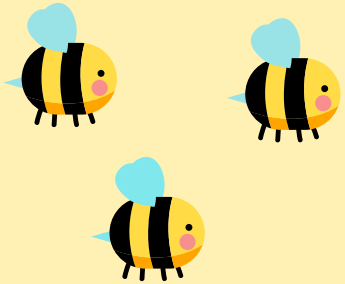
Health of Beehives

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

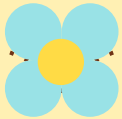
The majority of worker bees in a honey bee colony disappear

The Goals of this Project!

01

The Data

Look at the data and draw conclusions for the model design.



02

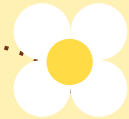
Base Model

Build a decent base model from where I can progress.

03

Neural Network

Build a Neural Network that exceeds the base model.



04

GCP

Moving into the Google Cloud.

02

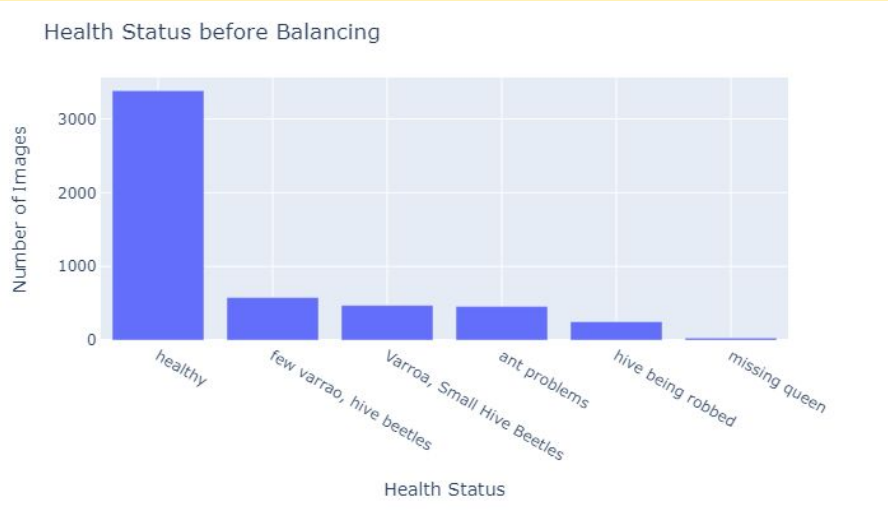
Results

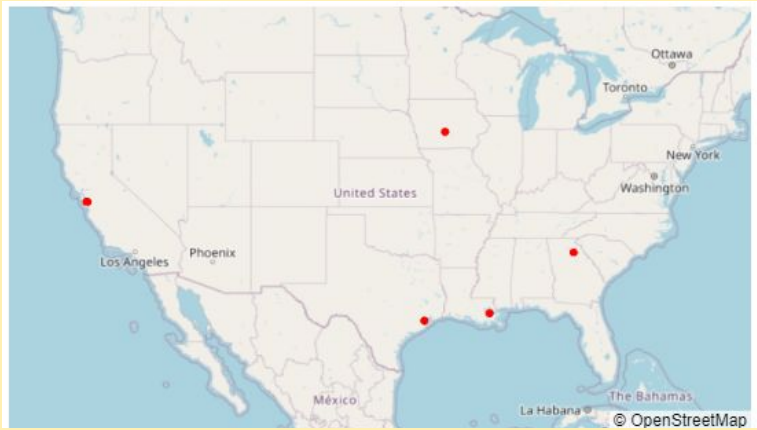
The Data and my Models

The Data

01

Imbalanced Data



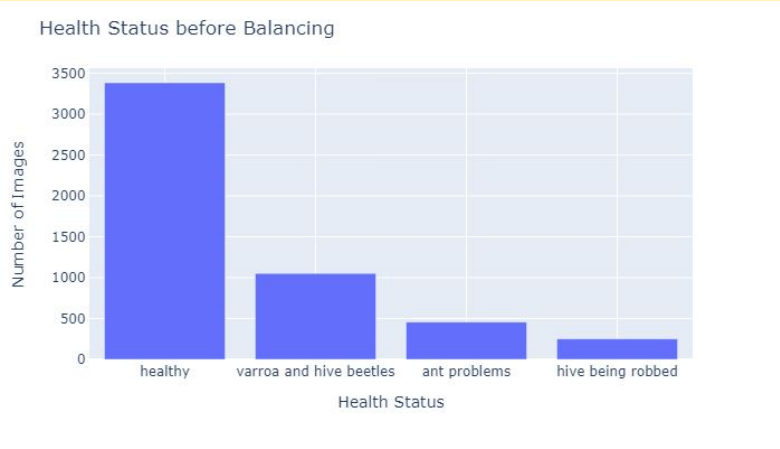


02

Five locations in the us

Balancing the data

Balancing the data for the Machine Learning Models

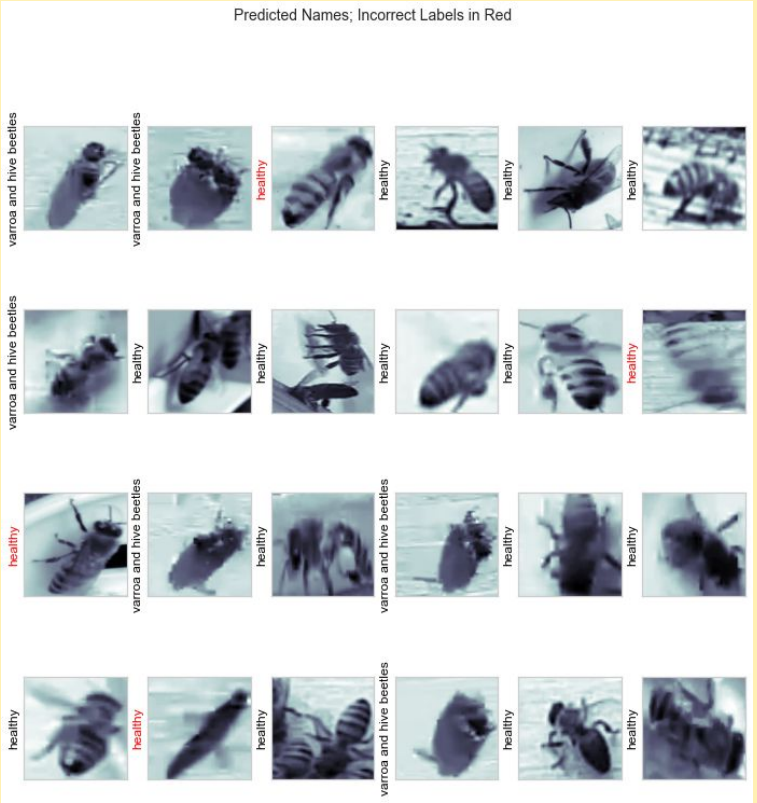


ML-Basemodel

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

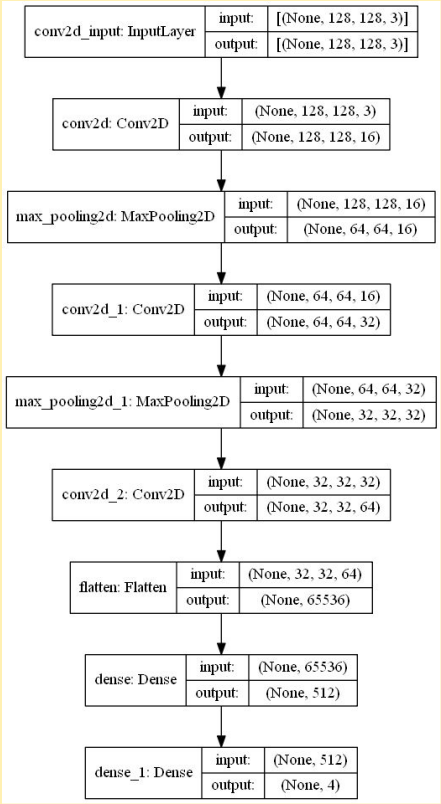


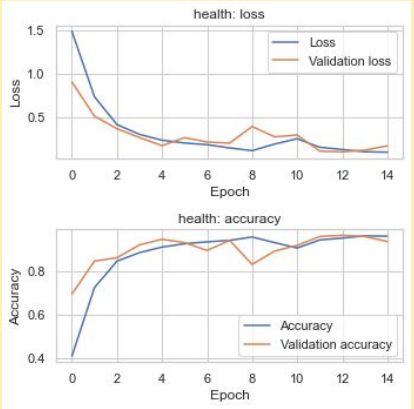
Neural Network

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

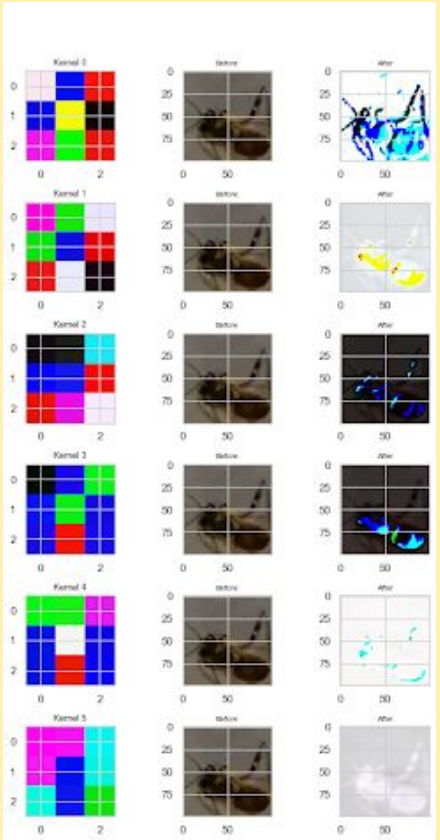




Neural Network

Checking the Model

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



03

Conclusion

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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 for Temperature and Humidity.

02

GCP

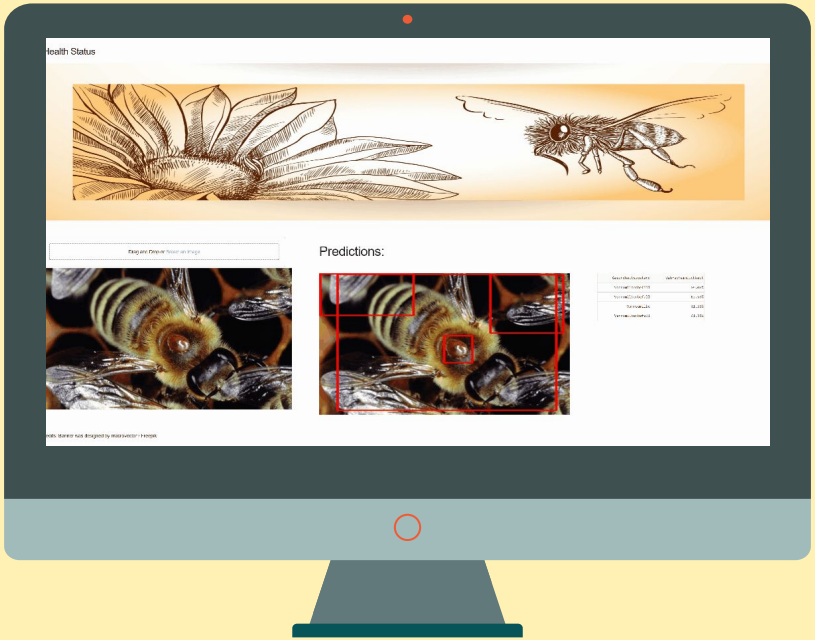
Using GCP to allow the detection of the health status via app.

03

App

Creating an App as graphic interface

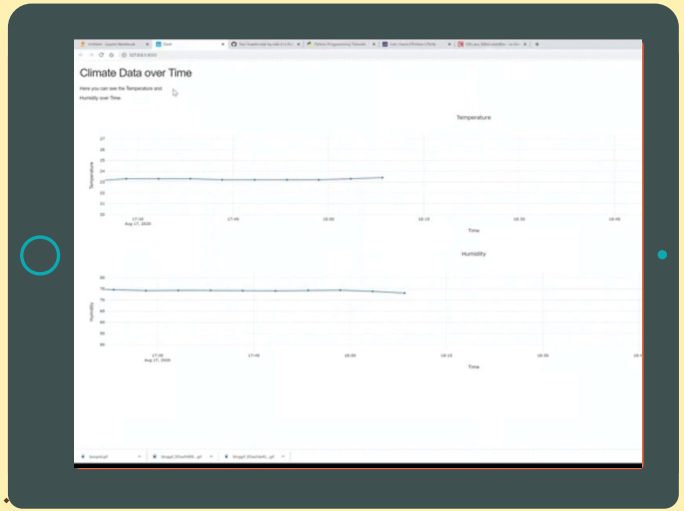
Current Status



- ✓ First **GCP-Vision Model** implemented in Dash-App
- ✓ Programming of **Temperature- and Humidity-Measurements** via DHT-22, ESP-32 Chips, Raspberry Pi and **SQL-Database**
- × Implementation and deployment in Bee Hives

Current Status

Track the Temperature
and Humidity!



Thanks!

Do you have any questions?

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