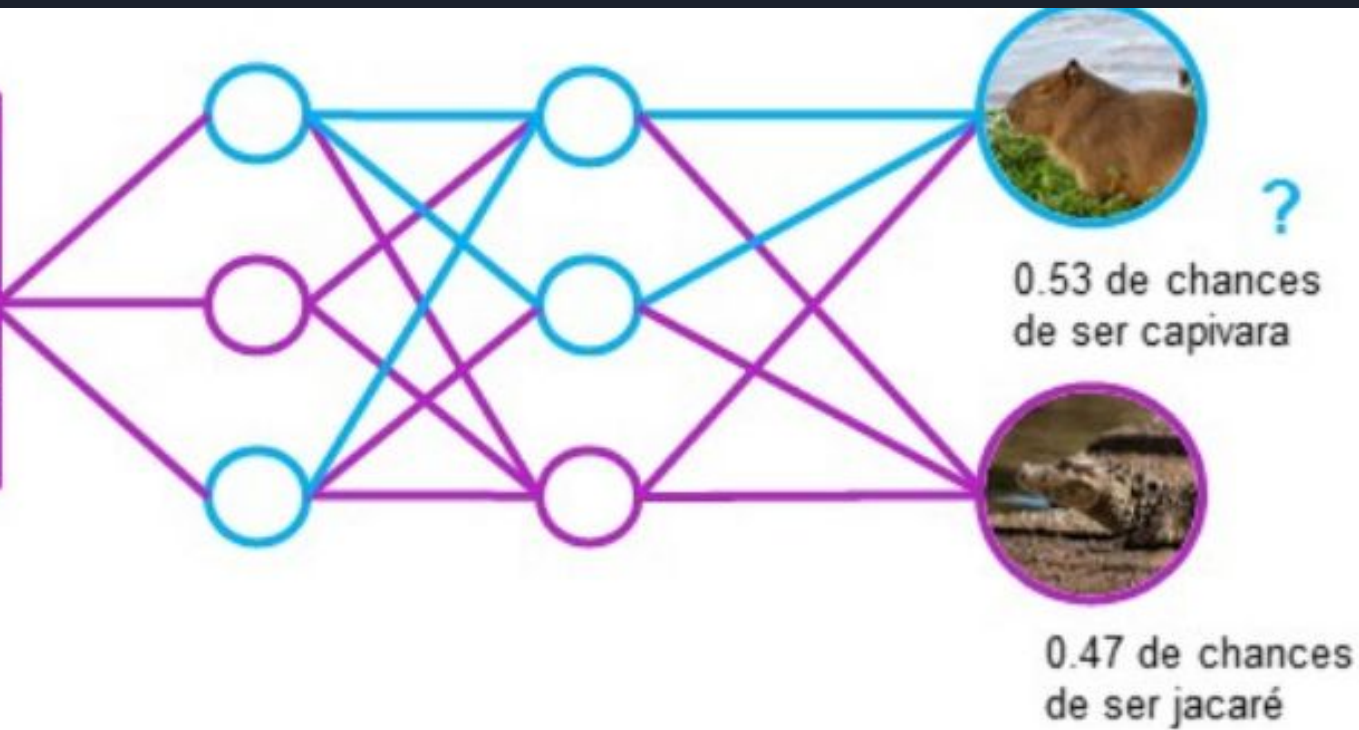
Fase de Treinamento

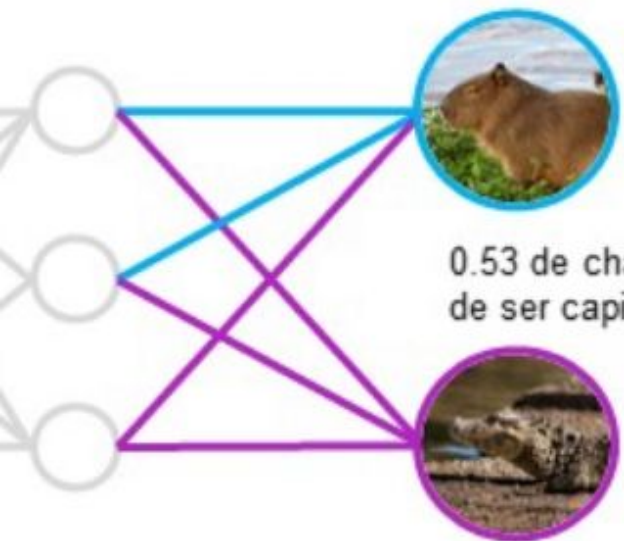
Colocamos imagens dos objetos que queremos classificar.

A IA irá estruturar os neurônios e sinapses baseados nas previsões e corrigir pesos quando erra

Dependendo da complexidade, pode ser necessário desde dezenas a centenas de imagens.







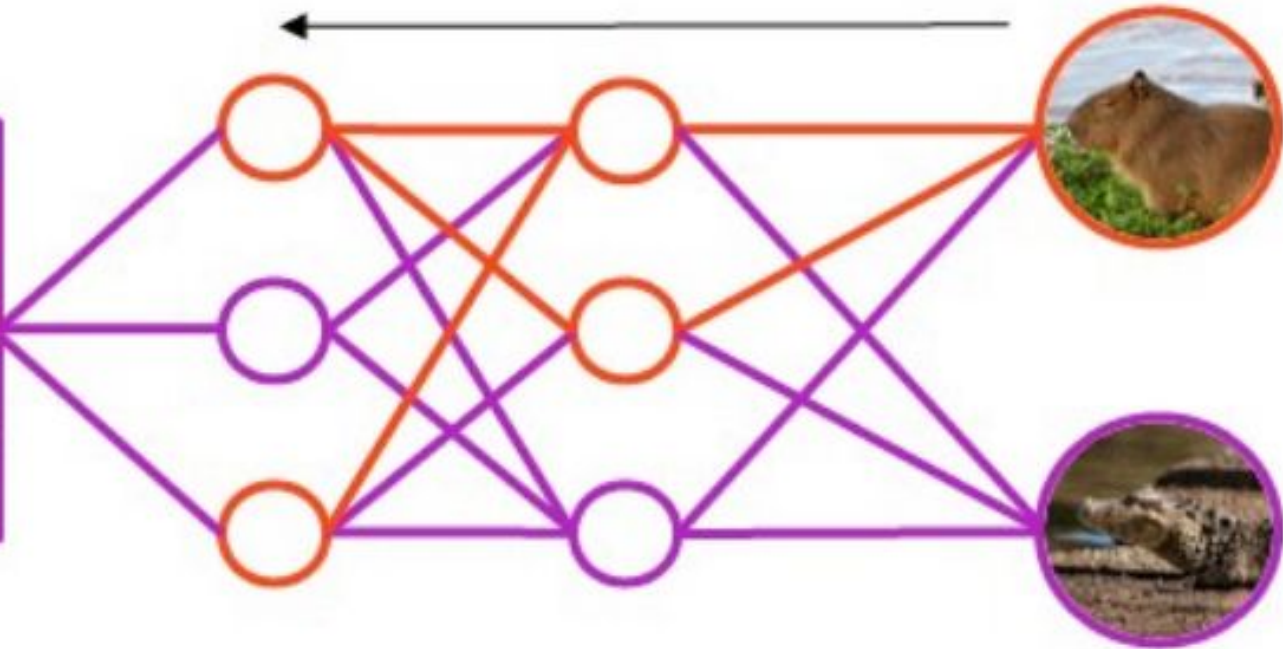
0.53 de chances
de ser capivara



0.47 de chances
de ser jacaré

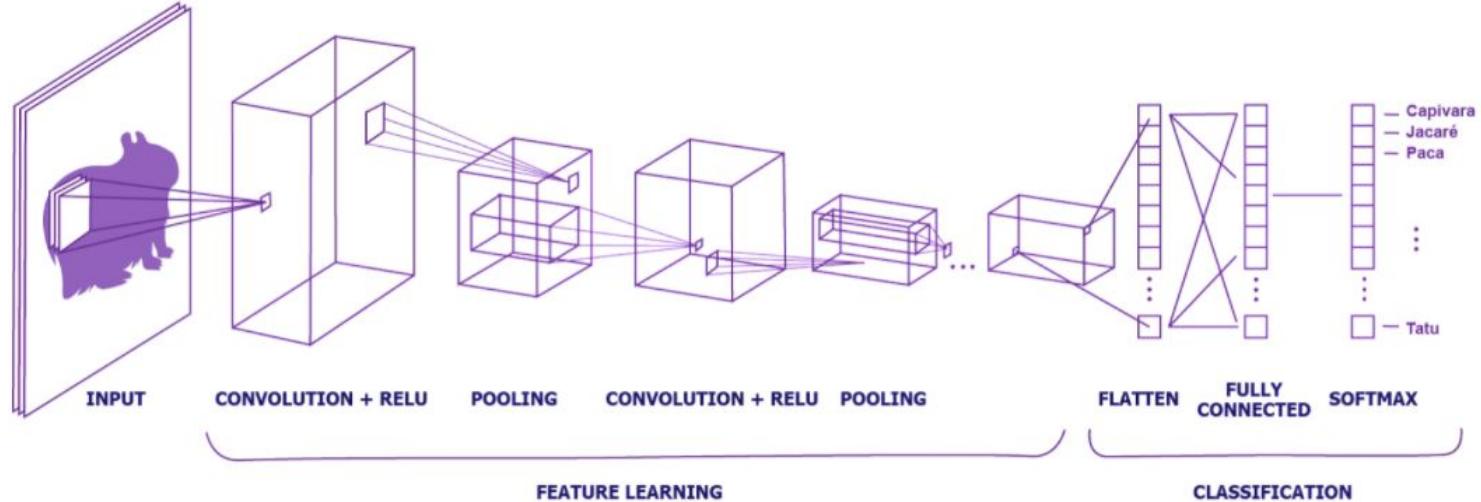
$$\begin{aligned} & \rightarrow (0.53 + 0)^2 = 0.2809 \\ & \quad + \\ & \rightarrow (0.47 + 1)^2 = 2.1609 \\ & \quad = \quad + \end{aligned}$$

Custo de 2.4418



Rede Neural Convolucional (RNC)

A Rede Neural Convolucional, também conhecida como **RNC**, é um tipo de rede neural profunda que é boa para resolver problemas de visão computacional, como classificação de imagens.



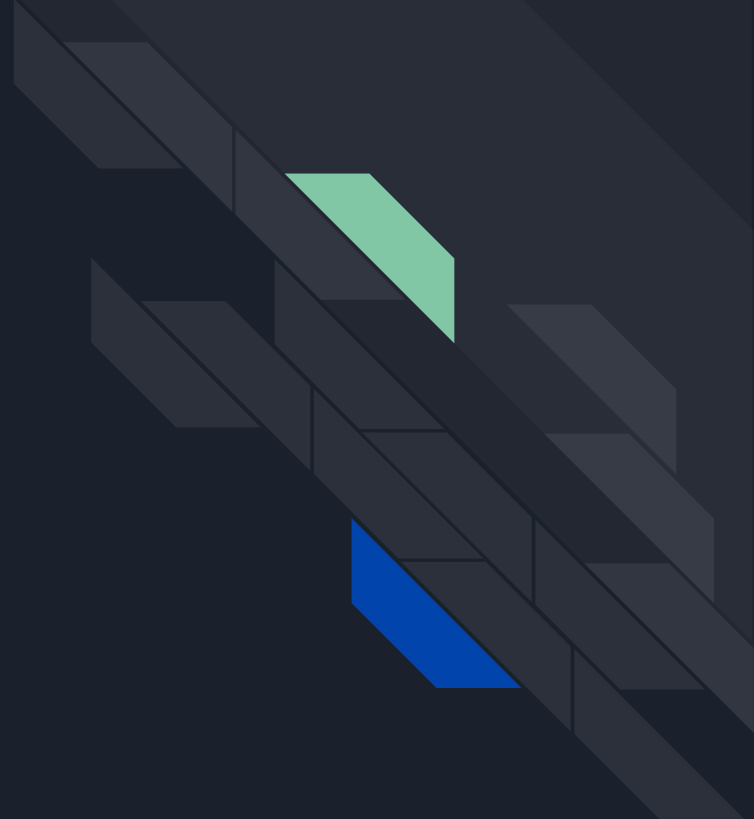


Fase de Previsão

Separamos uma parcela do conjunto de dados, que não será usado no treinamento para testar a precisão do modelo.

Caso não chegue ao resultado desejado, podemos treinar novos modelos, ajustando quantidade de épocas, taxa de aprendizado e batch size.

Experimento Prático



Apresentando Cora e Margot



Cora 



126 Image Samples




Margot 



32 Image Samples



 Add a class

Training

Train Model

Advanced 

Preview

 Export Model

You must train a model on the left before you can preview it here.

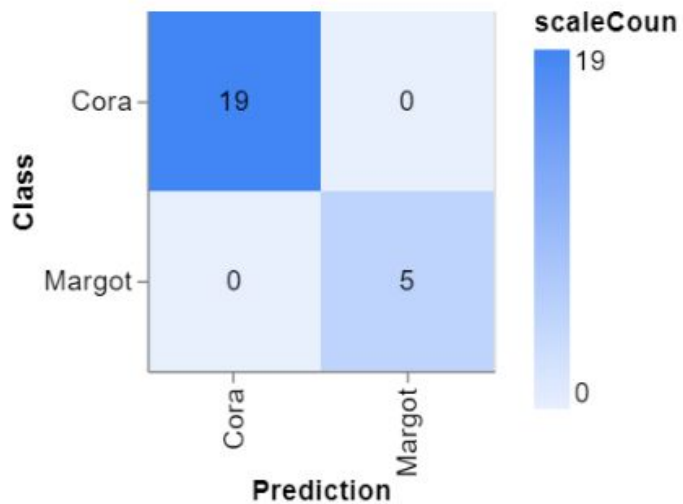
Accuracy per class

CLASS	ACCURACY	# SAMPLES
-------	----------	-----------

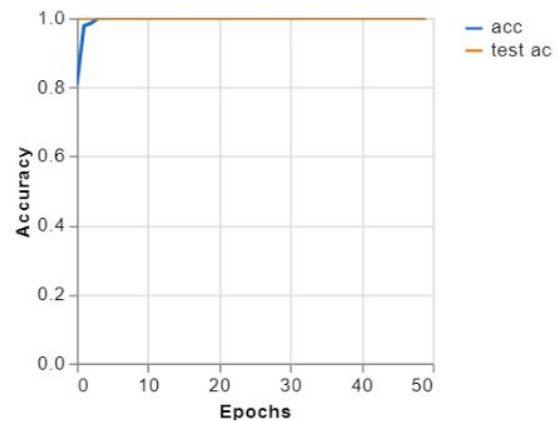
Cora	1.00	19
------	------	----

Margot	1.00	5
--------	------	---

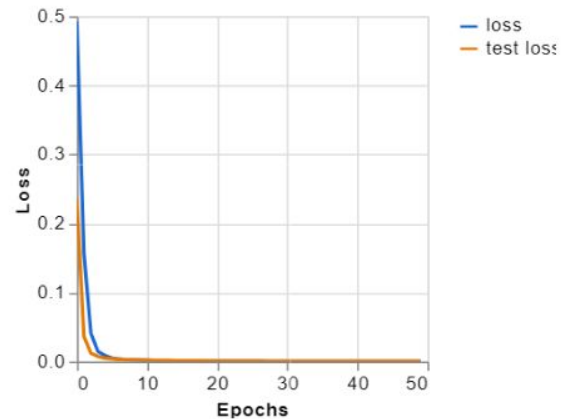
Confusion Matrix



Accuracy per epoch



Loss per epoch



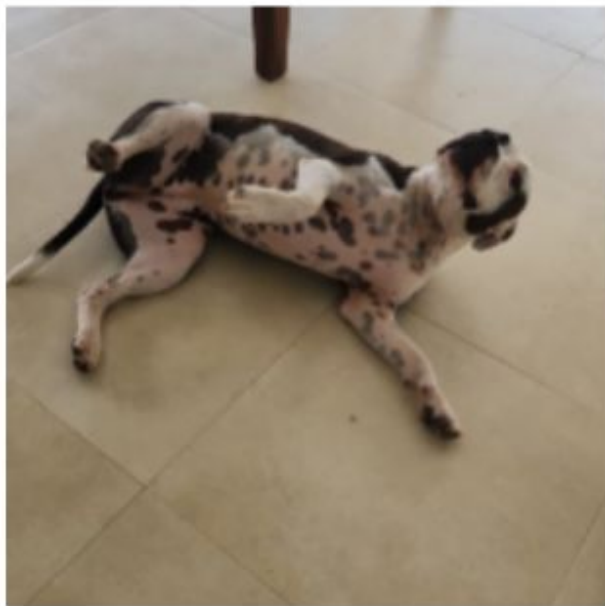


Output

Cora

100%

Margot



Output

Cora



Margot





Output

Cora

41%

Margot

59%

Cora

126 Image Samples



Margot

32 Image Samples



NoPet

328 Image Samples



Add a class

Training

Model Trained

Advanced

Epochs: 50

Batch Size: 16

Learning Rate:
0,001

Reset Defaults

Under the hood

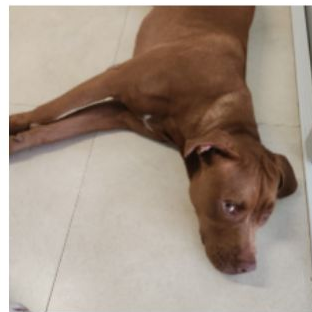
Preview

Export Model

Input ON File

Choose images from your files, or drag & drop here

Import images from Google Drive



Output

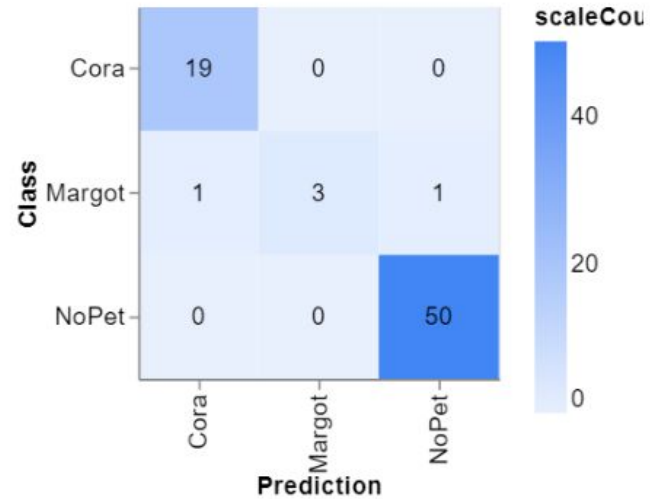
Cora 100%

Accuracy per class



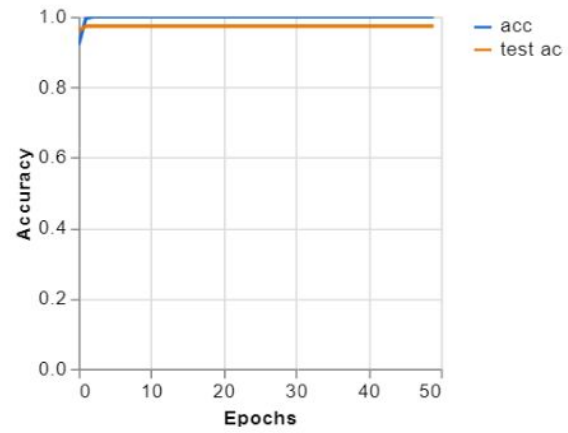
CLASS	ACCURACY	# SAMPLES
Cora	1.00	19
Margot	0.60	5
NoPet	1.00	50

Confusion Matrix

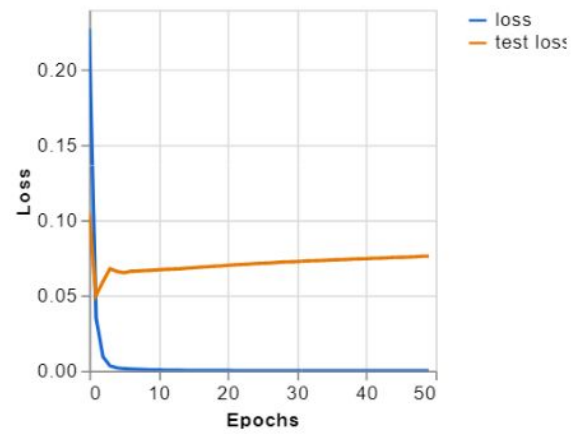


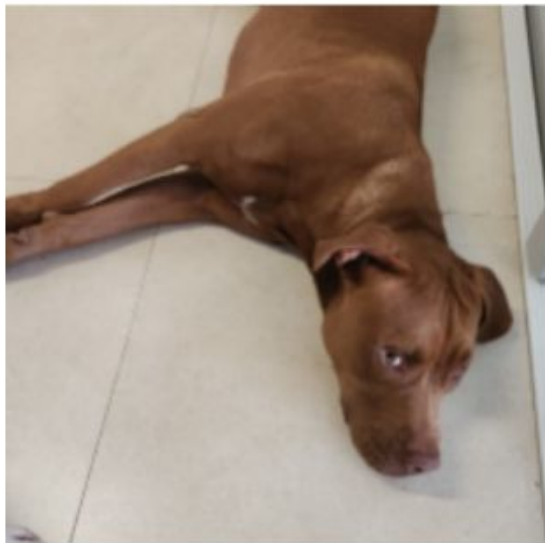


Accuracy per epoch



Loss per epoch





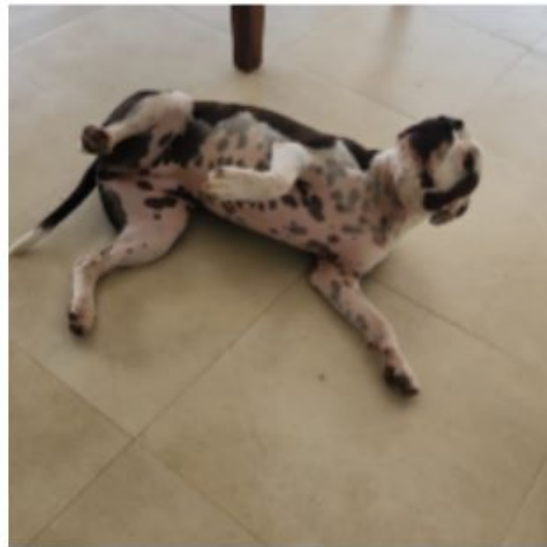
Output

Cora

100%

Margot

NoPet



Output

Cora



Margot



NoPet





Output

Cora



Margot



NoPet



100%

Xô 
DENGUE

Let's prevent Dengue!



What is Dengue?

Dengue is a **viral disease** transmitted mainly by the bite of the ***Aedes aegypti* mosquito** infected with the dengue virus

Epidemic of dengue cases in the state of Santa Catarina/Brazil

Florianópolis vive epidemia de dengue e é a 3ª cidade com mais casos em SC; veja por bairro

SC confirma quatro mortes e 1,7 mil casos de dengue em uma semana



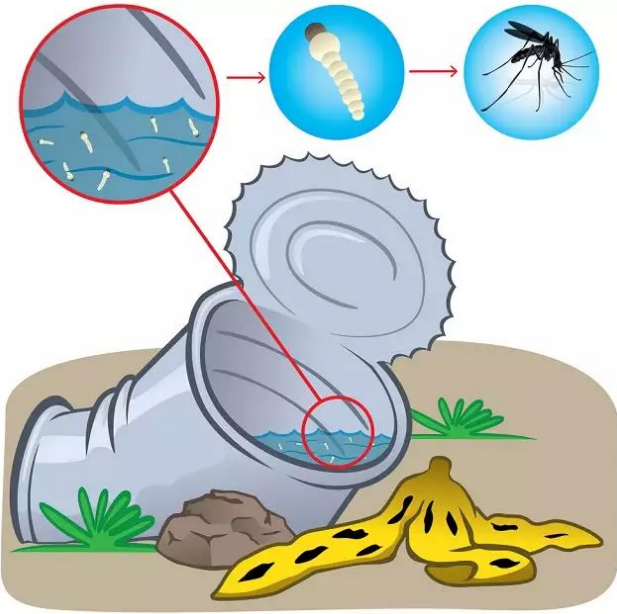
AEDES AEGYPTI

Santa Catarina registrou 85,9 mil casos de dengue em 2022

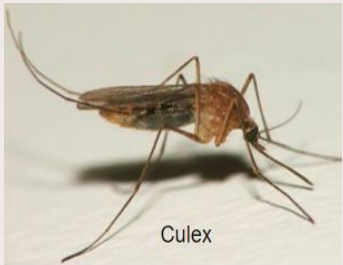
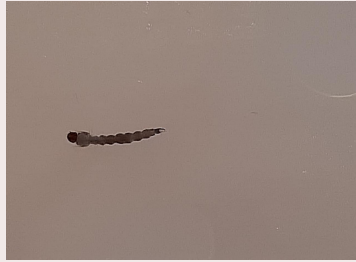
Também foram identificados 163 casos de chikungunya e 44 de zika, doenças transmitidas pelo Aedes aegypti

How Dengue can be prevented?

Eliminating points with **stagnant water** that are mosquito larvae breeding sites



Types of mosquitoes and larvae



Adult mosquitoes have characteristics that are easier to identify such as stripes and legs

In larvae the differences are more subtle

Usually, only a specialist is able to identify the species of a larva

App Xô Dengue



Help citizens to know if a mosquito larva s/he found is an *Aedes aegypti* (potential dengue vector)

We consider the main mosquito larvae found in urban environments in Santa Catarina/Brazil

- *Aedes albopictus*
- *Aedes aegypti*
- *Culex sp*
- and images of objects that are not mosquito larvae (**Nonmosquito**)

Requirements

User Story	AS a citizen I WANT to find out which is the species of a mosquito larva TO prevent a dengue epidemic
Functionalities	Classify the species of a mosquito from a photo of the mosquito larva
	Provide information on how to prevent the proliferation of the mosquito that transmits dengue

Machine Learning model

Task	Classify the mosquito specie based on a photo of the mosquito larva captured with the camera of an Android cell phone
------	---

Categories	<i>Aedes aegypti</i> , <i>Aedes albopictus</i> , <i>Culex</i> sp., Nonmosquito
------------	--

Risk and performance requirements

Risk	Misclassifying mosquito larvae species may harm actions for dengue prevention
------	---

Performance	The model will be optimized for accuracy to reduce the risk misclassification
-------------	---

Metrics	Accuracy(total/per category)	At least 0.95
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Dataset

Data source and labeling	Photos captured with a cell phone camera by researchers from the Computing in School Initiative/UFSC in cooperation with the Hematozoa Transmitter Laboratory/UFSC and the Laboratory Reference Network Coordination/Central Public Health Laboratory of SC
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Amount of data	Total no. of images: 1900 <i>Aedes aegypti</i> (649), <i>Aedes albopictus</i> (464), <i>Culex</i> sp (447), Nonmosquito (340)
----------------	--

Aedes aegypti ⋮

649 Image Samples

Webcam

Upload

Aedes albopictus ⋮

464 Image Samples

Webcam

Upload

Culex sp ⋮

544 Image Samples

Webcam

Upload

Nonmosquito ⋮

340 Image Samples

Webcam

Upload

Training

Model Trained

Advanced ⤴

Epochs: ⋮

Batch Size: ⋮

Learning Rate: ⋮

Reset Defaults 🕒

Under the hood 📄

Vocab ⤴

Accuracy per class ⋮

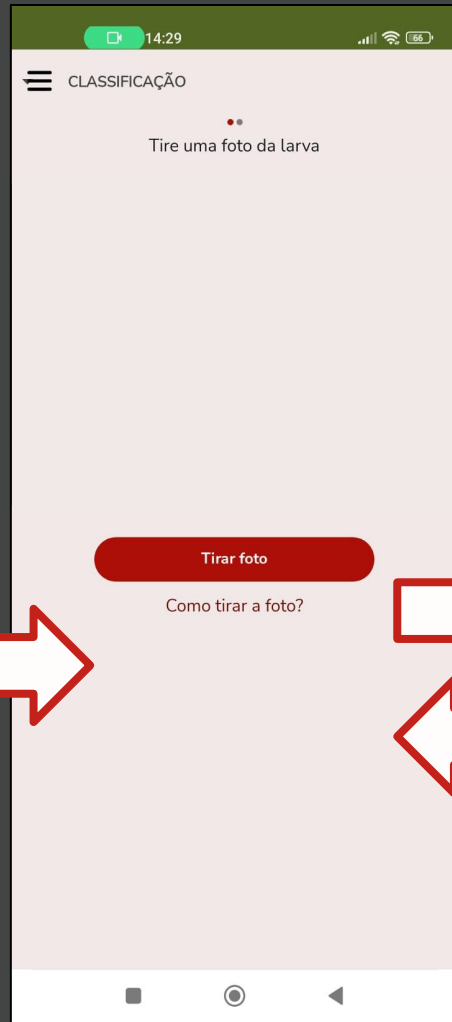
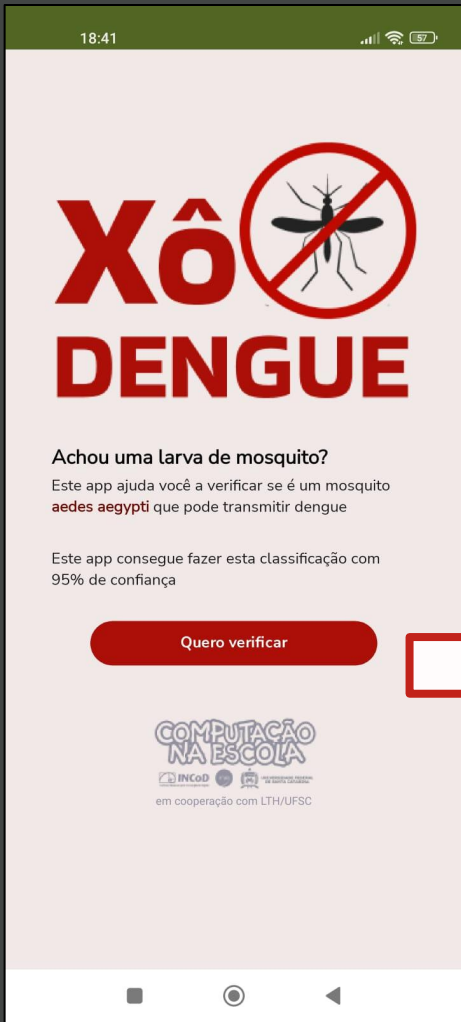
CLASS	ACCURACY	# SAMPLES
Aedes aegypti	0.93	98
Aedes albopictus	0.90	70
Culex sp	0.96	82
Nonmosquito	1.00	51

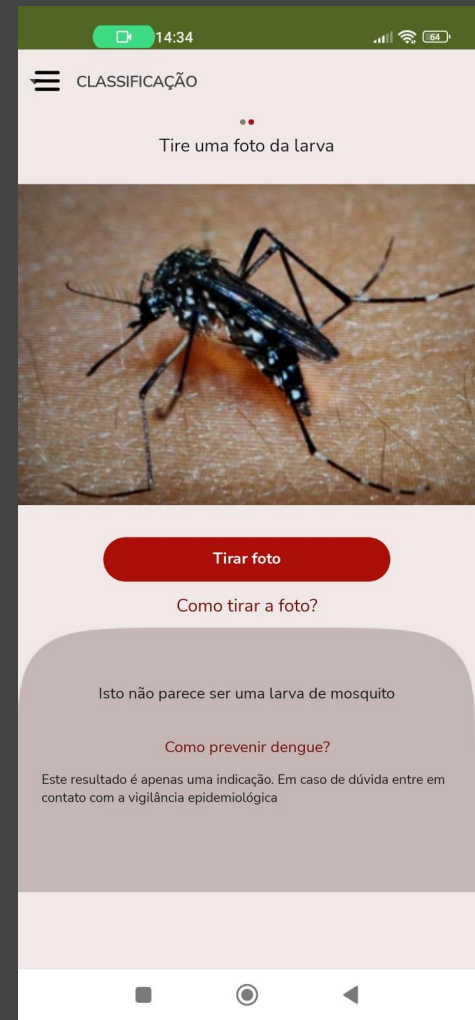
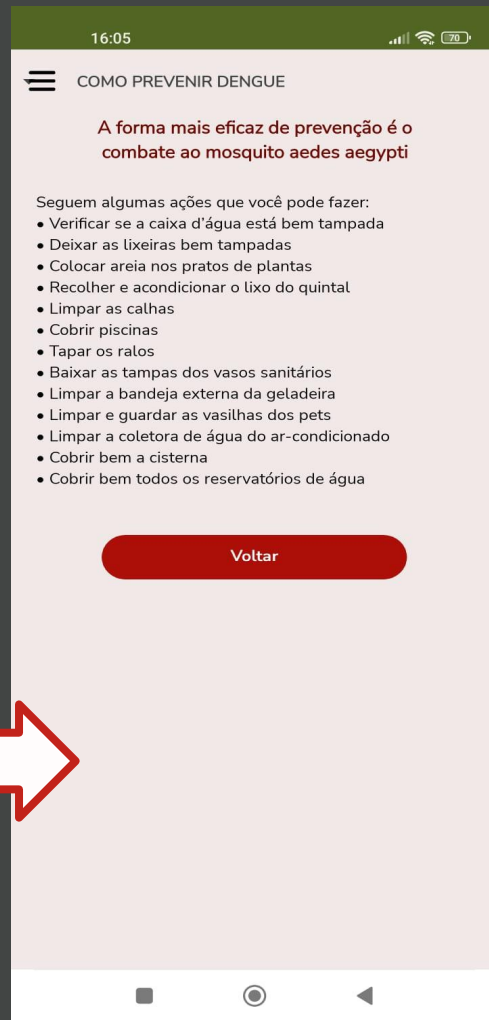
Confusion Matrix ⋮

Class	Aedes aegypti...	Aedes albopi...	Culex sp	Nonmosquito
Aedes aegypti...	91	3	4	0
Aedes albopi...	5	83	2	0
Culex sp	1	1	79	1
Nonmosquito	0	0	0	51

Accuracy per epoch ⋮

x: 41
acc: 1
test: 0.946843802929
acc:





Xô DENGUE

Team

Pedro Philippi Araújo

Ramon Mayor Martins

Lai von Wangenheim

Christiane Gresse von Wangenheim

Carlos José de Carvalho Pinto

Thanks to everyone who helped collecting images

