



Health of Beehives

Detecting the Health Status of Honeybees with Neural Networks

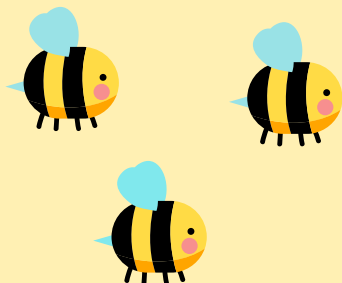


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Introduction

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.

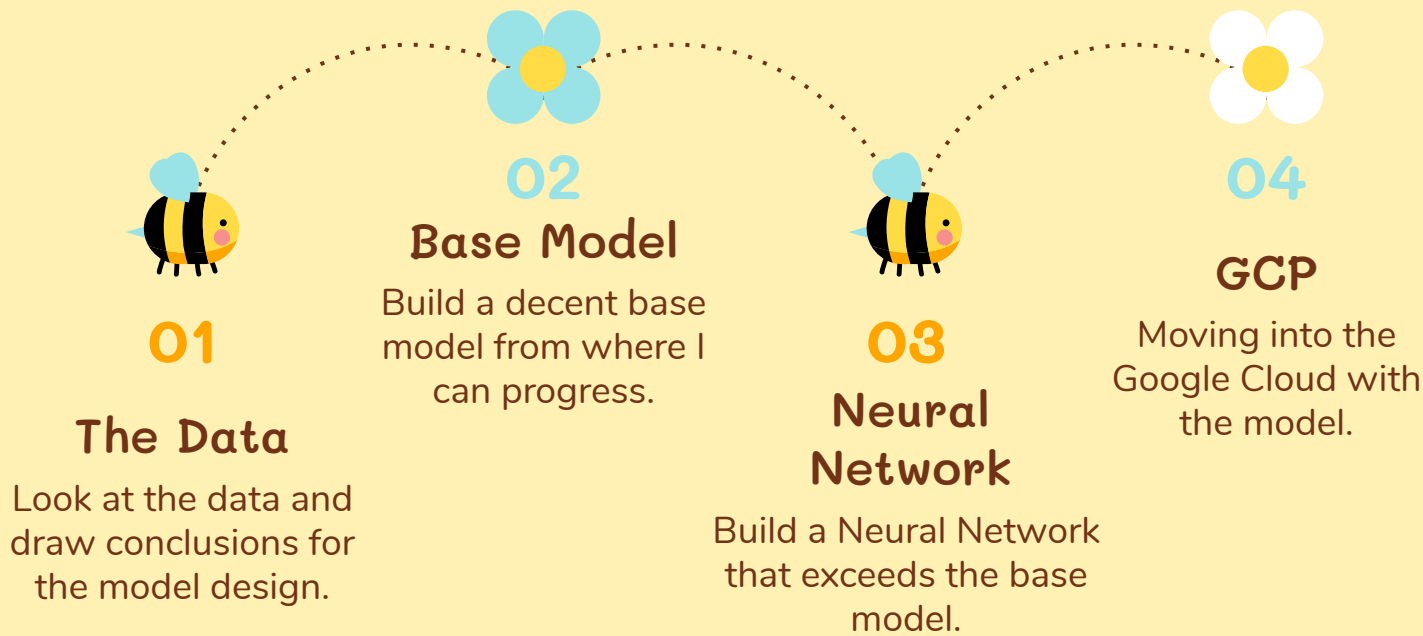
Predators

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

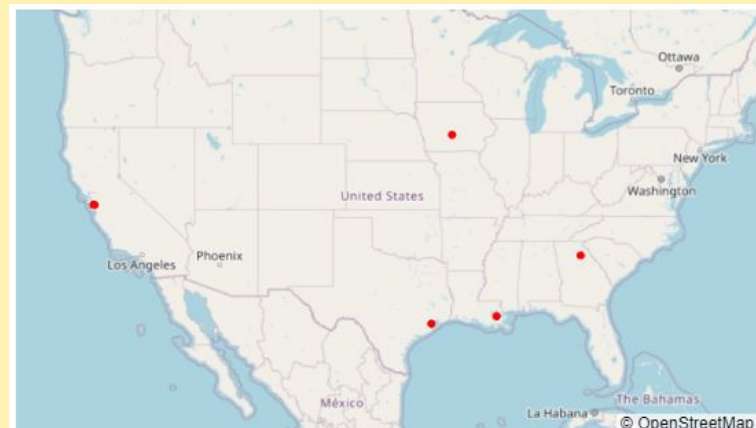
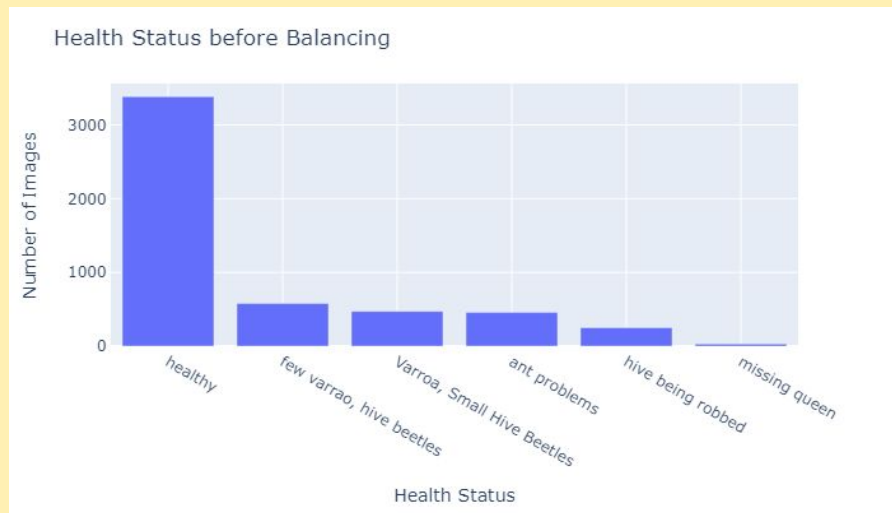
The Data and my Models



The Data

01

Imbalanced Data



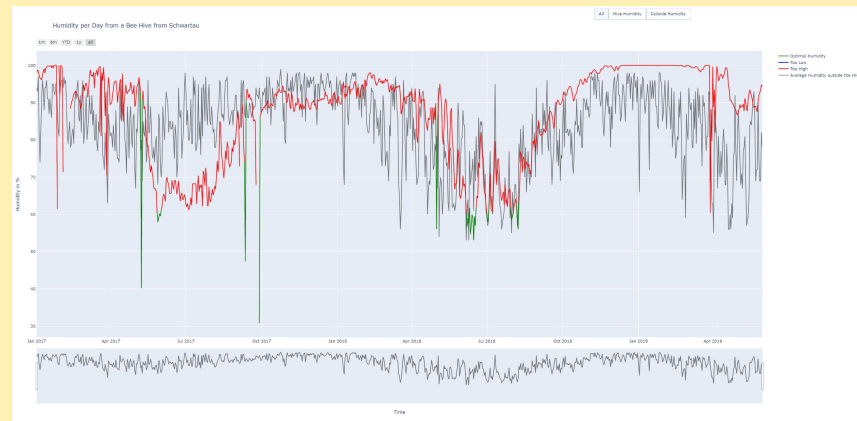
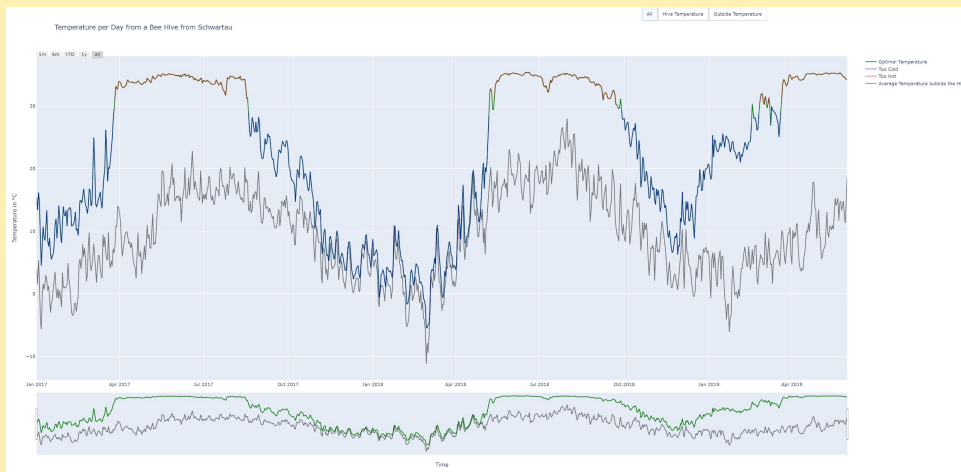
02

Five locations in the us

The Data

01

Optimal Temperature



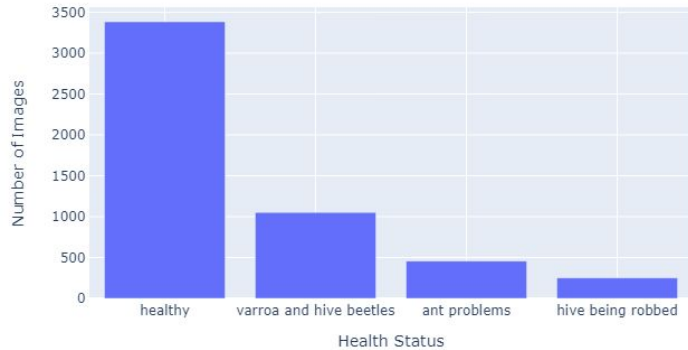
02

Optimal Humidity

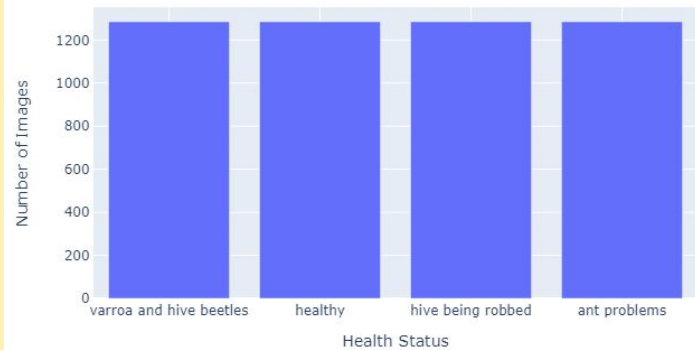
Balancing the data

Balancing the data for the Machine Learning Models

Health Status before Balancing



Health Status after Balancing



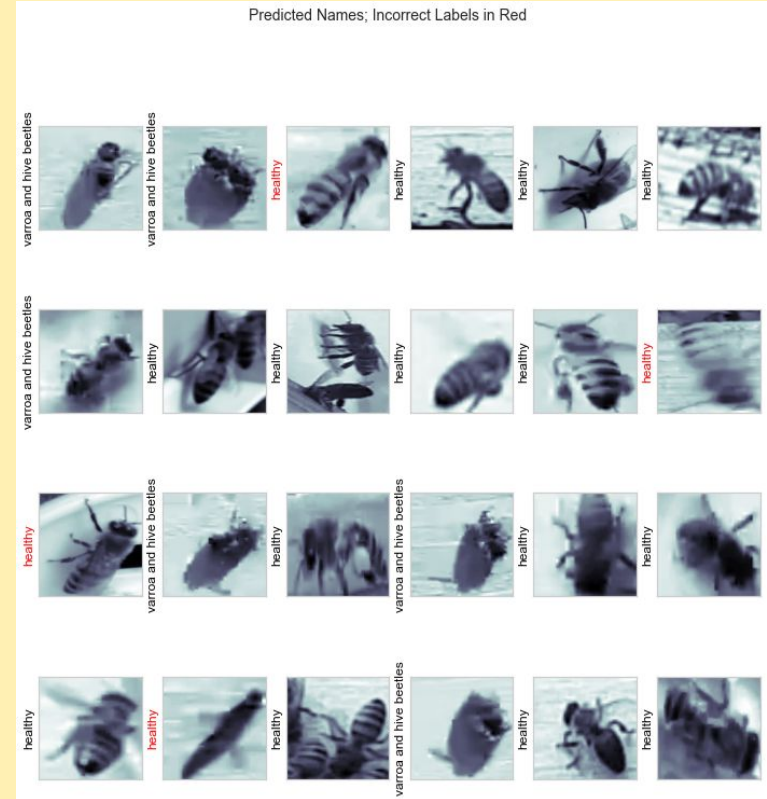
ML-Basemodel

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

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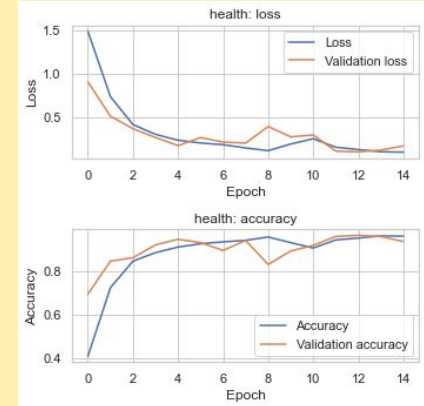
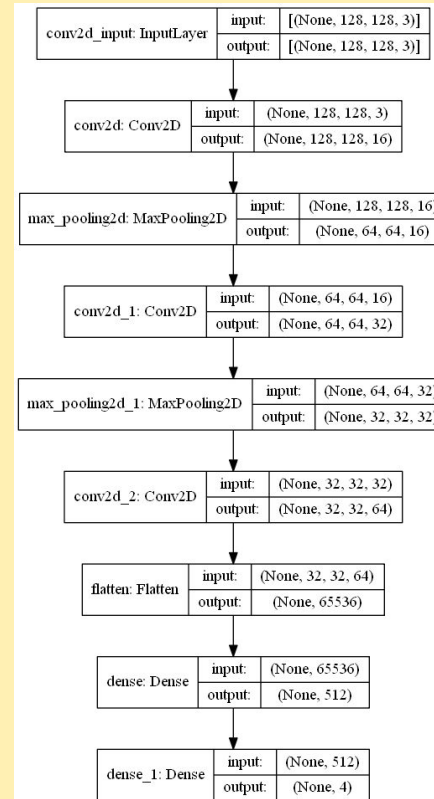


Neural Network

The Model

Convolutional Neural Network

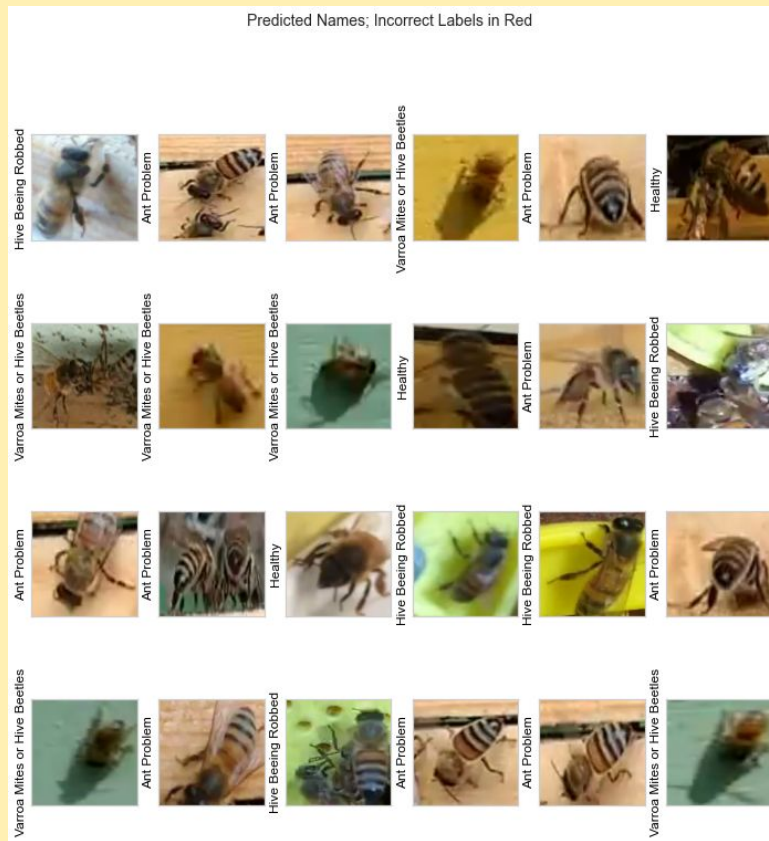
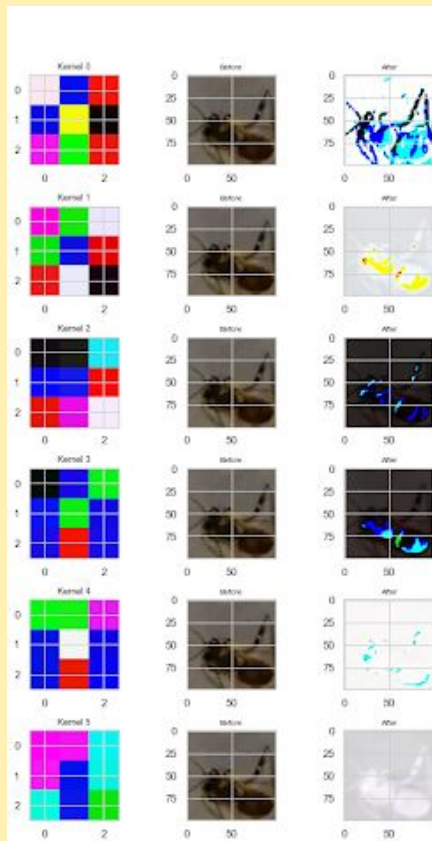
- 9 Layers
- 15 Epochs
- Predicted 98 % of the test images correctly
- Recall- and Precision-Scores much higher than in the Base Model

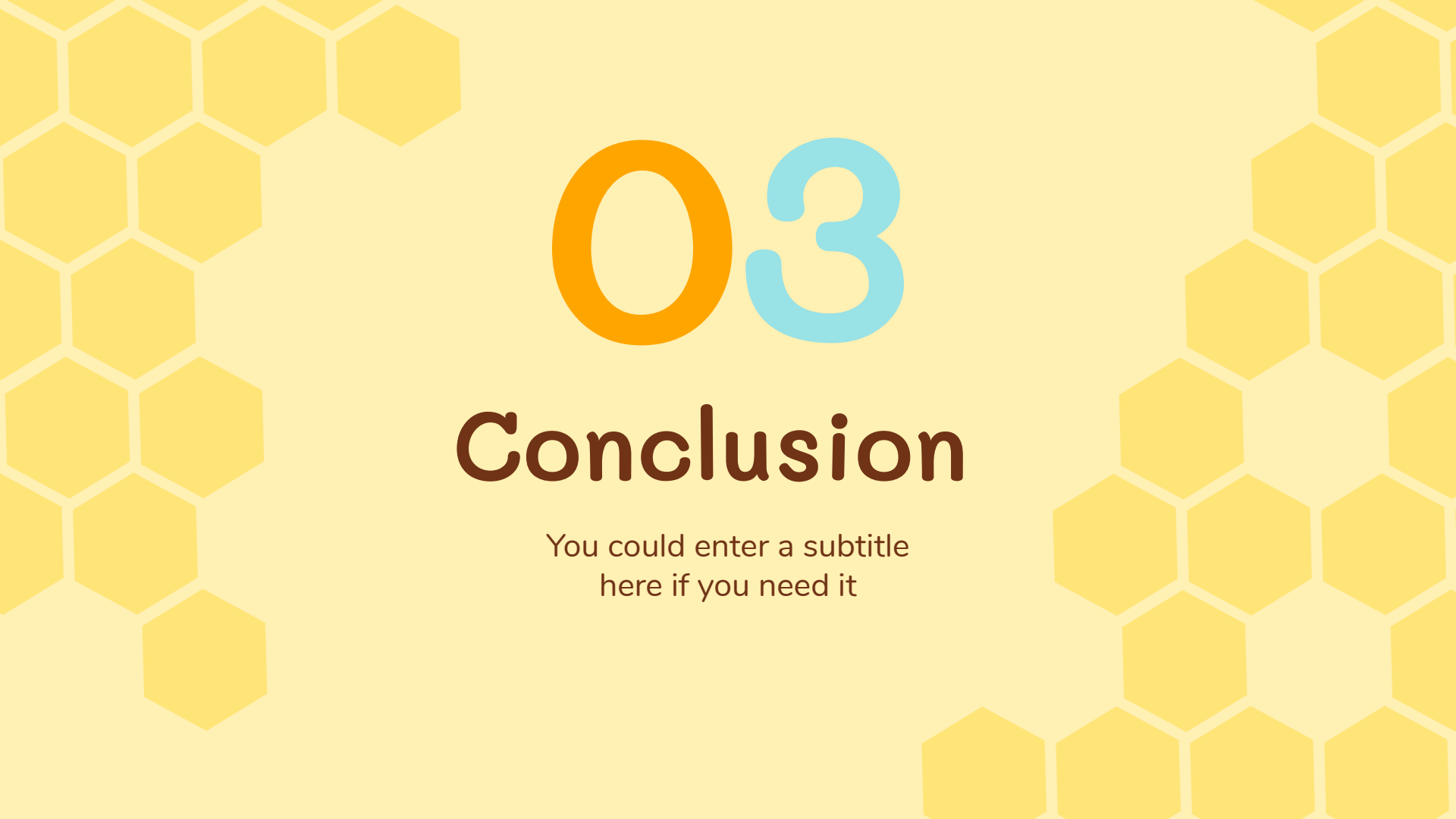


Neural Network

Checking the Model

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



The background of the slide is a light yellow color with a pattern of yellow hexagons of varying sizes, some of which are slightly offset, creating a honeycomb-like effect.

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

Installed a live tracking device of Temperature and Humidity.

02

GCP

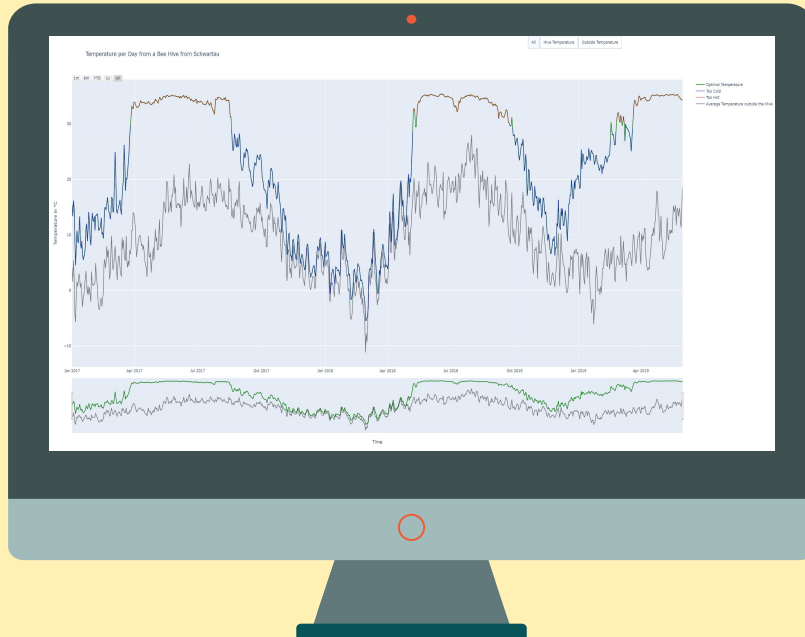
Using GCP to allow the detection of the health status via app.

03

App

Creating an App as graphic interface

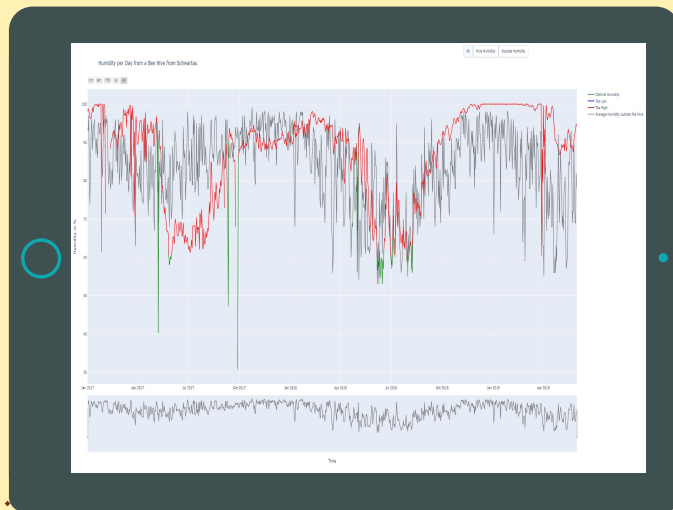
Desktop



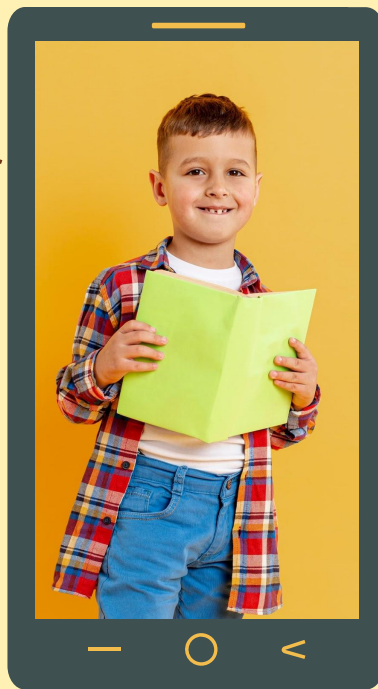
Track the Temperature!

Tablet

Track the Humidity!



Mobile



Classify your Beehive!

Thanks!

Do you have any questions?



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