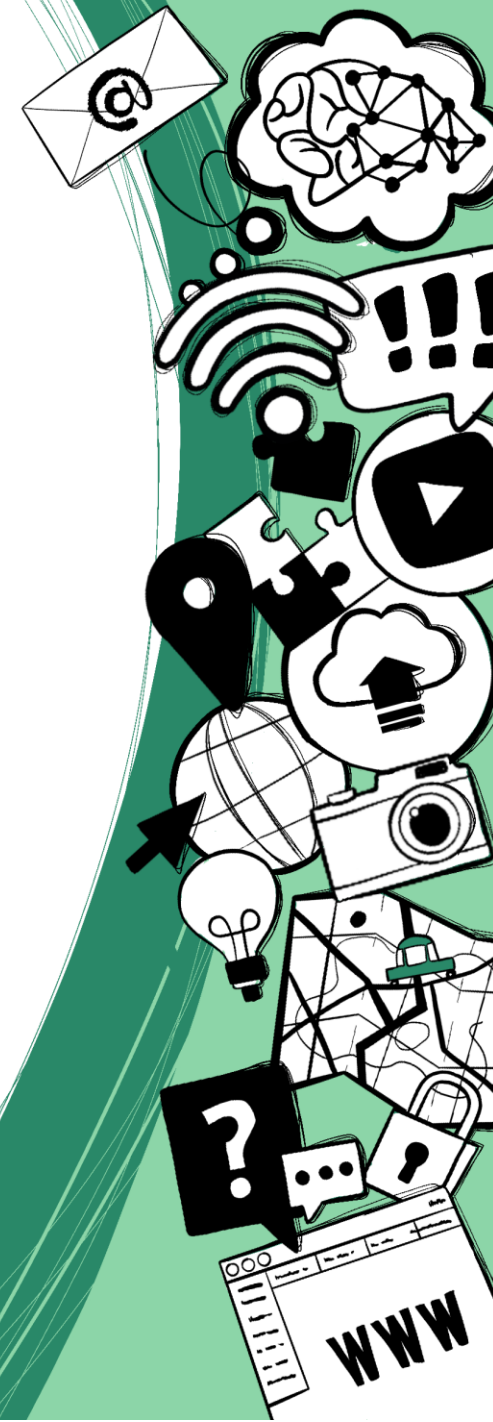# Supervised Learning Reliance on Data

Overfitting
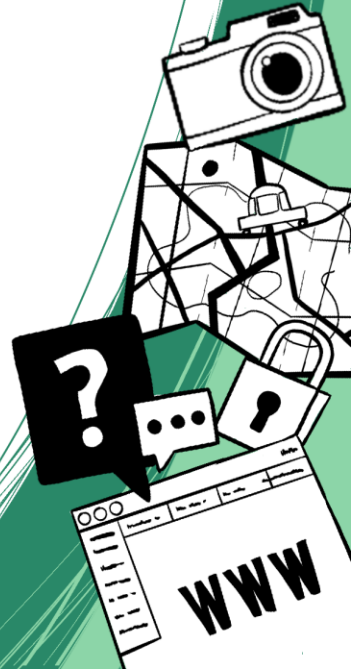
Overfitting

Characteristics

- The model performs very well **during training**

Dog ✔
Cat ✔ **99% Accuracy**

Overfitting

Characteristics

- The model performs very well **during training**

Dog ✔
Cat ✔ **99% Accuracy**

- The model performs very poorly on **different data**
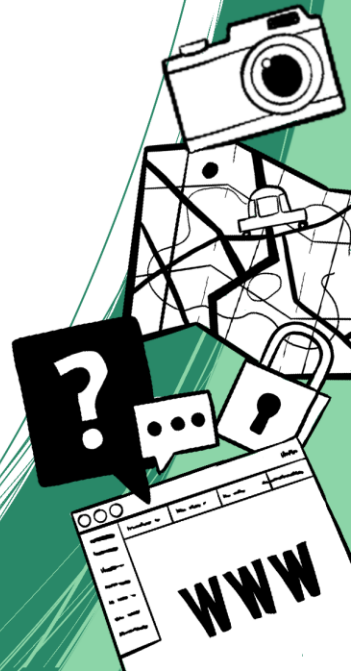

Cat ✘
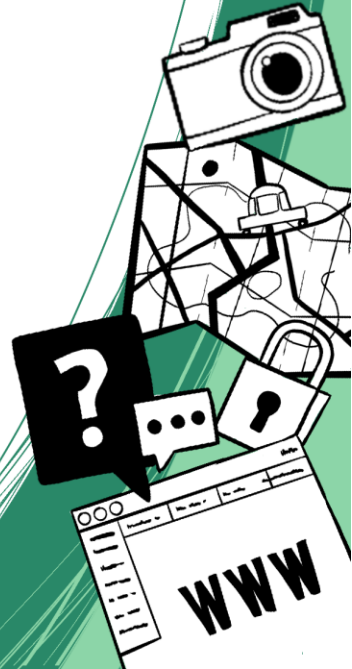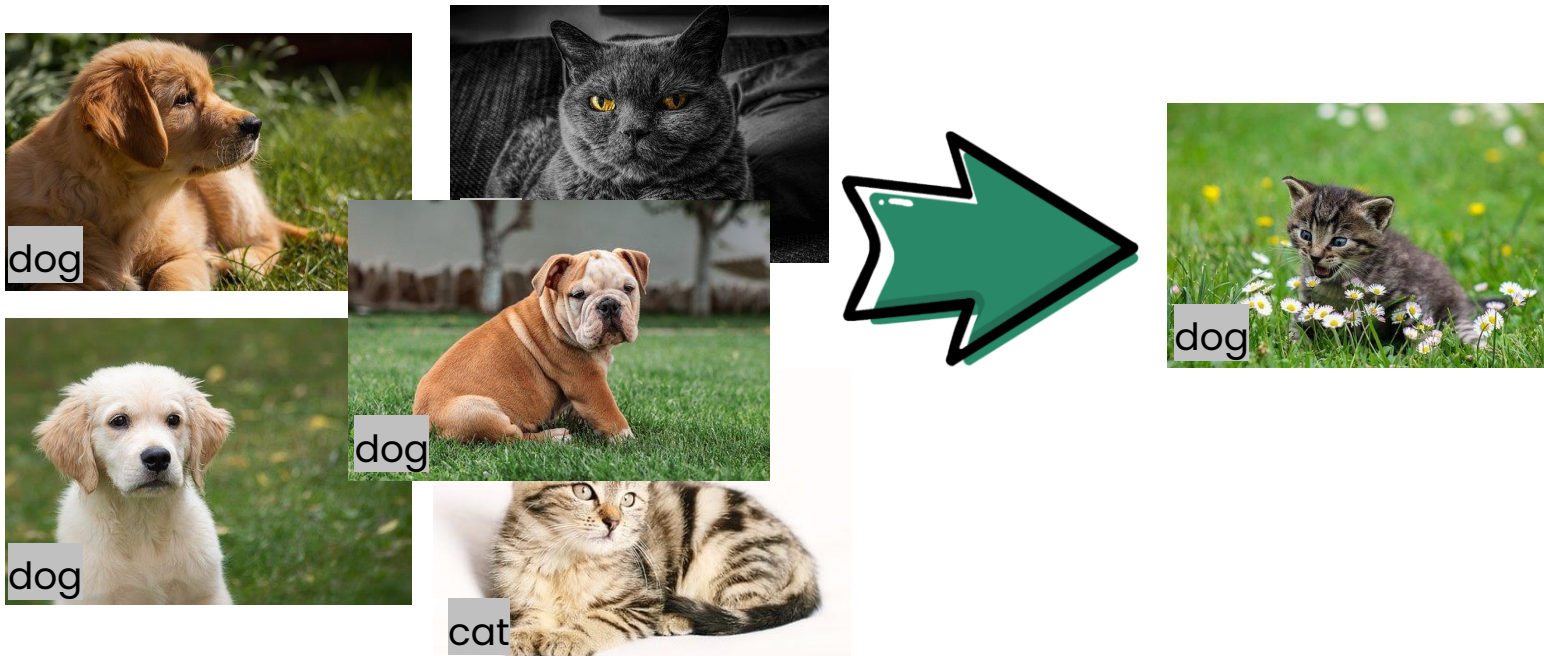Dog ✘ **30% Accuracy**

Overfitting

Possible Reasons

- The model did **not** learn **general enough** features
- The model focuses on the **wrong features**
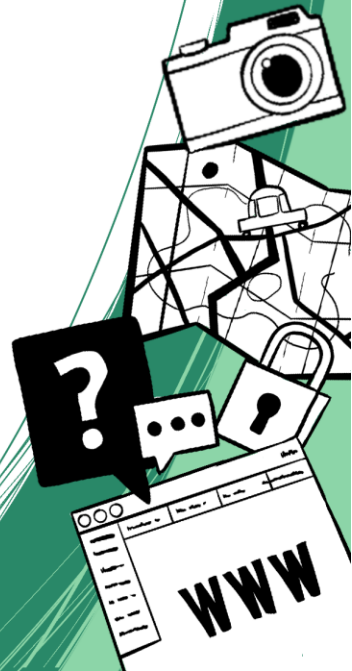
Overfitting

Example 1

Most images of **dogs** in the training set contain **grass**, therefore every image with **grass** will be classified as a **dog**.
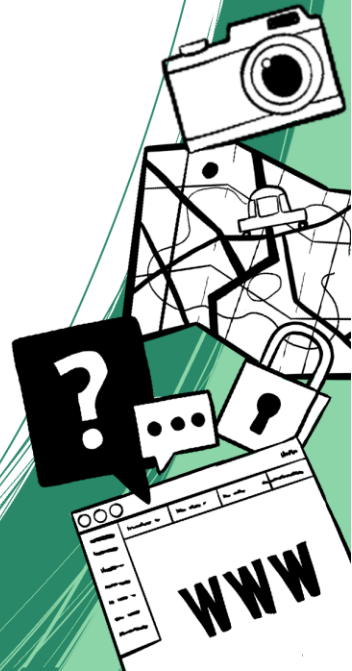
Overfitting

Example 2

All images are **closeups** of cats, therefore a image of a cat in a field will not be reconized.
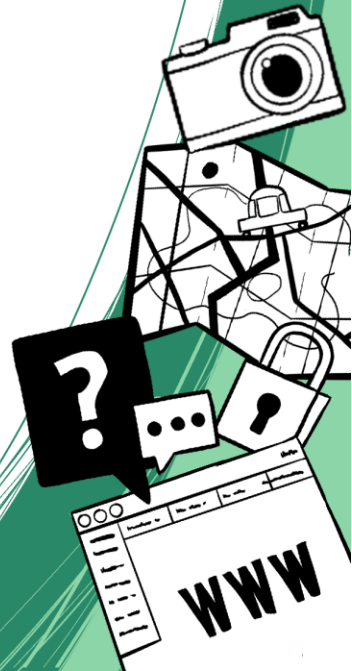
Overfitting

What examples can **you** think of?

Overfitting

What examples can **you** think of?

• Focus on hand **holding** object

• Focus on person or object in the **background**

• Focus on body **posture** instead of facial expression

• Focus on **hair** and **jewelry** instead of face

• Focus on hand **position** instead of gestures

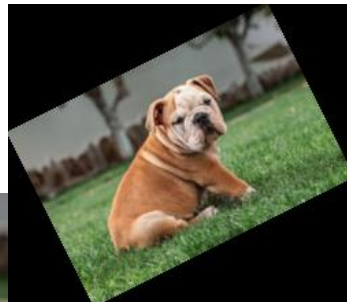• All training images where shot in **daylight**

• …

Overfitting

Possible solutions

- **More** data
- Better **generalized** data
- **Processing** data to reduce insignificant differences
- Increase **variety** by:

flipping

scaling

rotating

blurring

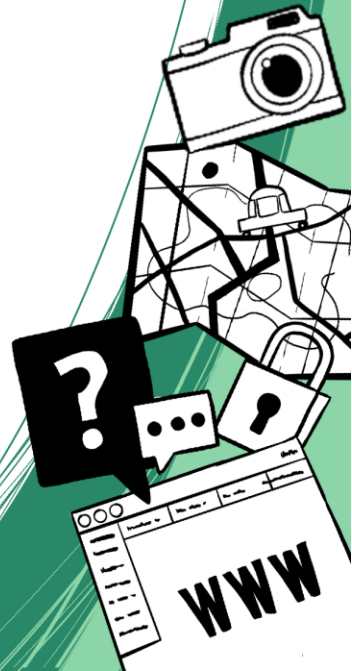desaturating

...

Underfitting

Underfitting

Characteristics

- the model just does **not** provide **usable results**

Cat ✗
Cat ✓
50% Accuracy

Underfitting

Possible Reasons

- **Too few** samples
- Training **data** is **too general**
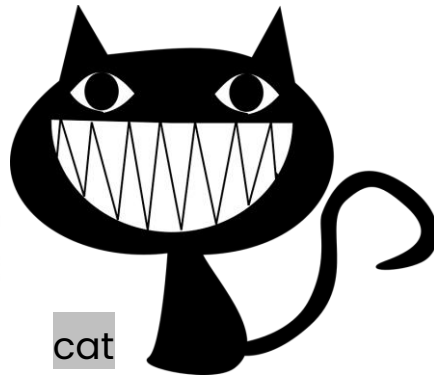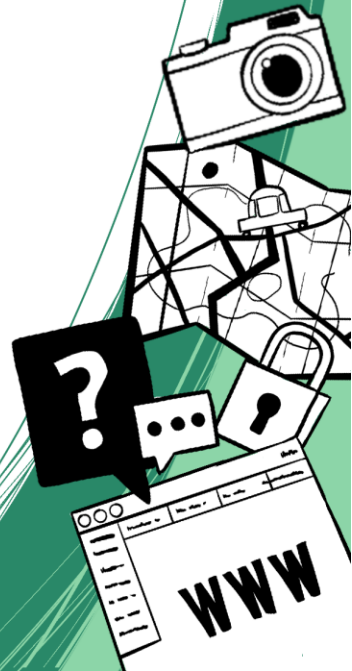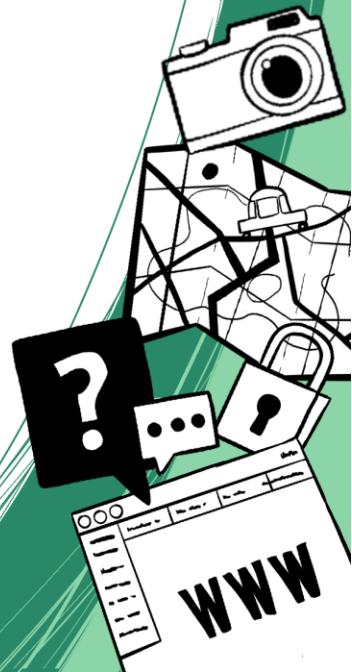- (Training parameters are way off)

Underfitting

Possible Solutions

• Use **more/better** samples for trainings-data

• Adjust training parameters (more iterations, …)

Biases and Fairness

Biases and Fairness

Imagine you create a **chatbot** that should act like a normal human. Therefore you use **live-chats** from **streaming platforms** like Twitch or YouTube for training.

Biases and Fairness

Imagine you create a **chatbot** that should act like a normal human. Therefore you use **live-chats** from **streaming platforms** like Twitch or YouTube for training.

- How well do you think this bot would perform?

- Do you see any **problems** that could occur?

Biases and Fairness

- Network **replicates** what it has **seen/learned**
  - racism, sexism, vulgarity, …
  - bias towards streamers with a loud audience
  - bias towards names and norms that are relevant at the time of training
  - …

Biases and Fairness

- Network **replicates** what it has **seen/learned**
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  - bias towards names and norms that are relevant at the time of training
  - …

- **Hard** to create **unbiased algorithms**

- Ethical question on **where to use** such algorithms
  - Where should machines be allowed to make decisions?
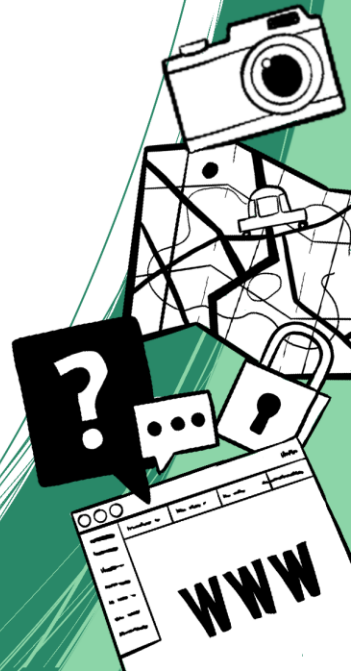 - How can we guarantee an fair and unbiased result?
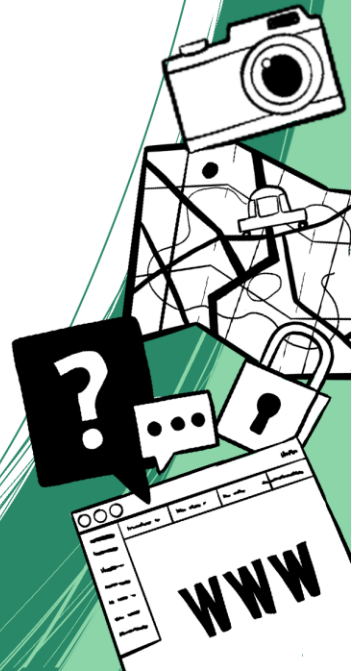
# Training Time and Transfer Learning

Training Time

- Training a **good model** from scratch can take **weeks**
  - If you include finding the right parameters it can even take months or years...

Transfer Learning

- Uses an **already trained model** as a starting point

- Requires much **less trainings-data**
  - usable results often with a few dozens of images

- Requires much **less time**
  - usually seconds to minutes

- Many **pre-trained models** are **freely available**
  - especially for image recognition
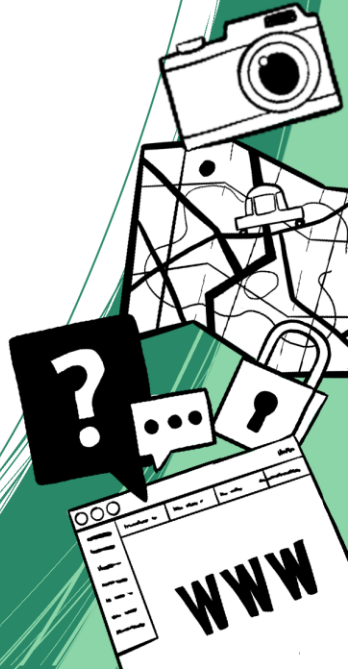
Up next

Training a **real world** image classification **model** and use it to **control** a game of **Snake**!