OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

EIT FAKULTÄT FÜR ELEKTROTECHNIK UND INFORMATIONSTECHNIK

Laboratory

Digital Signal Processing

Exemplary Report

Name Full names of the Students + Mat.-Numbers

Experiment Cat / dog disambiguation.

Date

1. Contents of the experiment

2. Preparatory exercises

3. Experiments

1. Contents of the Experiment

In this experiment, the task is to learn to distinguish between cats and dogs. For this, you will first learn what cats and dogs are and what differences they show. Then you will perform experiments in distinguishing between these two species.

2. Preparatory Exercises – To Be Done Before the Lab

2.1 Literature Research

a) Get familiar with the species dog. What are their main characteristics?

Answer:

Dogs (Canis lupus familiaris or Canis familiaris) come from the genus Canis (canines) and descend from the wolf-like canids [1] and are widely known as pets. It was the first species the mankind is known to have domesticated [2] and comes in a variety of shapes and sizes.

Their main characteristics are:

- They are the human's best friend
- They need to be walked several times a day
- They like to play catch
- They eat meat
- They can bark

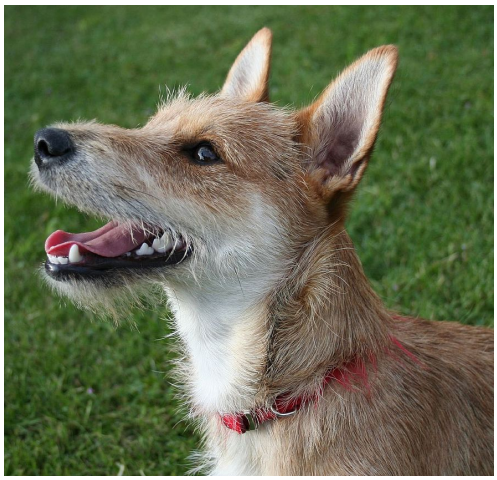

Fig. 1: An example of a dog

(Source: Wikimedia Commons)

[1] *Lindblad-Toh, K., Wade, C. M. et al. (2005). "Genome sequence, comparative analysis and haplotype structure of the domestic dog". Nature.* ***438*** *(7069): 803–819.*

[2] *Freedman, Adam H., Gronau, Ilan et al. (2014). "Genome Sequencing Highlights*

Genes Under Selection and the Dynamic Early History of Dogs". PLOS Genetics. PLOS Org. 10 (1): e1004016.

b) Get familiar with the species cat. What are their main characteristics?

Answer:

A cat (Felis catus) is typically a small meat-eating mammal, closely related to other felinessuch as lions etc. They were venerated in ancient Egypt and therefore are commonly believed to have been domesticated there [3] but there is also evidence of domestication around 7,500 BC [4]. Humans value cats for their ability to hunt vermin but also for companionship.

Their main characteristics are:

- They have sharp claws
- They clean themselves by licking
- They hunt mice
- They like boxes
- They meow

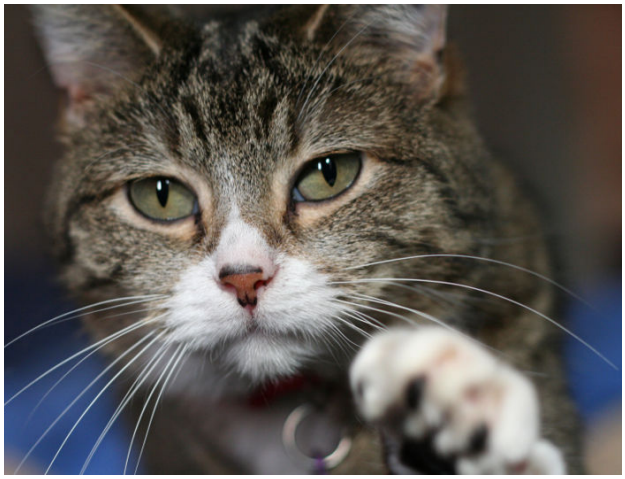

Fig. 2: An example of a cat

(Source: Wikimedia Commons)

[3] *Wade, N. (2007). "Study Traces Cat's Ancestry to Middle East". New York Times.*

[4] *Vigne J.D., Guilaine J., et al. (2004). "Early taming of the cat in Cyprus". Science. 304 (5668): 259.*

3. Experiments – To Be Done During the Lab

3.1 Visual Distinguishing

a) Look at Fig. 1 and Fig. 2. What are the figures showing?

Fig. 1

(Source: Wikimedia Commons)

Fig. 2

(Source: Wikimedia Commons)

Answer:

Fig. 1 shows an animal with short white fur, a long furry tail, a pink nose, two greenish eyes and two pointy ears.

Fig. 2 shows an animal with long black fur, a black nose, two dark eyes and two hanging ears.

b) In the previous task, Fig. 1 shows a cat and Fig. 2 shows a dog. Develop an algorithm for visual distinguishing between these two species.

Answer:

In the previous task, we have seen some characteristics of cats and dogs – the ear shape and nose colour seem to be the distinguishing characteristics in the examples. So the algorithm we develop checks for these characteristics and distinguishes between dogs and cats based on them.

Algorithm:

```
distinguishing(animal):                                  //define function
  if animal.hasPointyEars || animal.hasPinkNose:         //check cat characteristics
    return animal = cat                                  //animal is a cat
  if x.hasHangingEars || animal.hasBlackNose:            //check dog characteristics
    return animal = dog                                  //animal is a dog
```

On the first figure from the previous task, this algorithm would recognise a cat, since it has pointy

ears. On the second figure, this algorithm would recognise a dog, since it has hanging ears.

c) Does your algorithm also work on Fig 3. and Fig. 4 showing a dog and a cat, respectively?

Fig. 3: A dog

(Source: Wikimedia Commons)

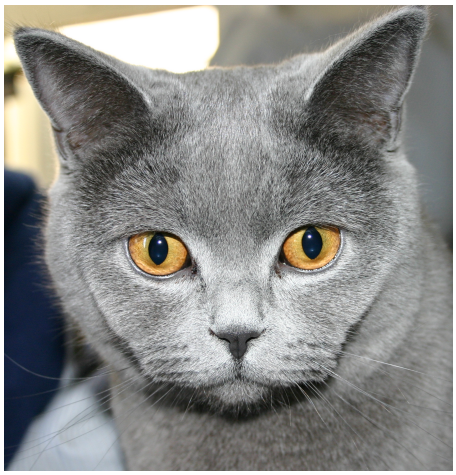

Fig. 4: A cat

(Source: Wikimedia Commons)

Answer:

The algorithm does not work on Fig. 3, since it shows a dog with pointy ears. This case is not covered by the developed algorithm, the algorithm only recognises dogs with hanging ears.

On Fig. 4, the algorithm would still deliver the right results – although the cat does not have a pink nose, it still has pointy ears, so the algorithm would assign this figure the right value “cat”.

d) Develop a general algorithm for distinguishing between cats and dogs. Does it cover all possible cases?

Answer:

The general algorithm has to cover a variety of cases in order to be generally applicable for the problem of distinguishing between cats and dogs. Therefore we need to define more distinguishing characteristics. From the figures above, we can derive two important distinguishing characteristics for cats: they have an almond-like eye shape and a flat nose compared to dogs.

Algorithm:

```
generalDistinguishing(animal):                    //define function
  if animal.hasAlmondEyes && animal.hasFlatNose:  //check cat characteristics
    return animal = cat                           //animal is a cat
  else:                                           //cat characteristics don't apply
    return animal = dog                           //animal is a dog
```

This algorithm would work on all the figures above. But still, there are possible cases that are not covered by the algorithm, for example when the nose or the eyes of the animal are not visible. For these cases, we would need to investigate further characteristics.