GreenMonitor

Techlabs - ST 2022 - Final presentation

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DS	Anna and Houda
AI/DL	Hany and Constanze
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Our Path: From idea to application

Original idea:

- The **CO_2 absorption of trees depends** on their **species**, **age** and **location**.
- Learn about and **predict the CO_2 absorption of trees in Berlin**

Our application allows the user

- to gain more **information about trees in the twelve districts of Berlin**.
- to understand the oldest and the highest tree in each districts of Berlin.
- to know the amount of CO2 each oldest and highest tree species in each district can absorb per year and in total life.
- to **identify trees** simply **by uploading pictures** with their smartphone or Laptop.

Vision: Facilitate people in Berlin to gain more knowledge about the trees surrounding them and on the trees impact on the environment in terms of CO_2 absorption.

Our application

DS

- Information about **trees distribution in Berlin**

- ML **prediction of the age of a tree**

UX

- **User research**
- Design
- Prototyping
- **Usability testing**

WD

- developed a **web application** based on the UX-Figma model.
- using HTML, CSS, Javascript, React and React Router.

AI/DL

- **species recognition** from a tree image
- creation of image dataset via **active learning**

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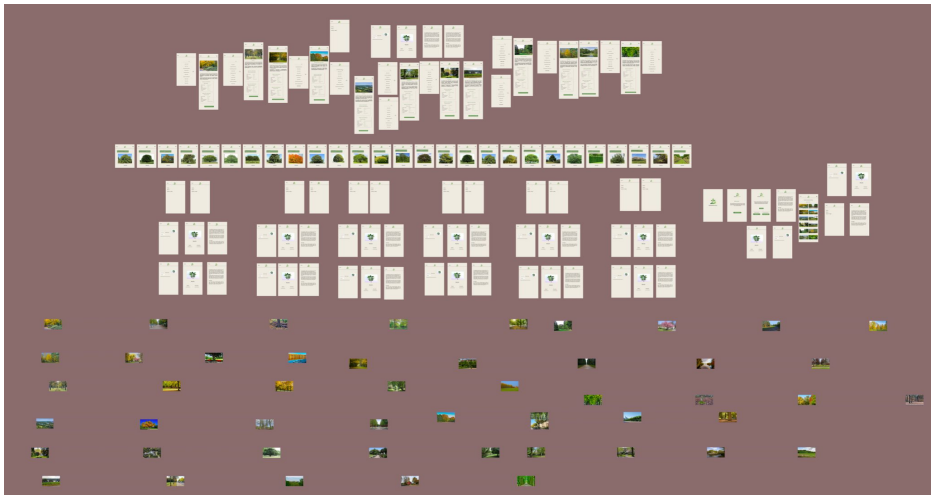
- Live demonstration -

UX: Design, User flow and Functionality

- Create a **logo** for the app.
- Transformed low fidelity mockup into high fidelity prototype.
- Analysed **user flow**.
- Optimized interactive prototype with available data from the DS.
- Carrying out usability testing; Analyzing data.

High fidelity prototype:



WD: Integration of all functionalities in our application

1. Web Dev Team **developed the web** based on the prototype designed by UX.
2. Bootstrapped fundamental architecture.
3. API Integrations(BackEnd functionalities on the image Upload part).
4. Collected data from DS and “hard coded” it to have the top ten trees species,streets with most trees, the oldest and highest tree in each districts .
5. Used google to search for how to calculate CO2 absorption with Species, Age,circumference, dry weight, CO2 absorption per year and in total for each districts.
6. Each German name species has been provided with the Scientific Name and an image of the species.
7. Created an external link that will help users for more information.
8. React router is used to direct to different pages based on the request.

DS: Dataset from Cleaning, Visualisations to ML

Create a Dataset

- Collected data of public trees in Berlin
- Cleaned dataset from anomalies
- Stored the dataset in an open source database (supabase)

```
df_cleaning.isnull().sum()
```

```
ID                          0
Baum Nr.                    0
Objektnr.                   0
Objektname                  0
Baumart deutsch             0
Baumart botanisch           0
Gattung botanisch           0
Straße                      0
Hausnr.                     0
Hausnr. Zusatz              0
Pflanzjahr                  0
Standalter                  0
Krone Durchmesser in m    175104
Stamm Umfang in cm          1121
Baumhöhe in m              91283
Bezirk                      0
dtype: int64
```

```
df_cleaning['Krone Durchmesser in m'].values[df_cleaning['Krone Durchmesser in m'] == 0] = 'NaN'
```

```
df_cleaning
```

	Raw_Num	ID	Baum Nr.	Objektnr.	Objektname	Baumart deutsch	Baumart botanisch	Gattung botanisch	Straße	Hausnr.	Hausnr. Zusatz	Pflanzjahr
0	0	00008100:000c1b36	16	5	Abbestraße	Gemeine Rosskastanie	Aesculus hippocastanum	AESCULUS	Abbestraße	19	0	1936
1	1	00008100:000c1b35	17	5	Abbestraße	Gemeine Rosskastanie	Aesculus hippocastanum	AESCULUS	Abbestraße	19	0	1926
2	2	00008100:000c1b32	20	5	Abbestraße	Gemeine Rosskastanie	Aesculus hippocastanum	AESCULUS	Abbestraße	14-20	0	1980
3	3	00008100:000c1aa3	24	241	Am Rupenhorn	Gemeine Rosskastanie	Aesculus hippocastanum	AESCULUS	Am Rupenhorn	3b	0	1975
4	4	00008100:000c196a	33	348	Arysallee	Amerikanische Rot-Eiche	Quercus rubra	QUERCUS	Arysallee	11	0	1980
...	...	...	...	...	...	...	...	...	...	...	...	...
406213	406213	00008100:002736c2	58/2	101624	Lobitzweg Köp	Pyramiden-Eiche	Quercus robur 'Fastigiata'	QUERCUS	Lobitzweg	0	0	2021
406214	406214	00008100:002cc7d0	29/1	102134	Pohlestraße Köp	Pyramiden-Hainbuche	Carpinus betulus 'Fastigiata'	CARPINUS	Pohlestraße	0	0	2021
406215	406215	00008100:002d53d4	A/81	30204	Kiefholzstraße Rev. I Ba	Feld-Ahorn	Acer campestre	ACER	Kiefholzstraße	0	0	2008
406216	406216	00008100:002d53df	A/80	30204	Kiefholzstraße Rev. I Ba	Feld-Ahorn	Acer campestre	ACER	Kiefholzstraße	0	0	2008
406217	406217	00008100:002db7d7	107/1	80174	Buntzelstraße Bo	Amberbaum	Liquidambar styraciflua	LIQUIDAMBAR	Buntzelstraße	107	0	2021

Baumart deutsch text	Baumart botanisch text	Gattung botanisch text	Straße text
Gemeine Rosskastanie	Aesculus hippocastanum	AESCULUS	Abbestraße
Gemeine Rosskastanie	Aesculus hippocastanum	AESCULUS	Abbestraße
Sand-Birke	Betula pendula	BETULA	Brahestraße
Winter-Linde	Tilia cordata	TILIA	Alemannenallee
Winter-Linde	Tilia cordata	TILIA	Goethestraße
Spitz-Ahorn	Acer platanoides	ACER	Erdener Straße
Gewöhnliche Esche	Fraxinus excelsior	FRAXINUS	Oppermannstraße
Gewöhnliche Esche	Fraxinus excelsior	FRAXINUS	Oppermannstraße
Gewöhnliche Esche	Fraxinus excelsior	FRAXINUS	Oppermannstraße
Gewöhnliche Esche	Fraxinus excelsior	FRAXINUS	Oppermannstraße
Vogelbeere	Sorbus aucuparia	SORBUS	Oppermannstraße
Gewöhnliche Esche	Fraxinus excelsior	FRAXINUS	Oppermannstraße
Gewöhnliche Esche	Fraxinus excelsior	FRAXINUS	Oppermannstraße
Gewöhnliche Esche	Fraxinus excelsior	FRAXINUS	Oppermannstraße
Gewöhnliche Esche	Fraxinus excelsior	FRAXINUS	Oppermannstraße
Gewöhnliche Esche	Fraxinus excelsior	FRAXINUS	Oppermannstraße
Berg-Ahorn, Weiss-Ahorn	Acer pseudoplatanus	ACER	Erdener Straße

Used tools:

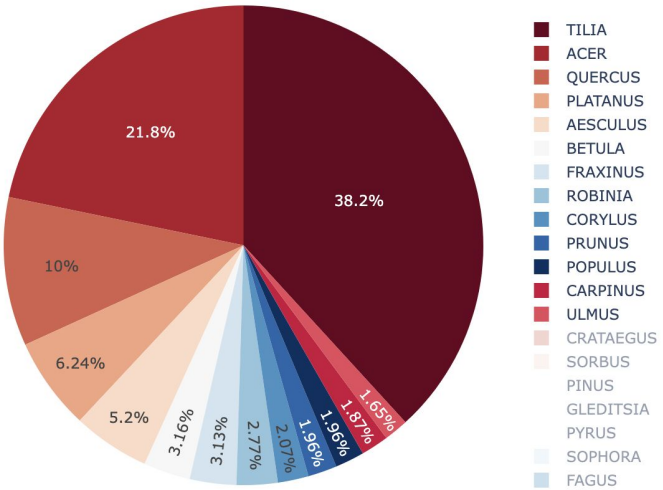
jupyter

supabase

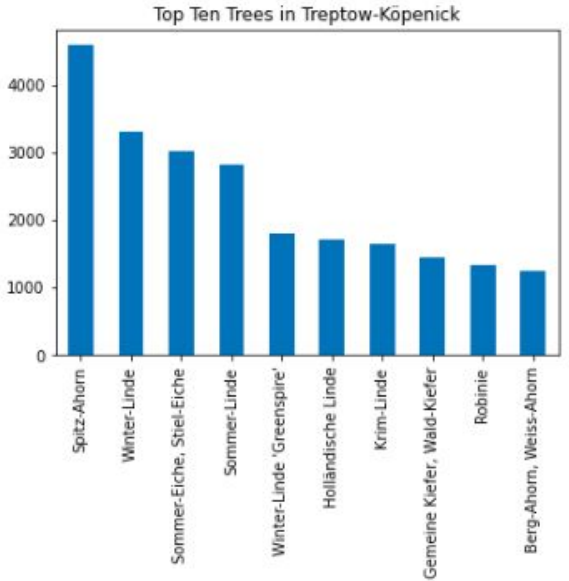
DS: Dataset from Cleaning, Visualisations to ML

Visualizations for tree species

Figure: Share of Trees per Species



Visualizations for districts



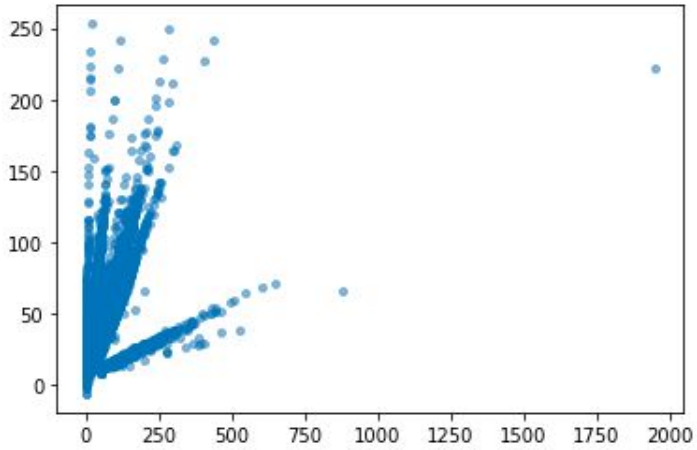
plotly

matplotlib

Machine Learning Algorithm

```
# Show data in a scatter plot
marker_size=15
plt.scatter(Y_test, Y_pred, marker_size, alpha=0.5)
```

```
<matplotlib.collections.PathCollection at 0x1b4e9b30488>
```



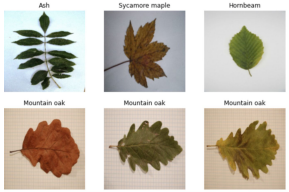
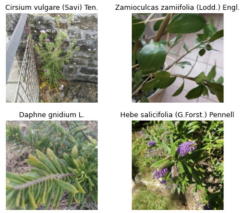
Estimate Age

We created an ML algorithm that predicts the age of the tree based on its species and girth.

Used Tools

matplotlib

AI/DL: Image classification of trees

	Image Dataset	Model development and training	Integration into web application
Initial	Austrian Tree datasets, leaves  # species: 5	(simple) sequential CNN 	Lets classify an image:  Choose file hornbeam-1.jpeg classify! This is a Mountain oak (I am 99.07% certain ...)
Final	Berlin specific trees, leaves  # species: 16	transfer learning using a pretrained model with MobileNetV2 & inaturalist	1. Identification of species 2. **Active learning** to improve image dataset (Superintendent)

Google colab TensorFlow Keras TensorFlow.js

Our technical stack

Documentation

DS

supabase

pandas

jupyter

Communication

UX

uizard

Sketch

WD

HTML CSS JS

React JS

Visual Studio Code

Bootstrap

AI/DL

Google colab

Keras

TensorFlow.js

TensorFlow

bing

Thank you for your attention and looking forward to your insights & feedback

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Mentor	Faruk

Home Back Upload Image

Active_Learn_Trees

About

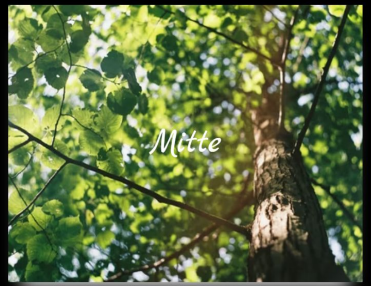
It is an application that allows you to identify Leaves simply by uploading pictures with your smartphone or Laptop. It has the ability to filter recognized species by family. The more visually clear picture you upload about the leave you are observing, the more accurate the identification will be. There are indeed many plants that look alike from afar and it is sometimes small details that distinguish two species of the same genus. It allows you to gain more information about Trees with respect to the selected district.

Districts UploadImage

Home Back Upload Image

Active-Learn-Trees

Select District



Information

No of Trees:

2000

No of People:

Lorem ipsum dolor sit amet consectetur adipisicing elit. Nostrum, quas quasi laboriosam voluptatem aliquam commodi est eos omnis odit quidem magni dolor provident corporis. Saepe libero beatae harum architecto reprehenderit.

Choose File classify!

Results

Name :

This is a Mountain oak

Certainity :

94.44% certain ...

Aim: Recognise a tree species from an image