DECISION TREES

Cat classification example

	Ear shape (x_1)	Face shape (x_2)	Whiskers (x_3)	Cat
	Pointy	Round	Present	1
	Floppy	Not round	Present	1
	Floppy	Round	Absent	0
	Pointy	Not round	Present	0
	Pointy	Round	Present	1
	Pointy	Round	Absent	1
	Floppy	Not round	Absent	0
	Pointy	Round	Absent	1
	Floppy	Round	Absent	0
	Floppy	Round	Absent	0

Decision Tree

Root node

Decision node

Leaf node
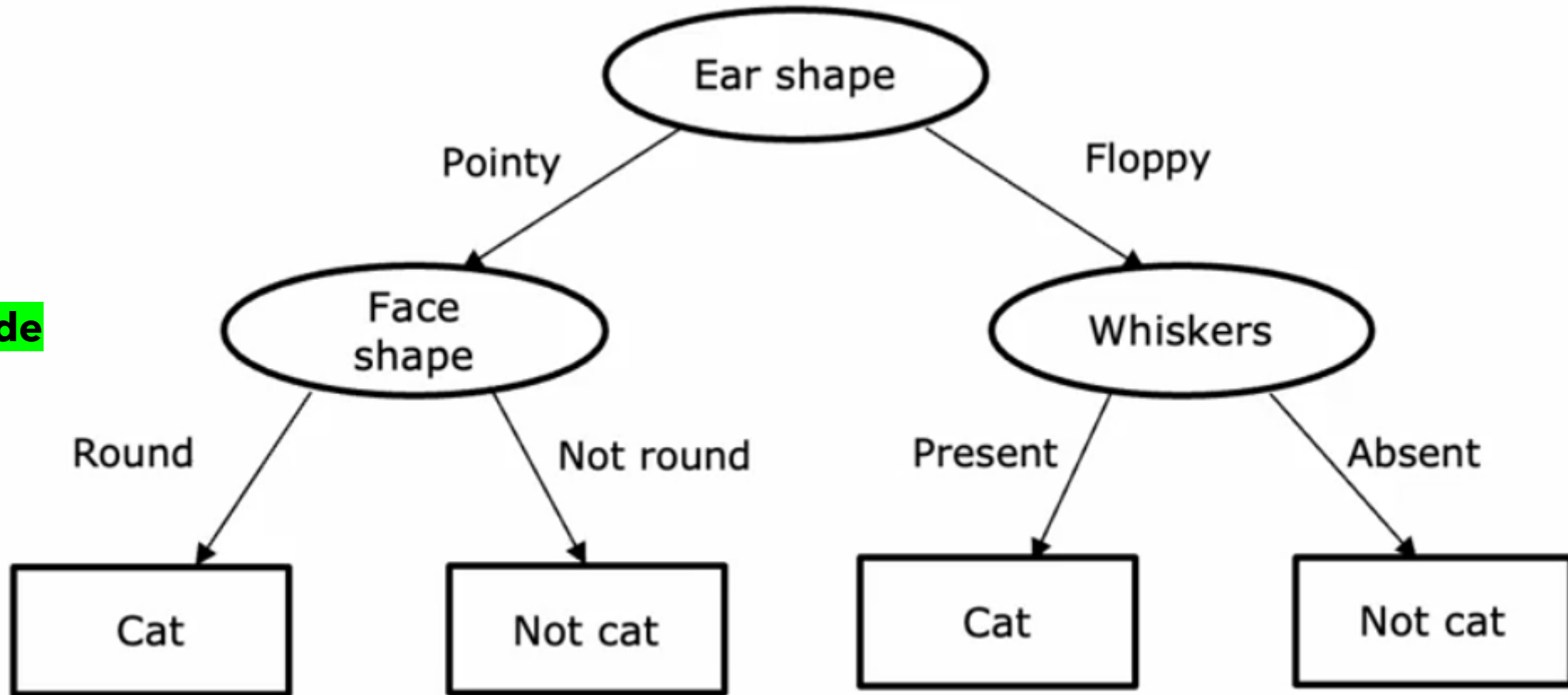
Decision Tree

Decision Tree Learning

Decision Tree Learning

Decision Tree Learning

Decision Tree Learning

Decision Tree Learning

Decision Tree Learning

Decision Tree Learning
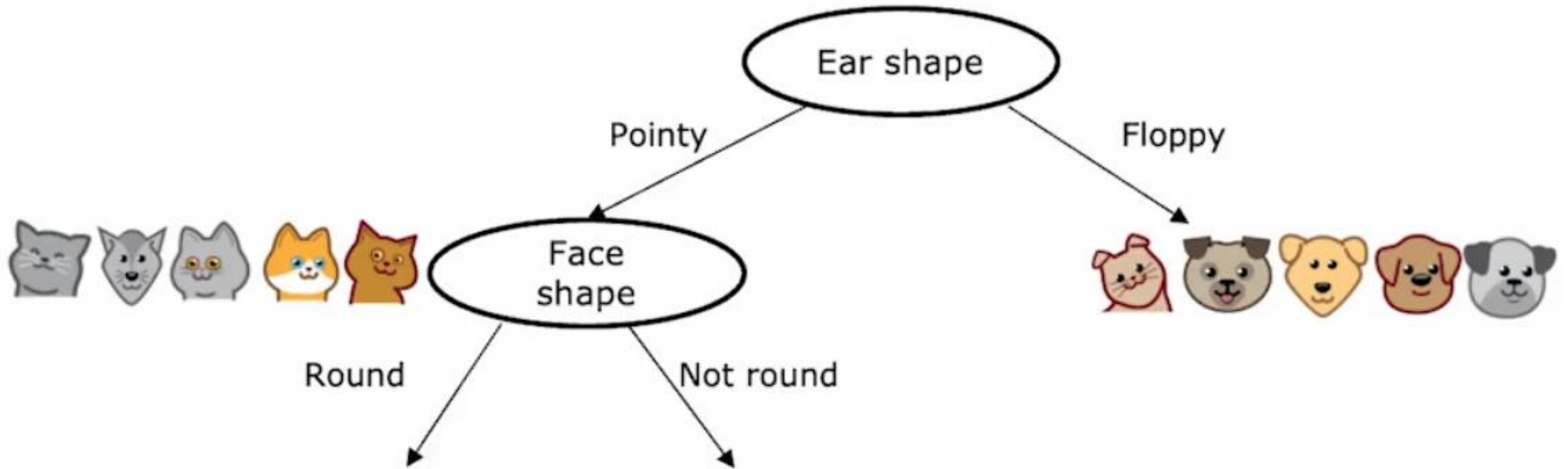
Decision Tree Learning
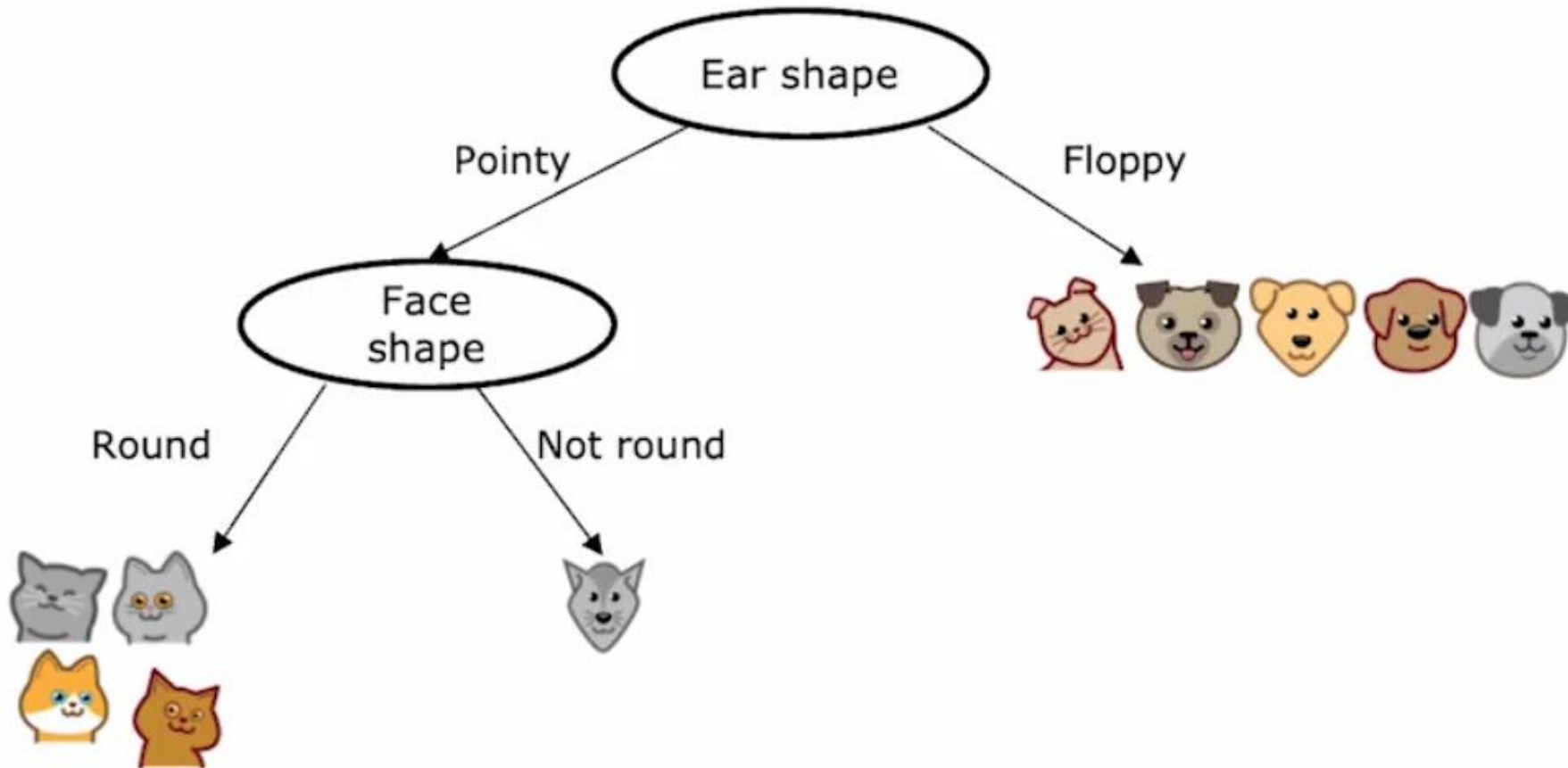
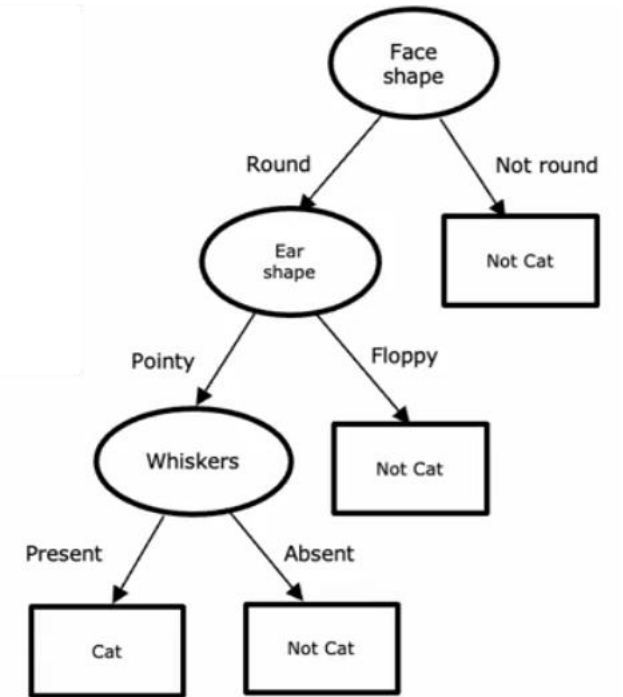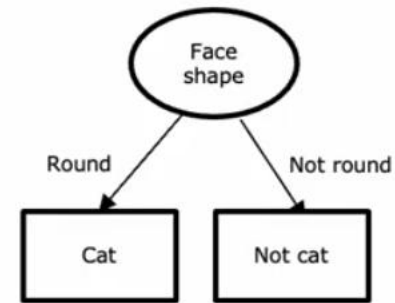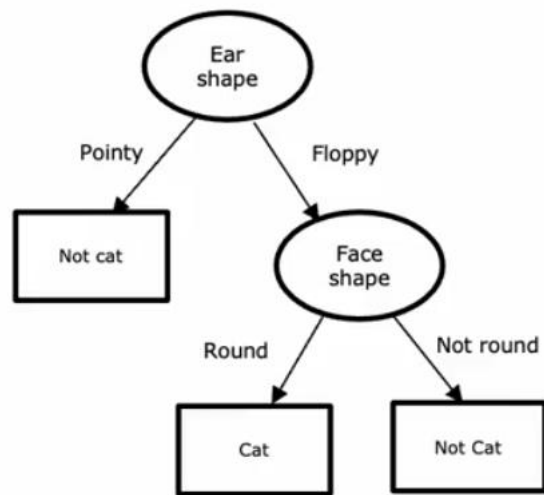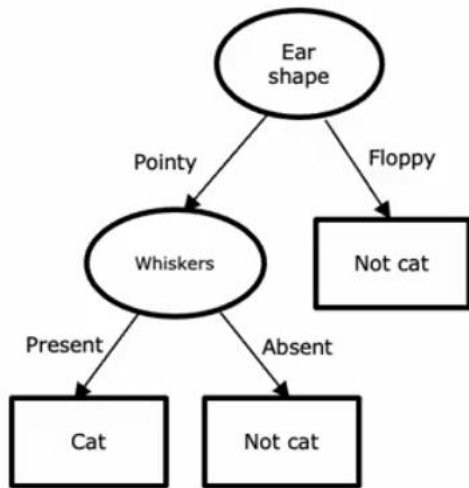# Decision Tree Learning
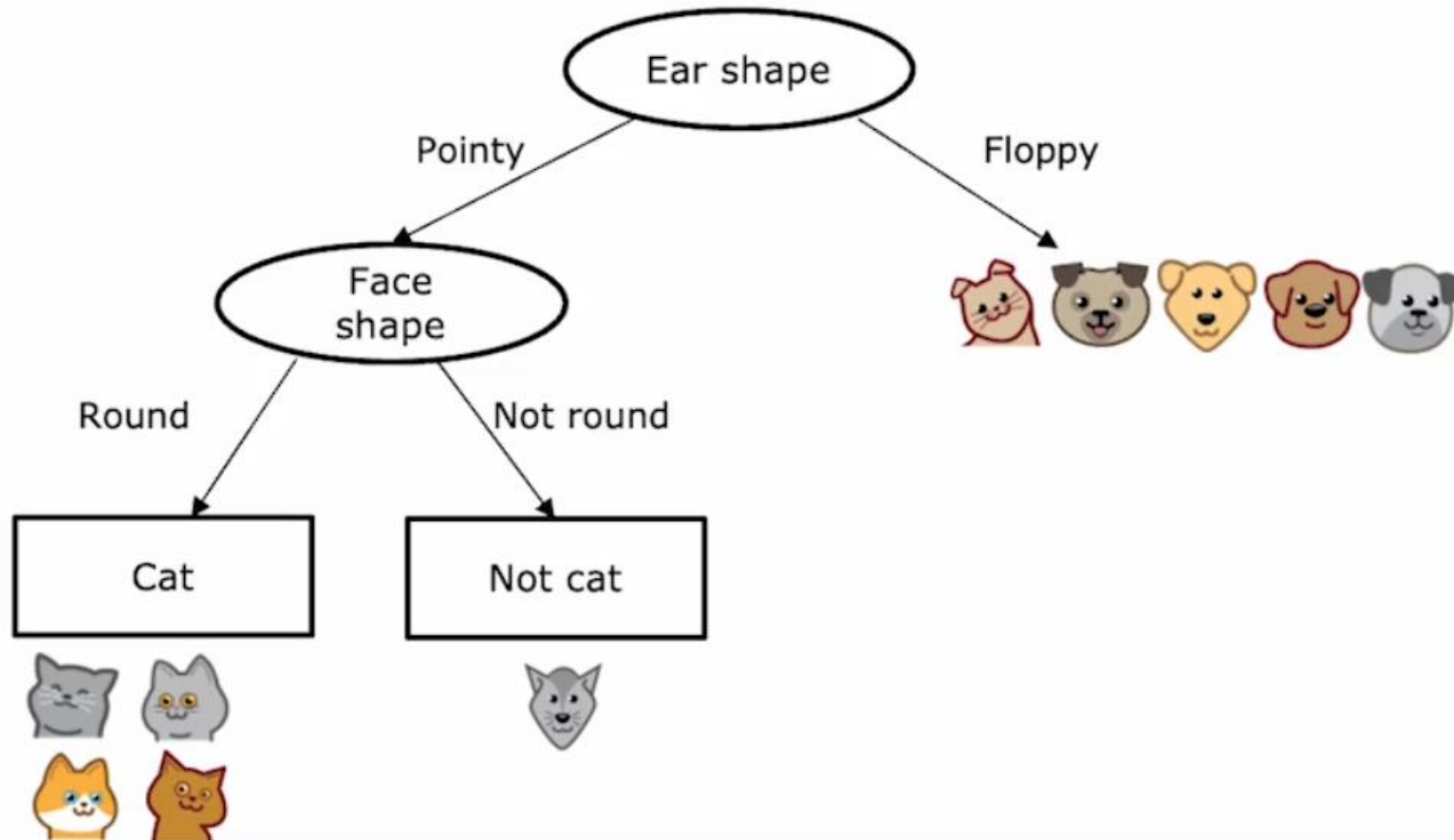
Decision Tree Learning
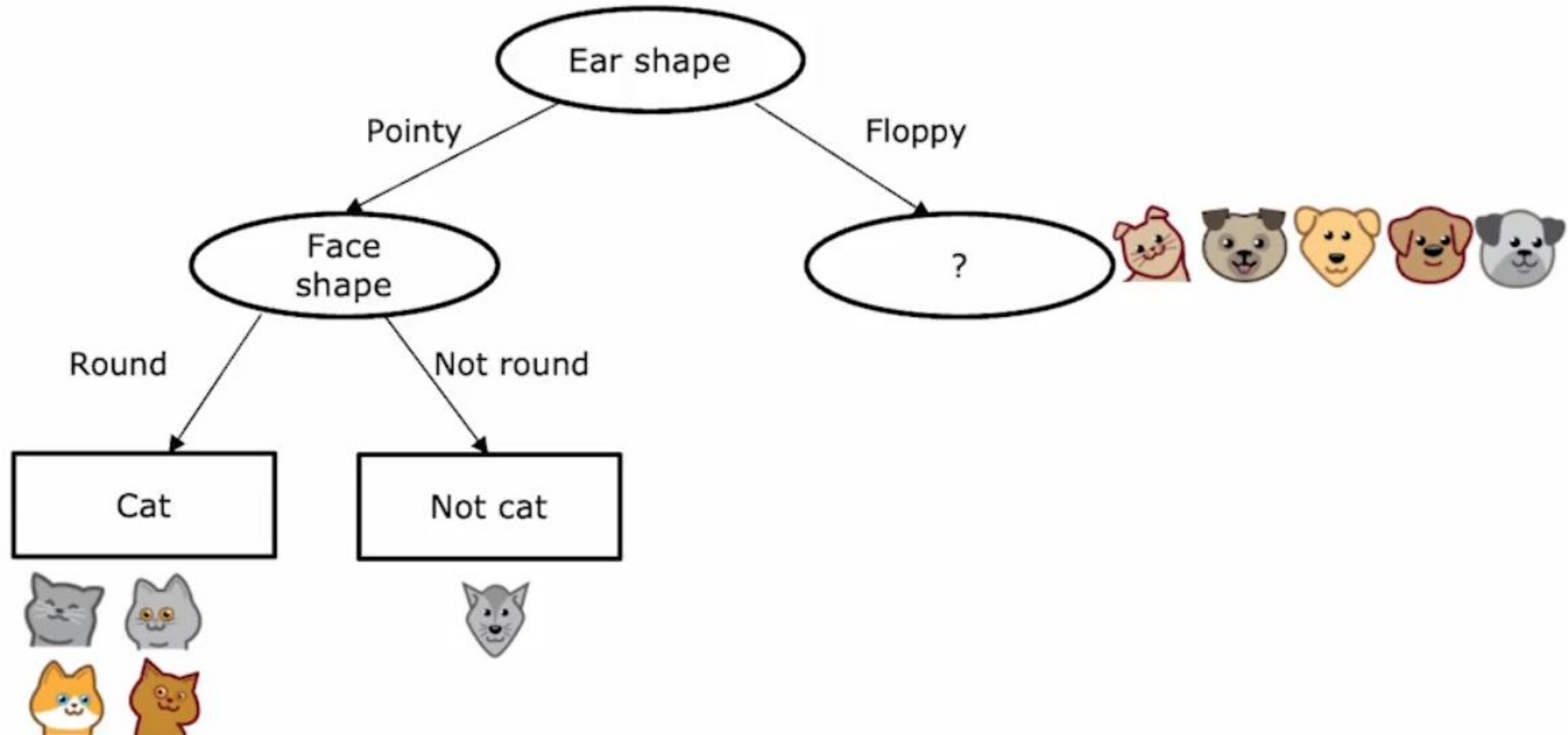
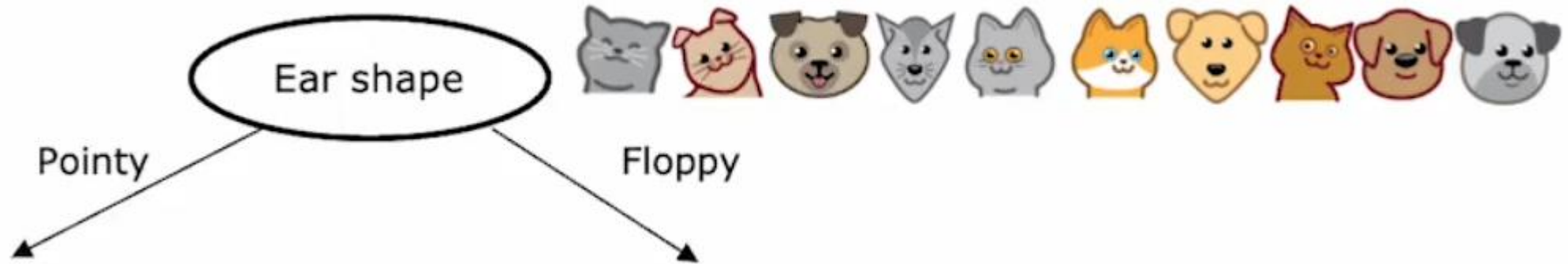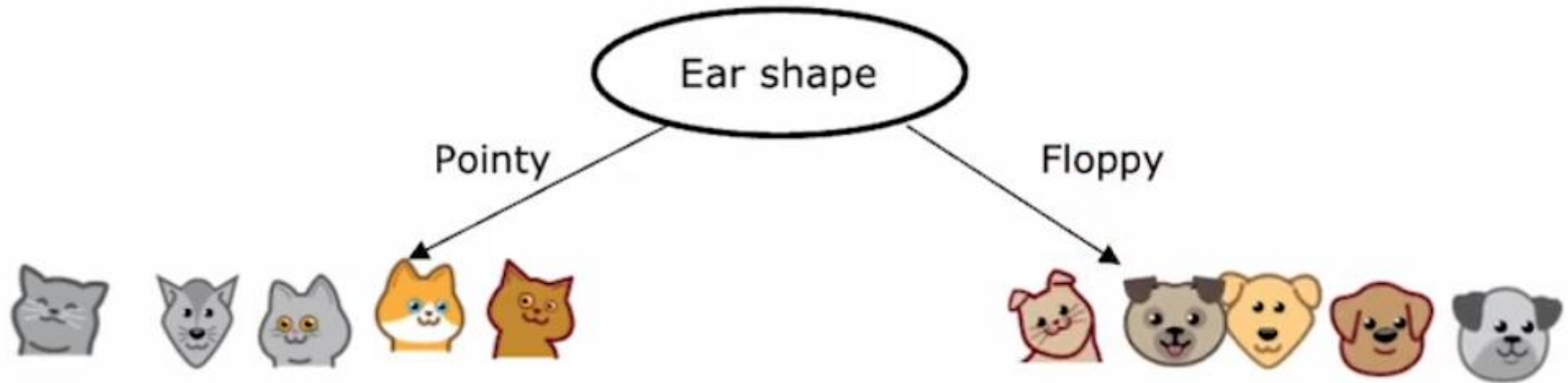# Decision Tree Learning

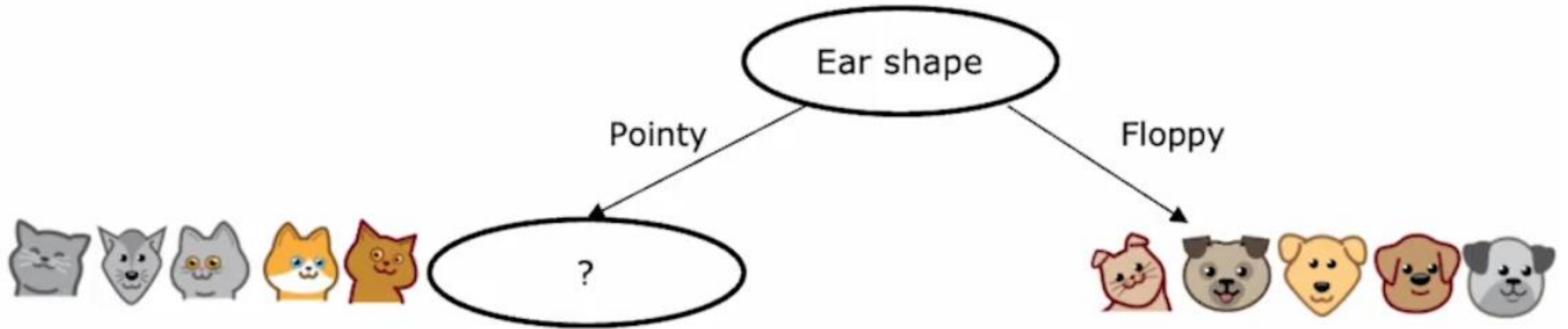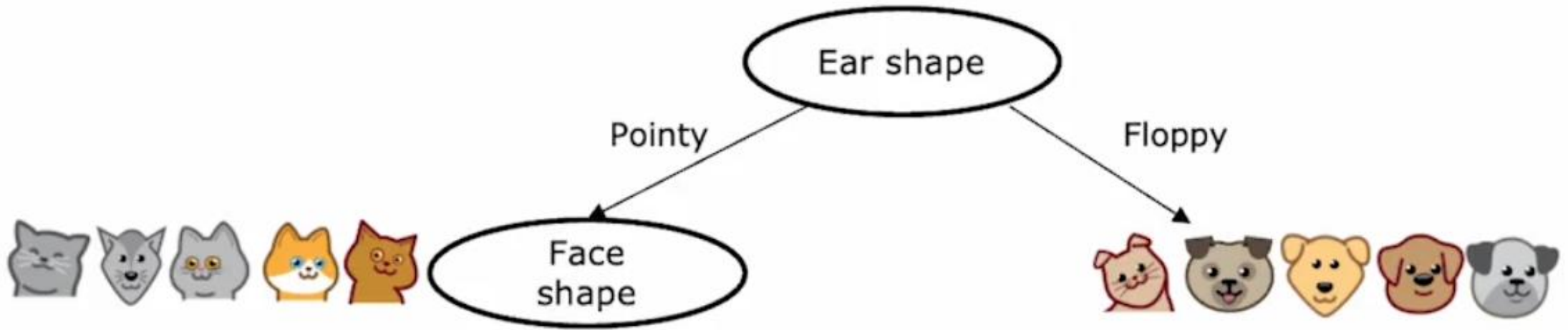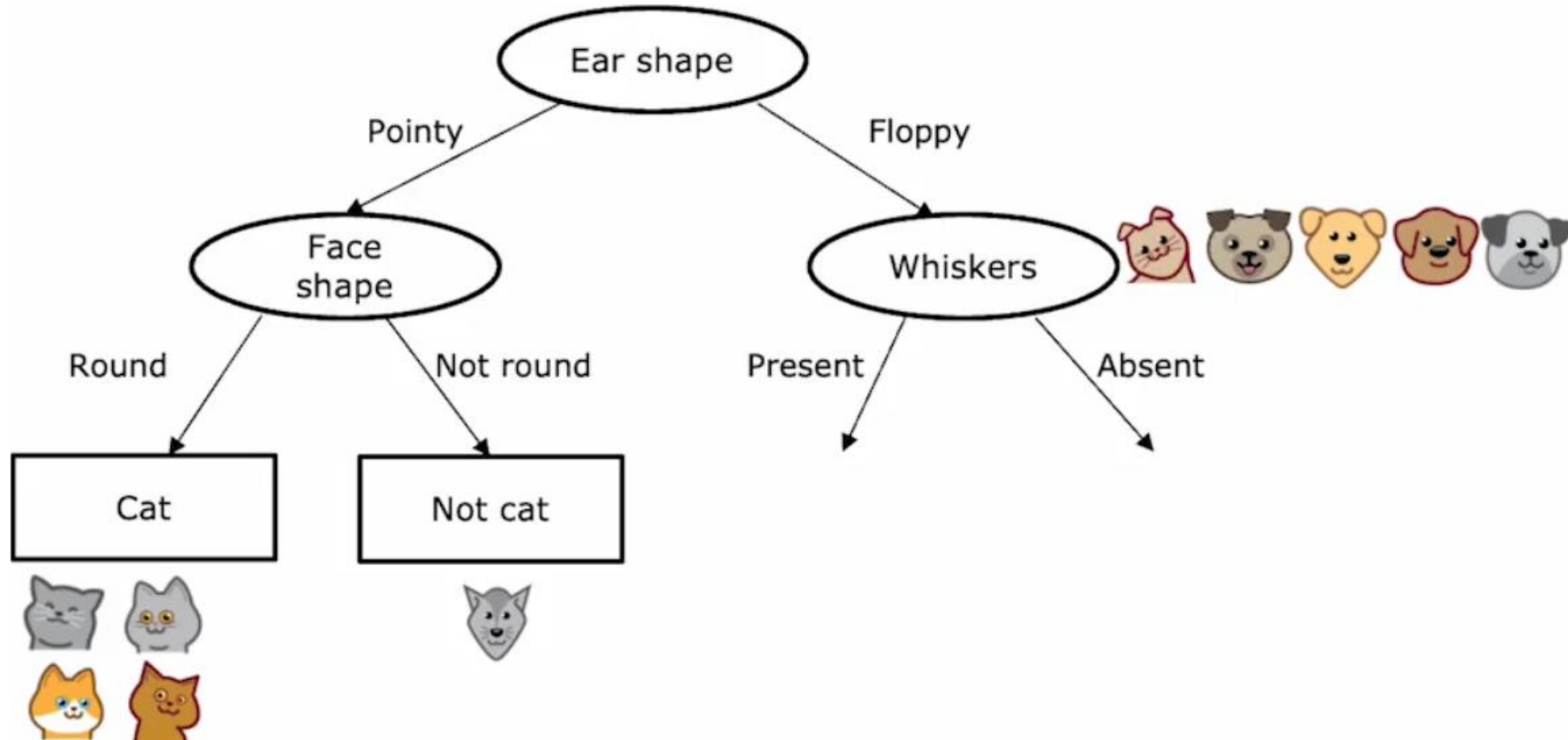# Decision Tree Learning
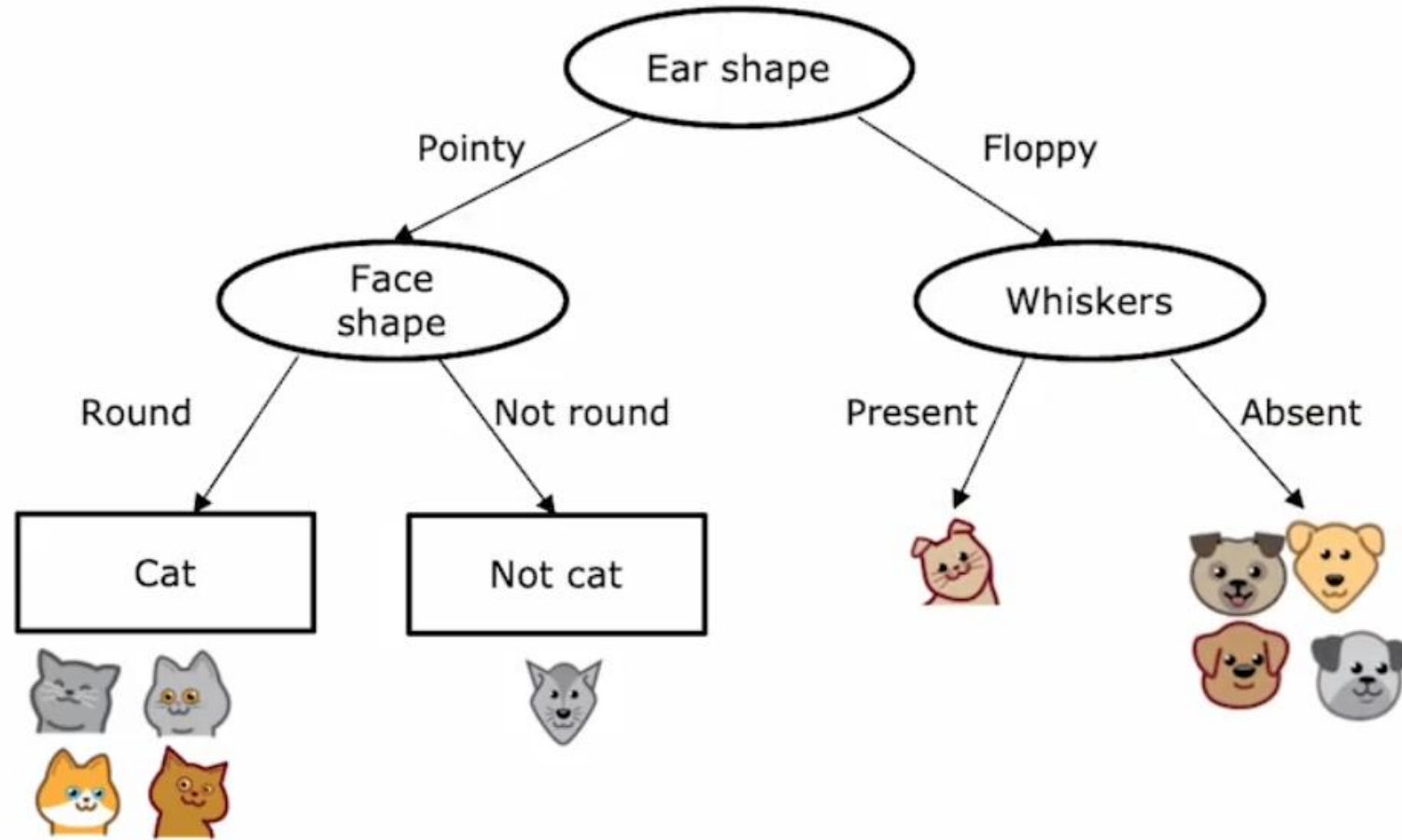
Decision Tree Learning
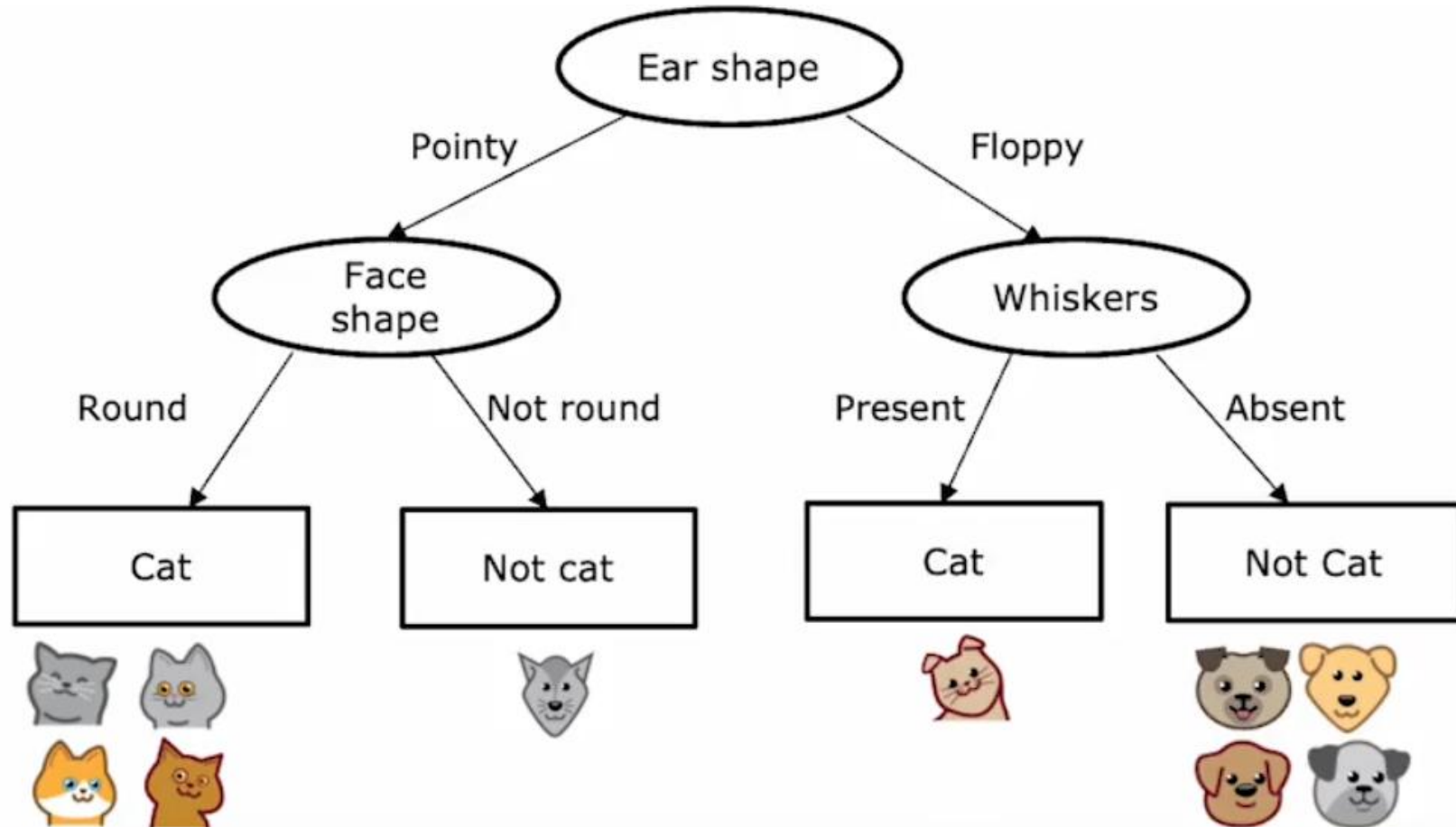
Decision Tree Learning

- Decision 1: How to choose what feature to split on at each node?

Answer: Maximize purity (or minimize impurity)
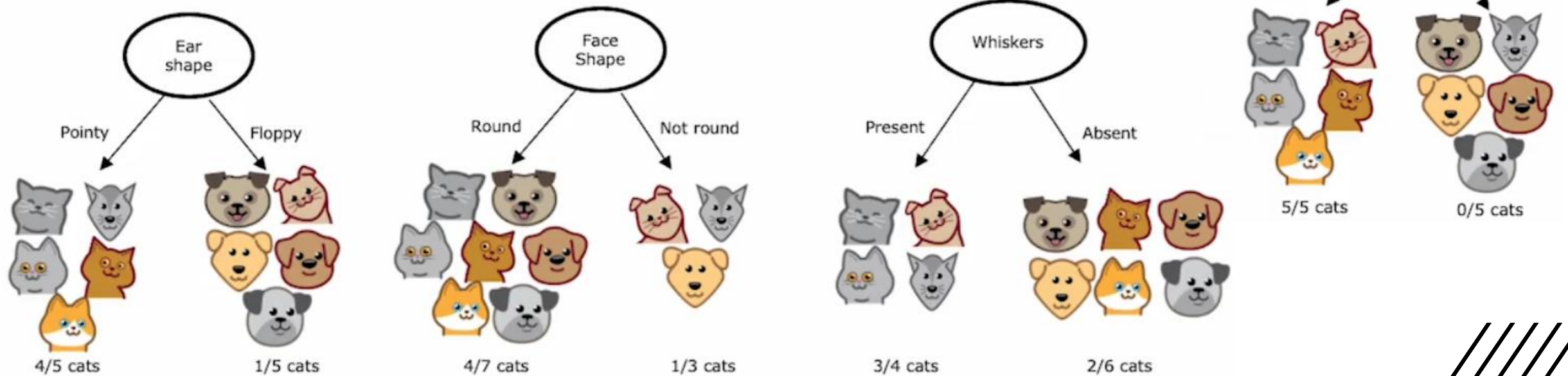
Decision Tree Learning

- Decision 2: When do you stop splitting?

Answer:

1. When a node is 100% one class

2. When splitting a node will result in the tree exceeding a maximum depth

3. When improvements in purity score are below a threshold

4. When number of examples in a node is below a threshold

Example

- Predicting whether a person will buy a car

Age	Income	Credit Score	Buys Car?
25	Low	Fair	No
30	Medium	Good	Yes
45	High	Excellent	Yes
35	Medium	Fair	No
50	High	Good	Yes
28	Low	Excellent	No

Example: "Should You Order Pizza?"

- Imagine it's 11 PM, you're feeling hungry, and you need to decide whether to order pizza. 🍕

- Your decision depends on three factors:

1. Hunger Level – Low, Medium, High

2. Bank Balance – Low, Okay, High

3. Delivery Time – Fast, Slow

Hunger Level	Bank Balance	Delivery Time	Order Pizza?
High	High	Fast	✅ Yes
Medium	Okay	Fast	✅ Yes
Low	High	Slow	❌ No
High	Low	Slow	❌ No
High	Okay	Fast	✅ Yes
Medium	Low	Fast	❌ No

🍽️ Will TMP Get an Order Today?

- Imagine you're a TMP owner competing with University mess that serves food to students every day. Whether you get an order depends on what the mess is serving today!

Problem Statement:

- If students like today's mess food, they won't order from the restaurant.

- If they don't like the mess food, they'll order from the restaurant.