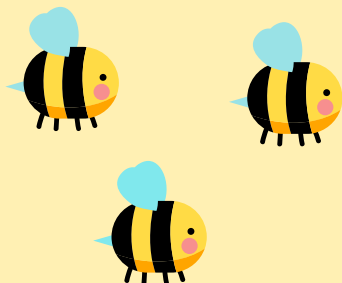




# Health of Beehives

Detecting the Health Status of Honeybees with Neural Networks



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# Introduction

Background Informations  
about the Honey Bee

01

“We ought to do good to others as simply as a horse runs, or a bee makes honey, or a vine bears grapes season after season without thinking of the grapes it has borne.”

—**Marcus Aurelius**



# Facts about the honey bee!



Humidity between the **50% and 60%** is optimal for breeding.

Optimal **temperature** for breeding is between the **30-35 °C**.

Unpasteurized honey contains about **22 amino acids** and a **31 minerals**.

It takes roughly **556 worker bees** to visit **2 million flowers** to produce **0.5 kg of honey**.



One **honey bee** can pollinate up to **2000 flowers** a day.



The **queen** can produce over **1,500 eggs** per day at **30-second** intervals.



# The importance of bees!



## Pollination

**70%** of the 124 most important crops worldwide **depend on pollination** by insects. In Europe, the figure is as high as 84%.



## Value

In 2005, the estimated **commercial value** of western honey bees was just under **\$200 billion** worldwide.

# The bees are under attack!



## Pests

Varroa mites depleted bee populations severely.

## Neocorticoids

Affect the developmental stability of honey bees.

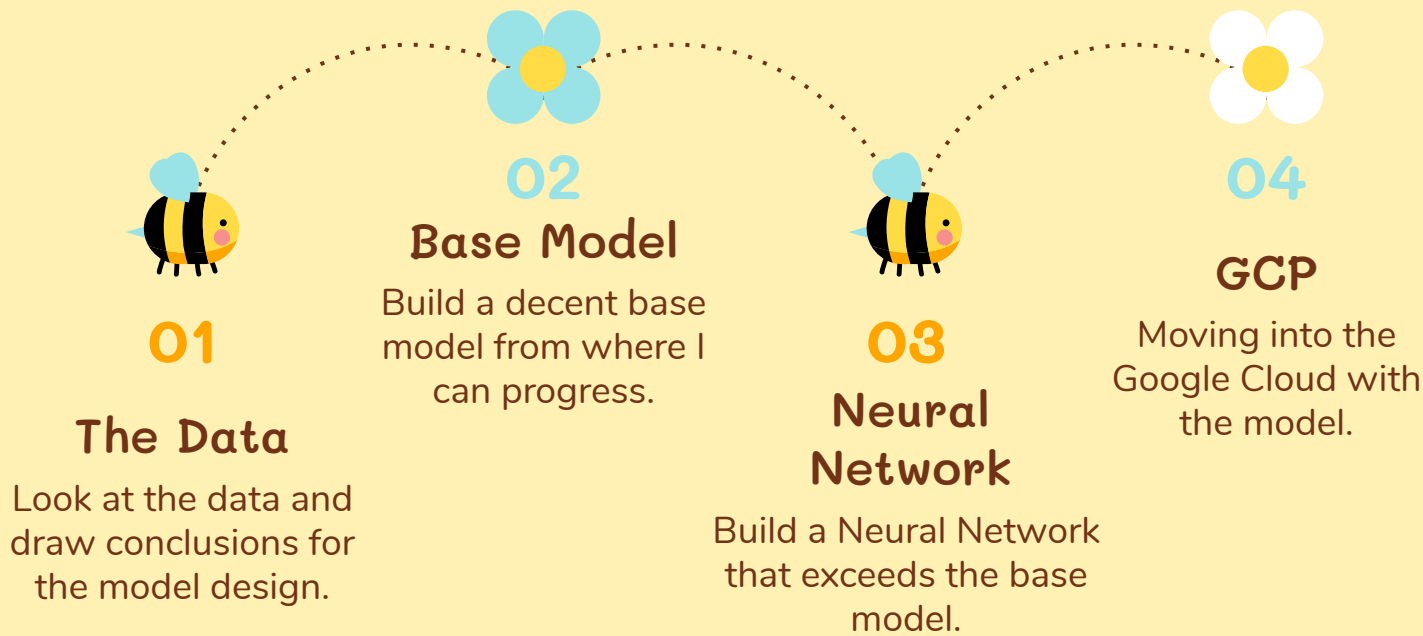
## Predators

New invasive predators like the Asian giant hornet

## Colony collapse disorder

The majority of worker bees in a honey bee colony disappear

# The Goals of this Project!







# 02

## Results

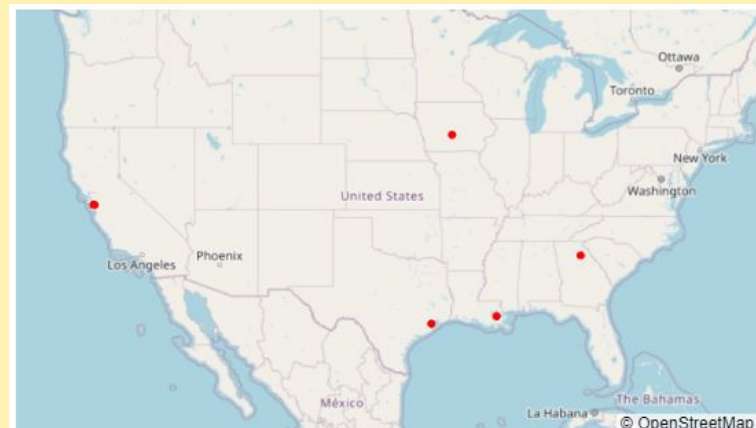
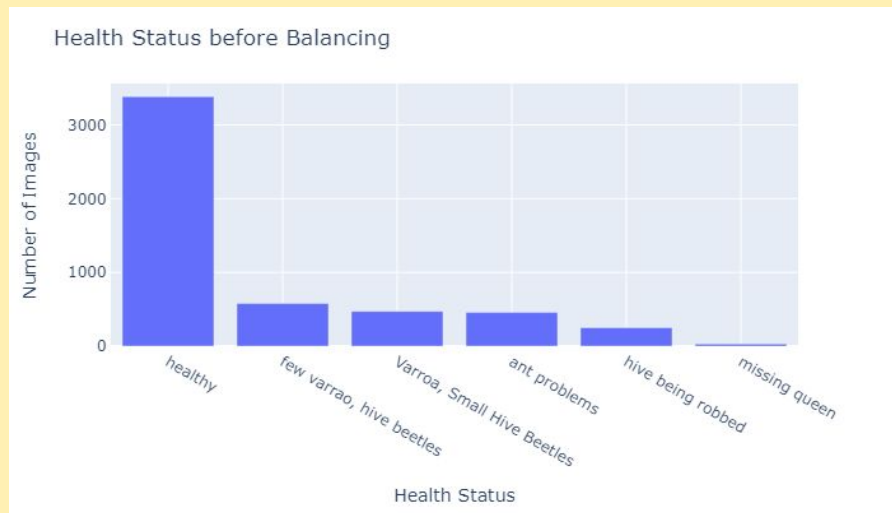
The Data and my Models



# The Data

01

## Imbalanced Data



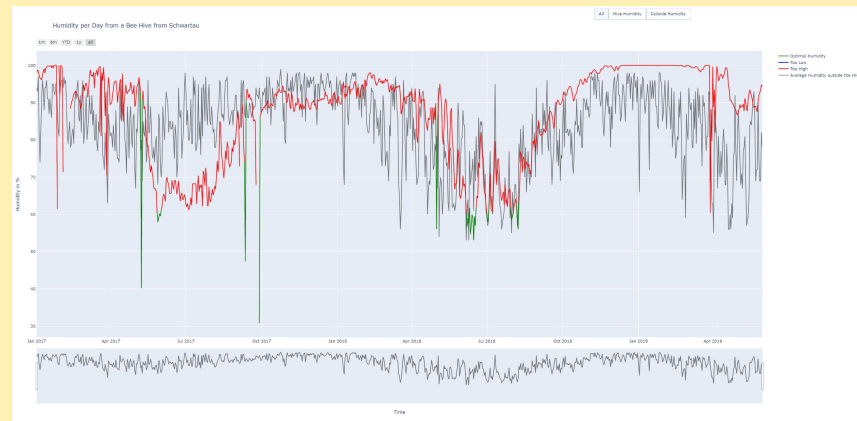
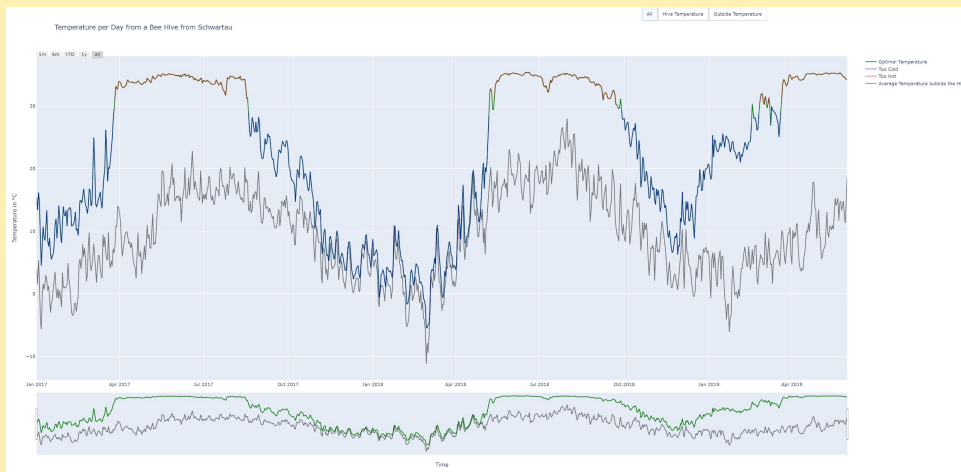
02

Five locations in the us

# The Data

01

## Optimal Temperature



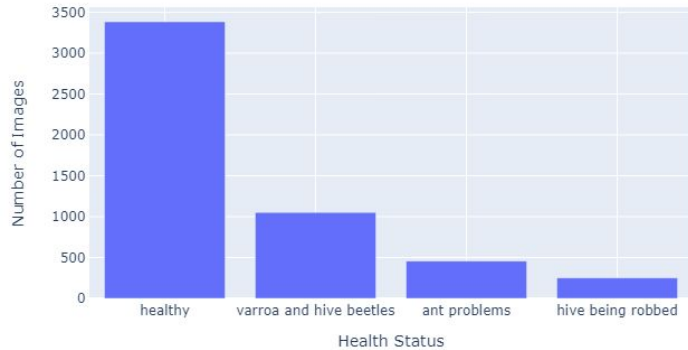
02

## Optimal Humidity

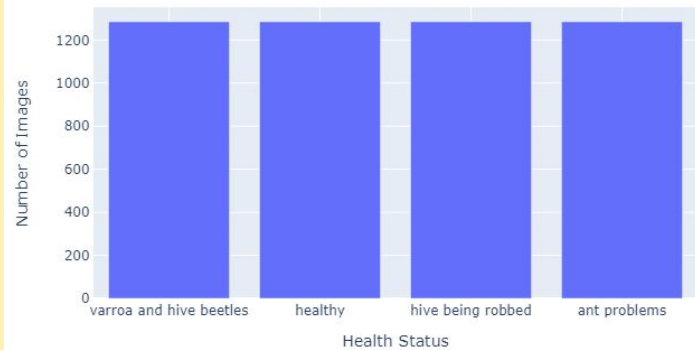
# Balancing the data

## Balancing the data for the Machine Learning Models

Health Status before Balancing



Health Status after Balancing



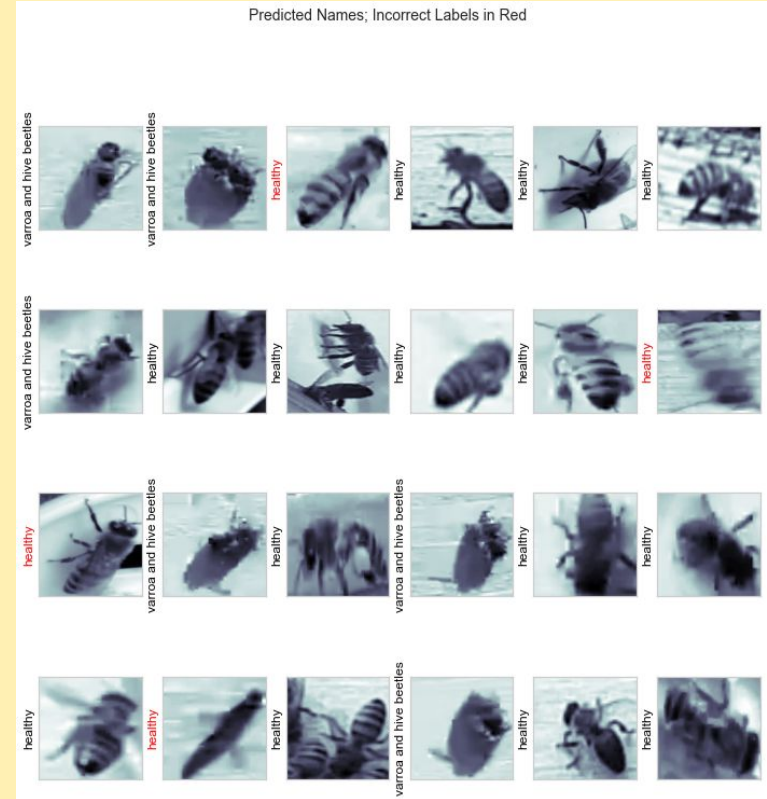
# ML-Basemodel

## The Model

Support Vector Machines  
(SVM)

- Predicted 84 % of the test images correctly
- The correct prediction for Hive being robbed and Ant Problems were low

.....

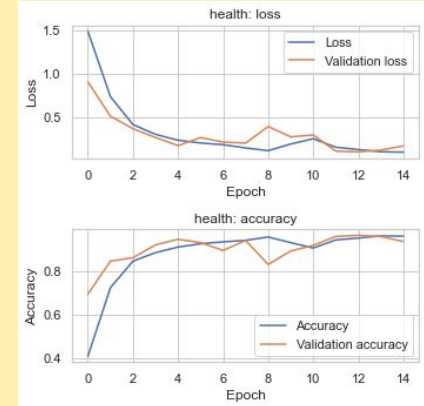
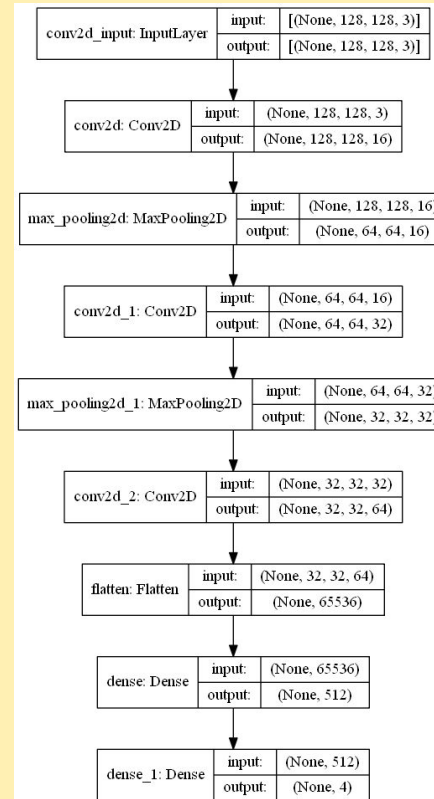


# Neural Network

## The Model

Convolutional Neural Network

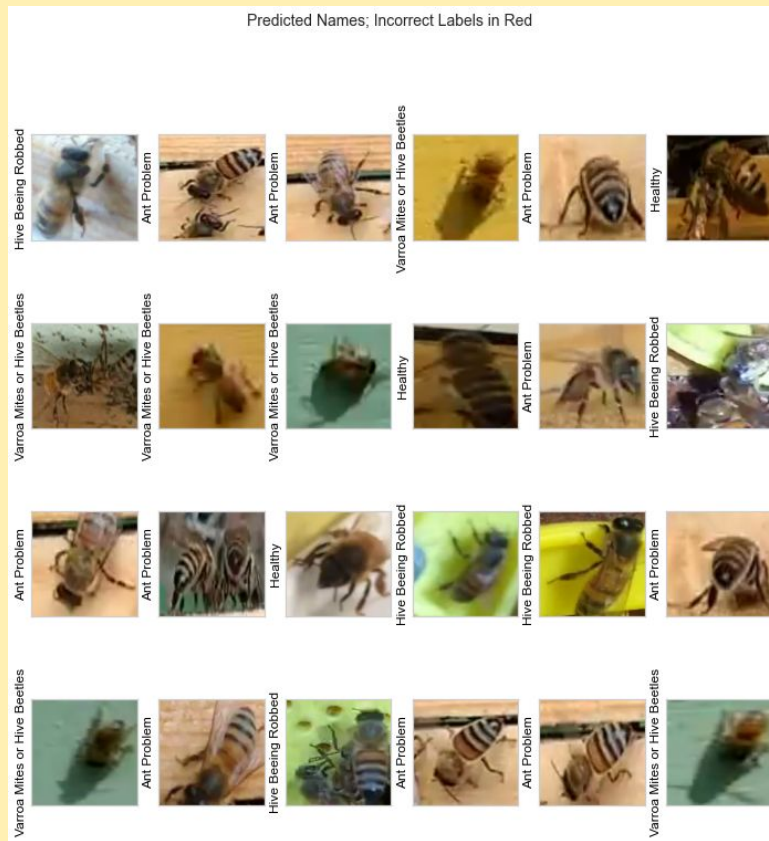
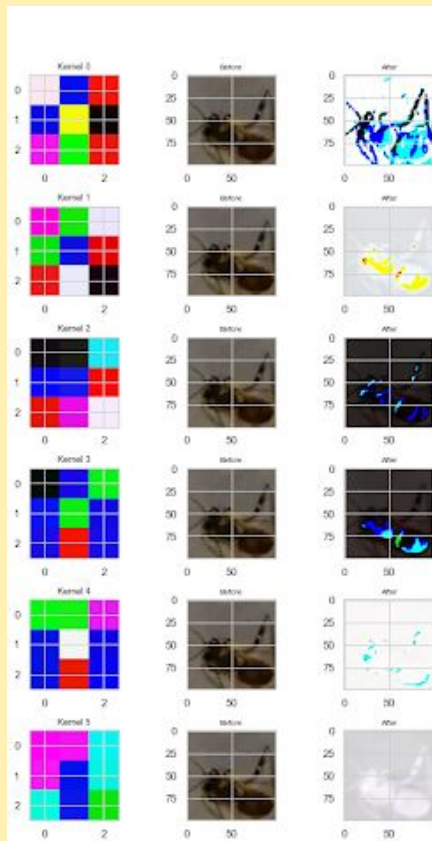
- 9 Layers
- 15 Epochs
- Predicted 98 % of the test images correctly
- Recall- and Precision-Scores much higher than in the Base Model

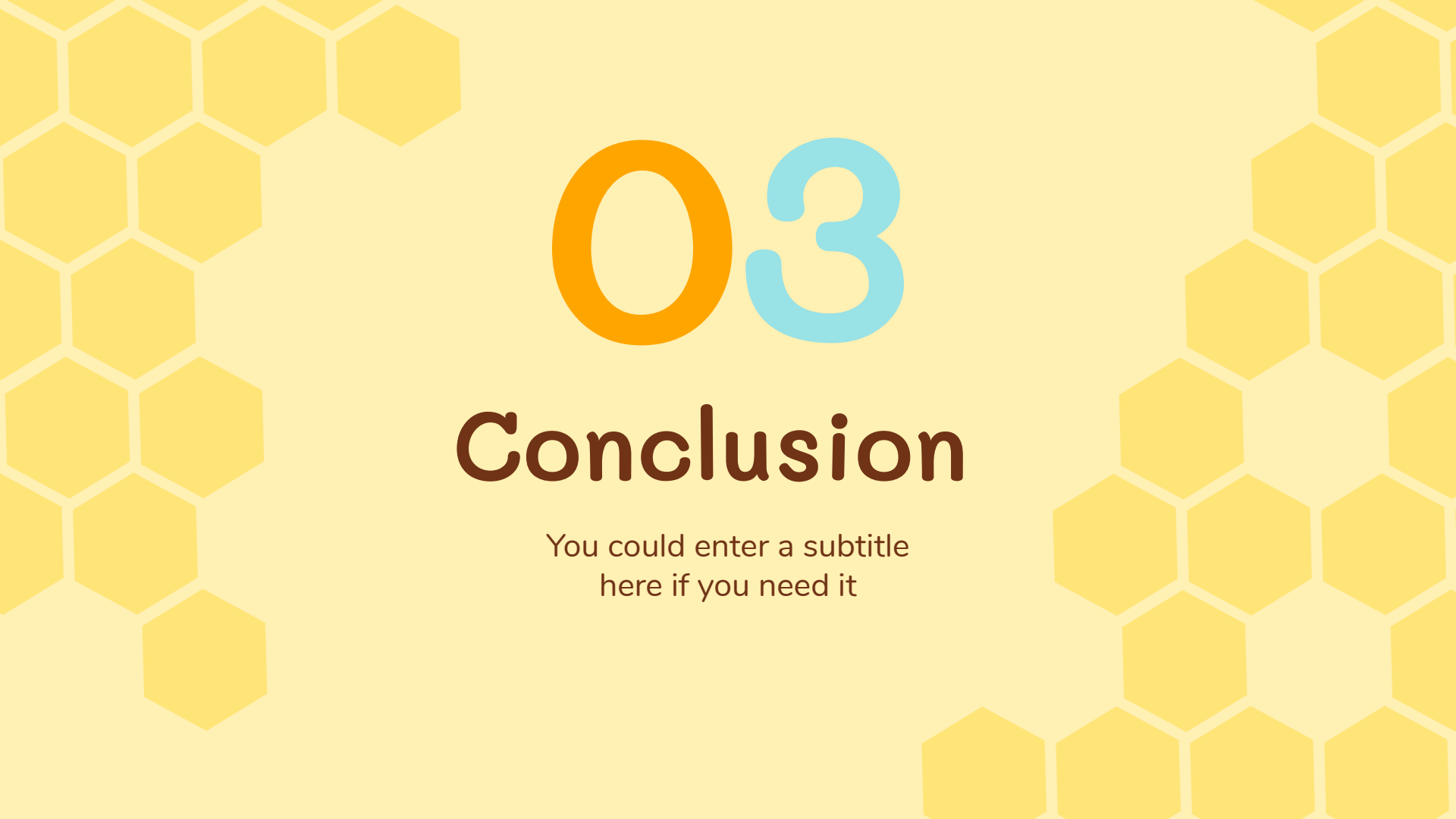


# Neural Network

## Checking the Model

- Predicted 98 % of the test images correctly
- Model predicted the bees and not the background of the image





# 03

## Conclusion

You could enter a subtitle  
here if you need it



# Goals accomplished?

- ✓ Cleaned and balanced the data.
- ✓ Made a decent Base Model.
- ✓ Created a CNN that exceeds the Base Model.
- ✓ Moved into the Google Cloud.
- ✓ Created a Google Vision Model.
- ✗ Installed a live tracking device of Temperature and Humidity.
- ✗ Created an app for detecting the health status of bee hives with GCP.



# Future work!

01

## Live Tracking

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Installed a live tracking device for Temperature and Humidity.

02

## GCP

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Using GCP to allow the detection of the health status via app.

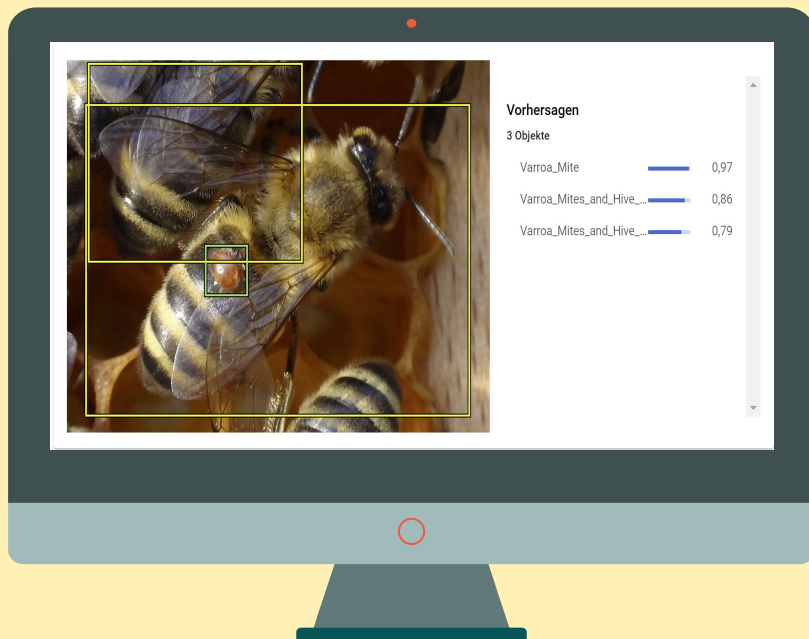
03

## App

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Creating an App as graphic interface

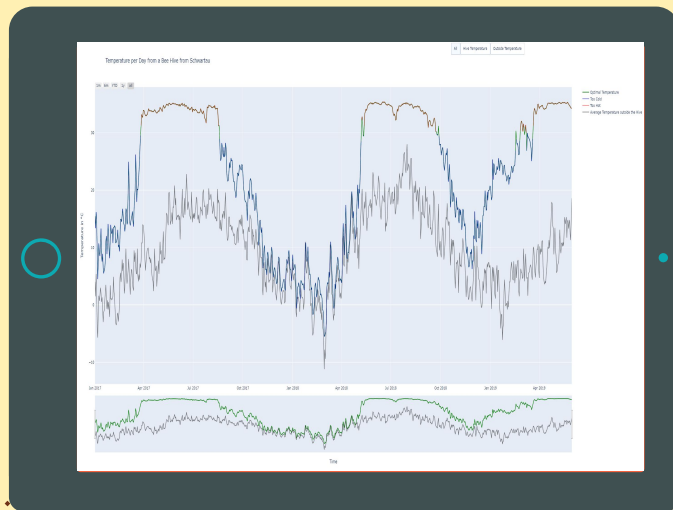
# Desktop



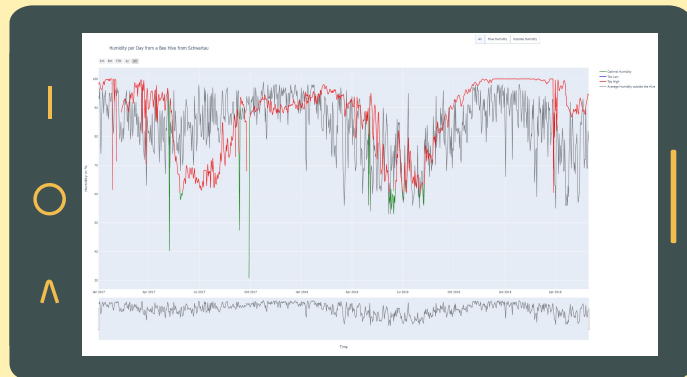
Classify your Beehive!

# Tablet

Track the Temperature!



# Mobile



Track the Humidity!

# Thanks!

Do you have any questions?



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