CSE 435 – Pattern Recognition

INTRODUCTION

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Structure of the module

Two Parts

- Pattern recognition and Machine Learning
- Neural Networks and Deep Learning

Assessment

- 2 Class Test x 20% each = 40%
- Exam (Mid + Final) = 60%

Textbook

- Pattern Recognition & Machine Learning – Christopher M. Bishop

Getting started

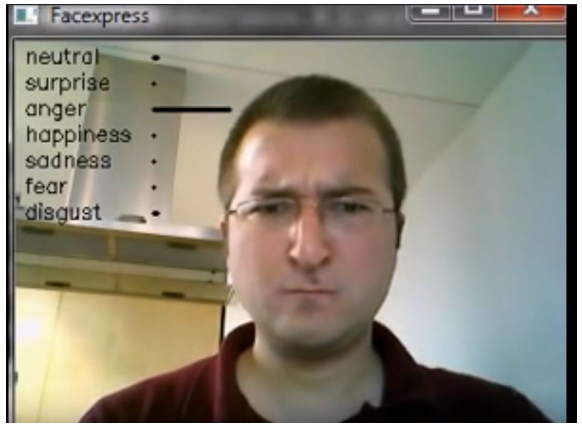
- Some applications
- Some history
- Present day

Some applications

https://youtu.be/aaOB-ErYq6Y?t=117

Driverless car

Facial expression recognition



https://www.youtube.com/watch?v=LdQw8PSV2P8

Iris recognition

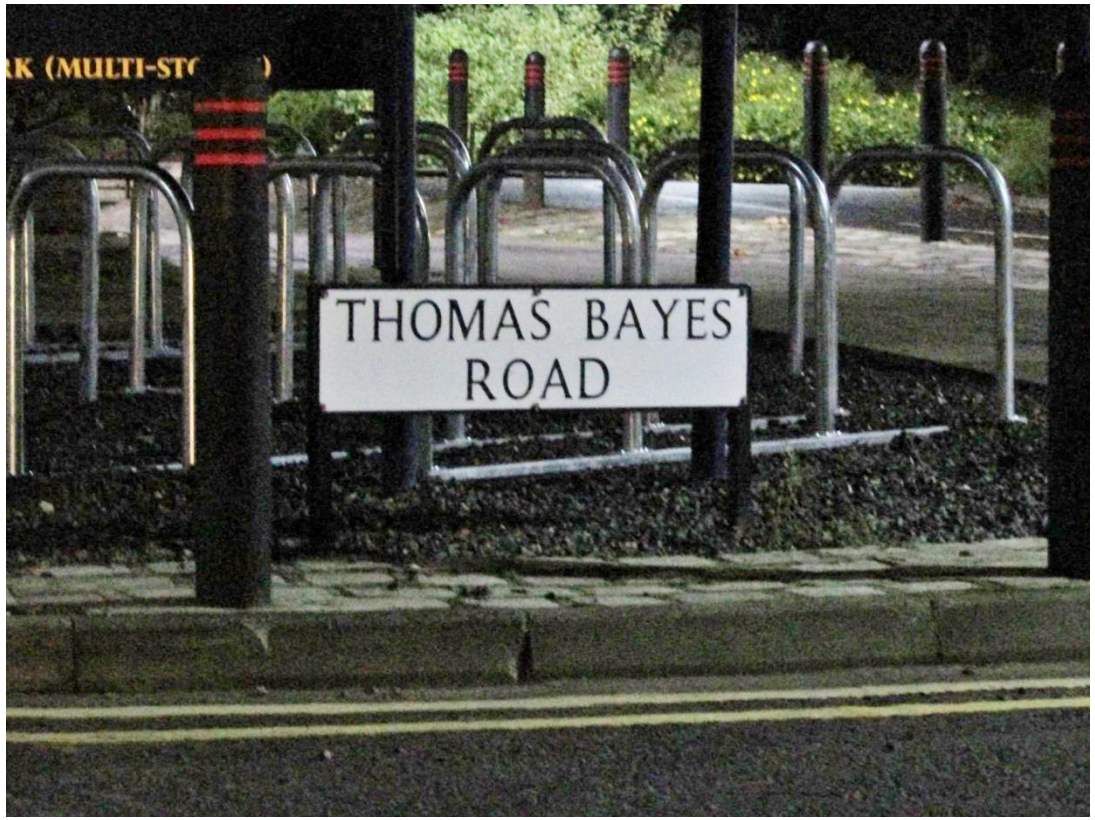
You hum the song, we'll find it!

https://www.midomi.com/

Some history

Thomas Bayes: An obscure 18th century clergyman and statistician who published 2 minor works but who nowadays is "more important than Marx and Einstein put together"…

Telegraph Magazine, 3 February, 2001



Some history

Mike Lynch, the "Bayesian Millionaire", founded his company **Autonomy** in 1991.

Telegraph Magazine, 3 Feb 2001

Developed systems for
•- matching fingerprints for the Essex police force
•- reading car number plates

2001:

Autonomy has been estimated at £ 4.7 billion

2011:

In October 2011 Autonomy was sold to Hewlett-Packard for $ 11 billion

Present day

26/09/2021

https://www.kaggle.com/competitions

kaggle

Create

Home

Competitions

Datasets

Code

Discussions

Courses

More

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Tabular Playground Se...

PetFinder.my - Pawpul...

KerasTuner + TF Decisi...

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NFL Big Data Bowl 2022
Help evaluate special teams performance
Analytics · 3 months to go
$100,000

PetFinder.my - Pawpularity Contest
Predict the popularity of shelter pet photos
Research · Code Competition · 4 months to go
$25,000

Google Brain - Ventilator Pressure Prediction
Simulate a ventilator connected to a sedated patient's lung
Research · a month to go
$7,500

Wikipedia - Image/Caption Matching
Retrieve captions based on images
Playground · 2 months to go
Swag

Tabular Playground Series - Sep 2021
Practice your ML skills on this approachable dataset!
Playground · 4 days to go
Swag

Pattern Recognition / Machine Learning

- Questions to the human expert
- Related areas
- Basic concepts
- The pattern recognition cycle

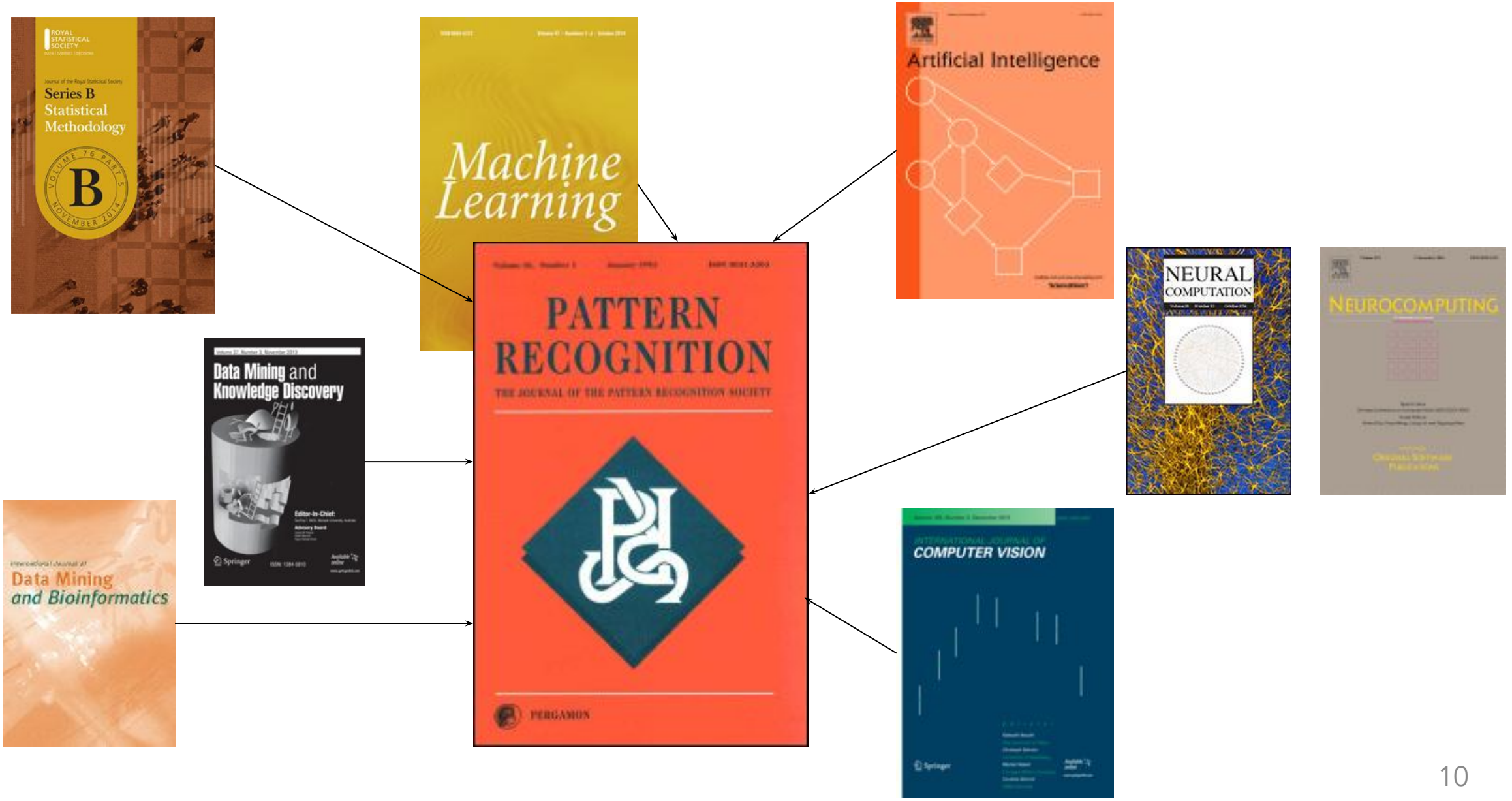
Questions for the human expert

1. How do I describe the problem so that the machine understands it? (design a representation)

2. How do I classify/predict/make a decision? (verbalise or explicate in some way the algorithm)

3. Can I get the machine to learn the algorithm itself? (Pattern Recognition & Machine Learning)

Which other disciplines is pattern recognition related to?



Basic concepts

Classes and class labels

= groups of similar objects, $\Omega = \{\omega_1, \ldots, \omega_c\}$

We shall assume that the classes are *mutually exclusive*, i.e., each object belongs to one and only one class.

c classes

Features

= the measurements, attributes, descriptors $x_1, x_2, \ldots x_n$

n features

Objects

= the "things" that we classify
instances, examples

N objects in a data set

"Round and square apples" data set

features

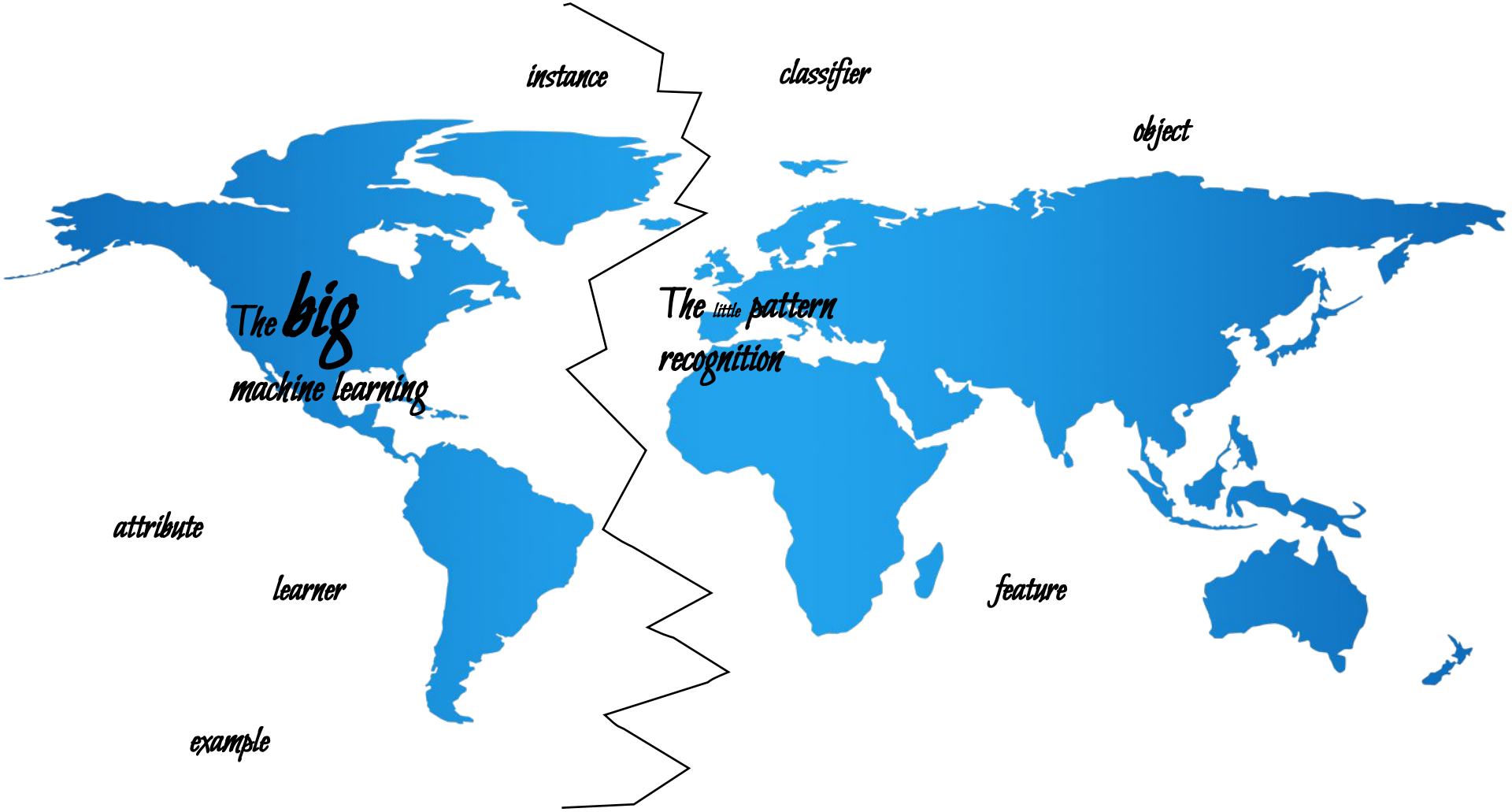
class

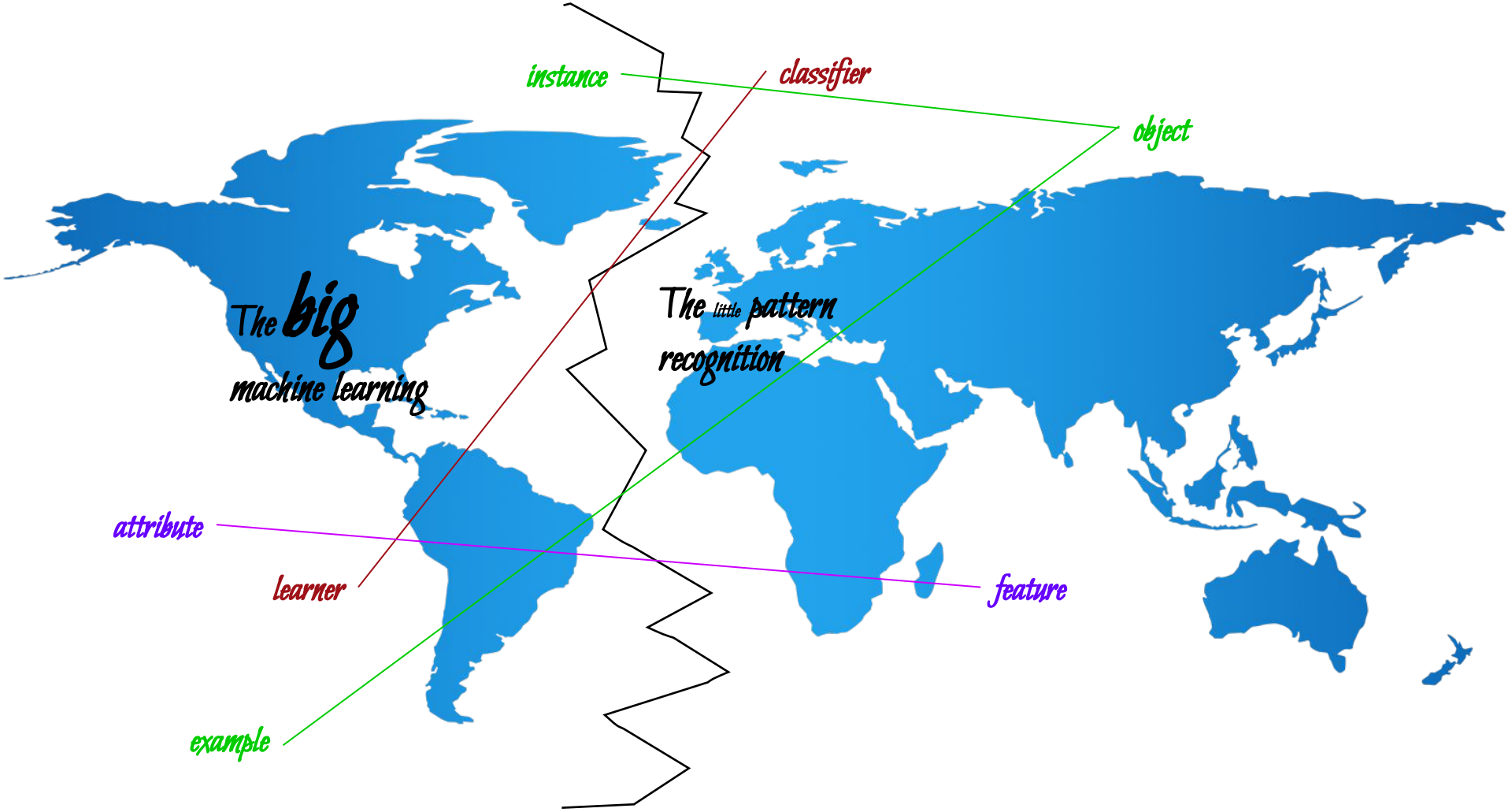
objects

Object	Shape	Shape colour	Leaf colour	Class label
	Round	Blue	Blue	1
	Square	Green	Blue	1
	Square	Green	Green	2
	Square	Red	Blue	1
	Round	Red	Red	1
	Square	Blue	Blue	2
	Square	Red	Green	1
	Round	Green	Red	2
	Round	Blue	Green	2
	Round	Green	Blue	2

Can you guess the classification rule?

Can you label this one?


instance
classifier
object
The big
machine learning
The little pattern
recognition
attribute
learner
feature
example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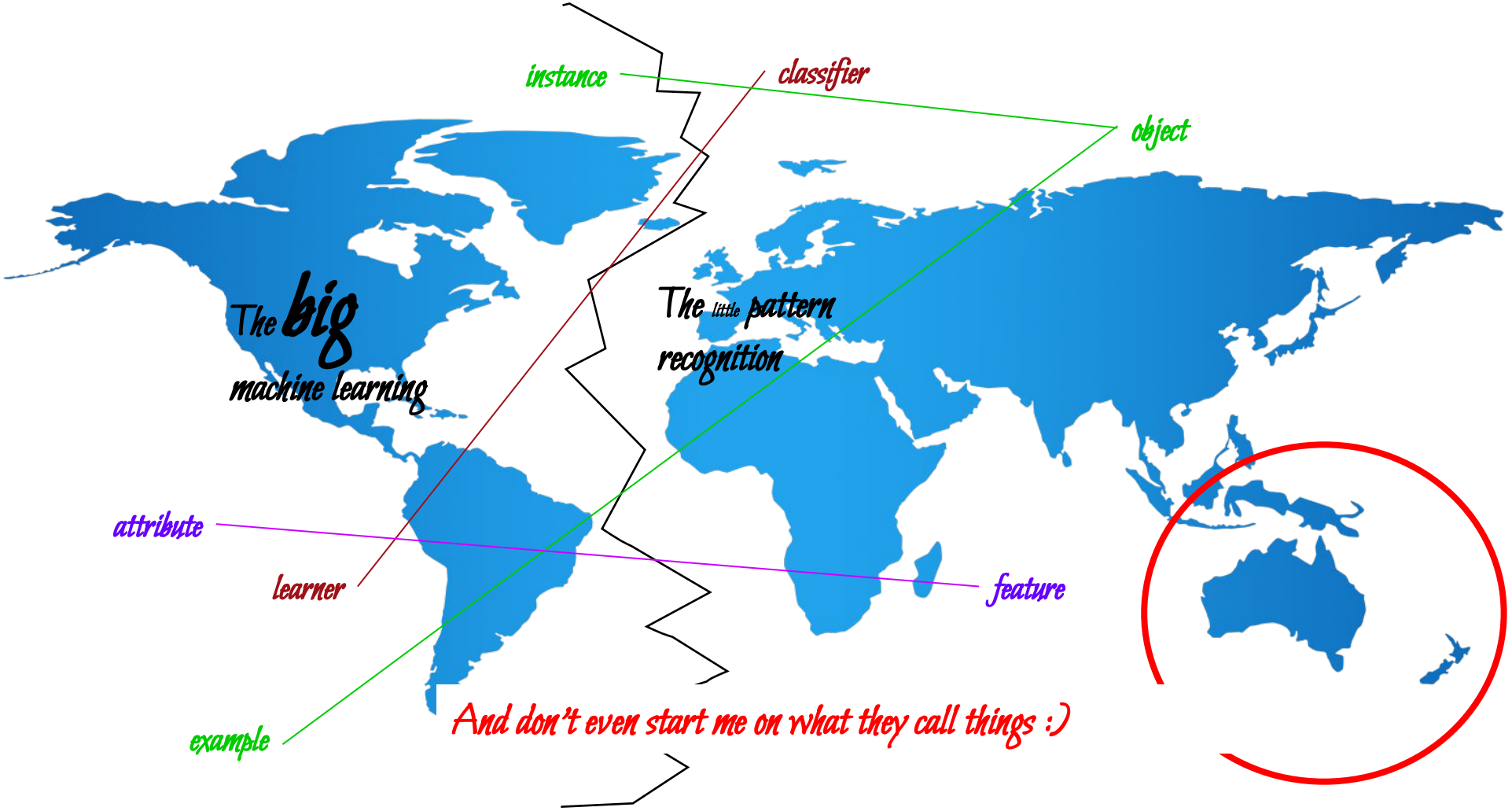
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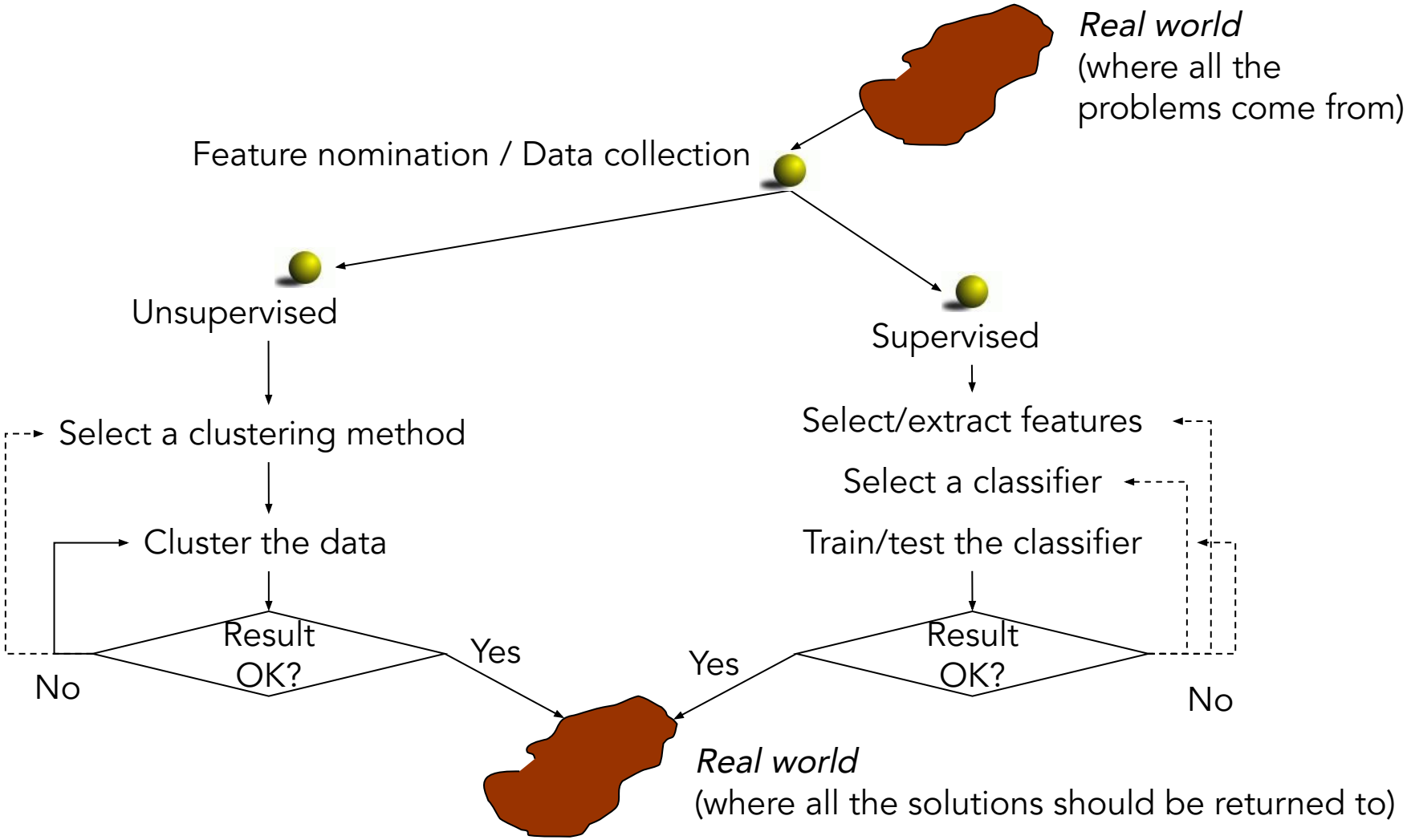
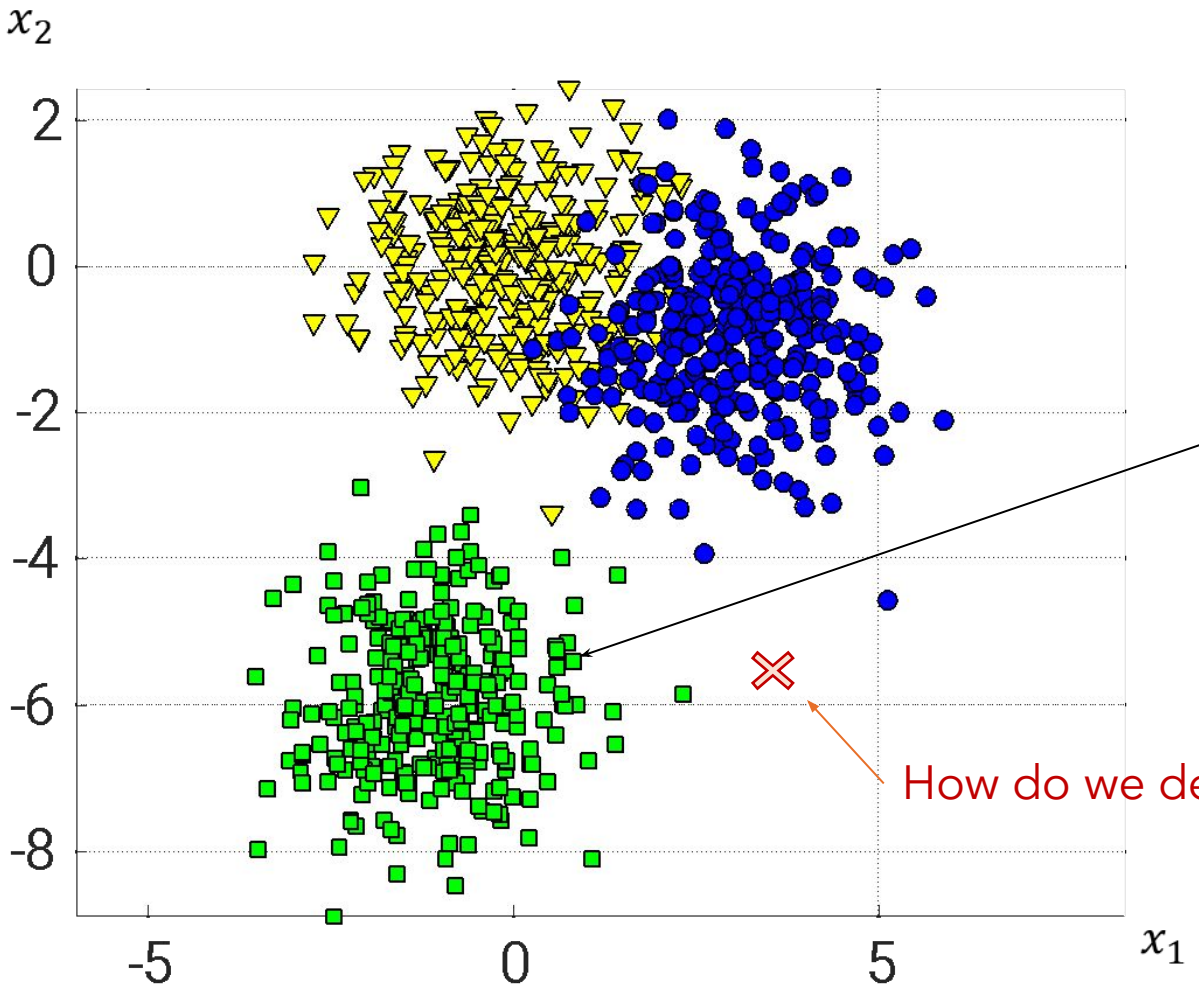
And don't even start me on what they call things :)

The Pattern Recognition cycle



Example: SUPERVISED LEARNING (Classification)



c = 3 classes
n = 2 features
N = 900 objects

object #395

Class label:
GREEN SQUARE

How do we determine the label of a new point?

Answers

Answers to the questions from slide 12:

(1) Round and the same colour OR Square and different colour = class 1, else class 2
(2) Class 2

Answer to the question from slide 17:

We can assign the new point to the nearest cluster. In this case it is class Green Square.