Machine Learning: Lesson 12

Introduction to Unsupervised Learning

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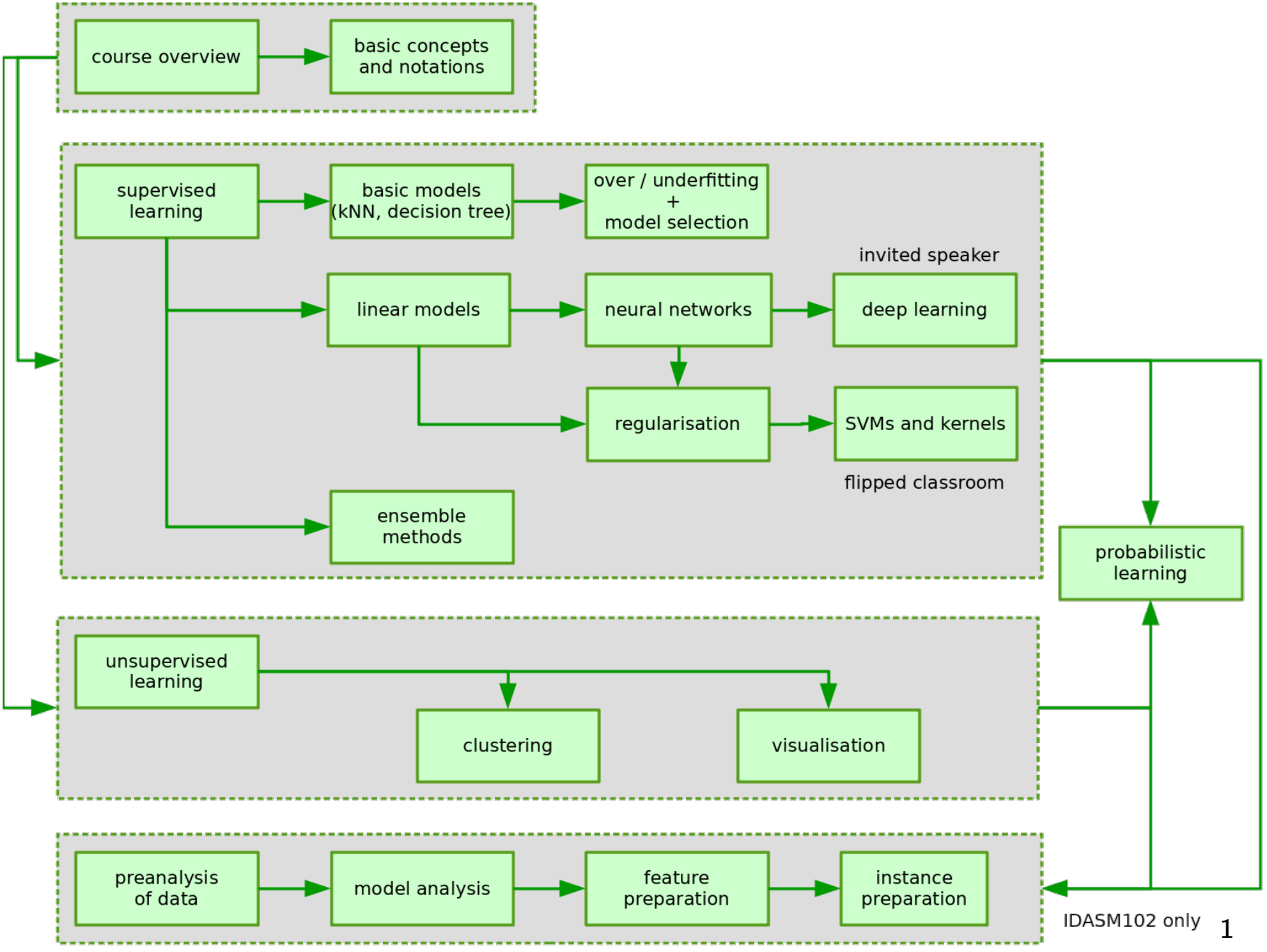
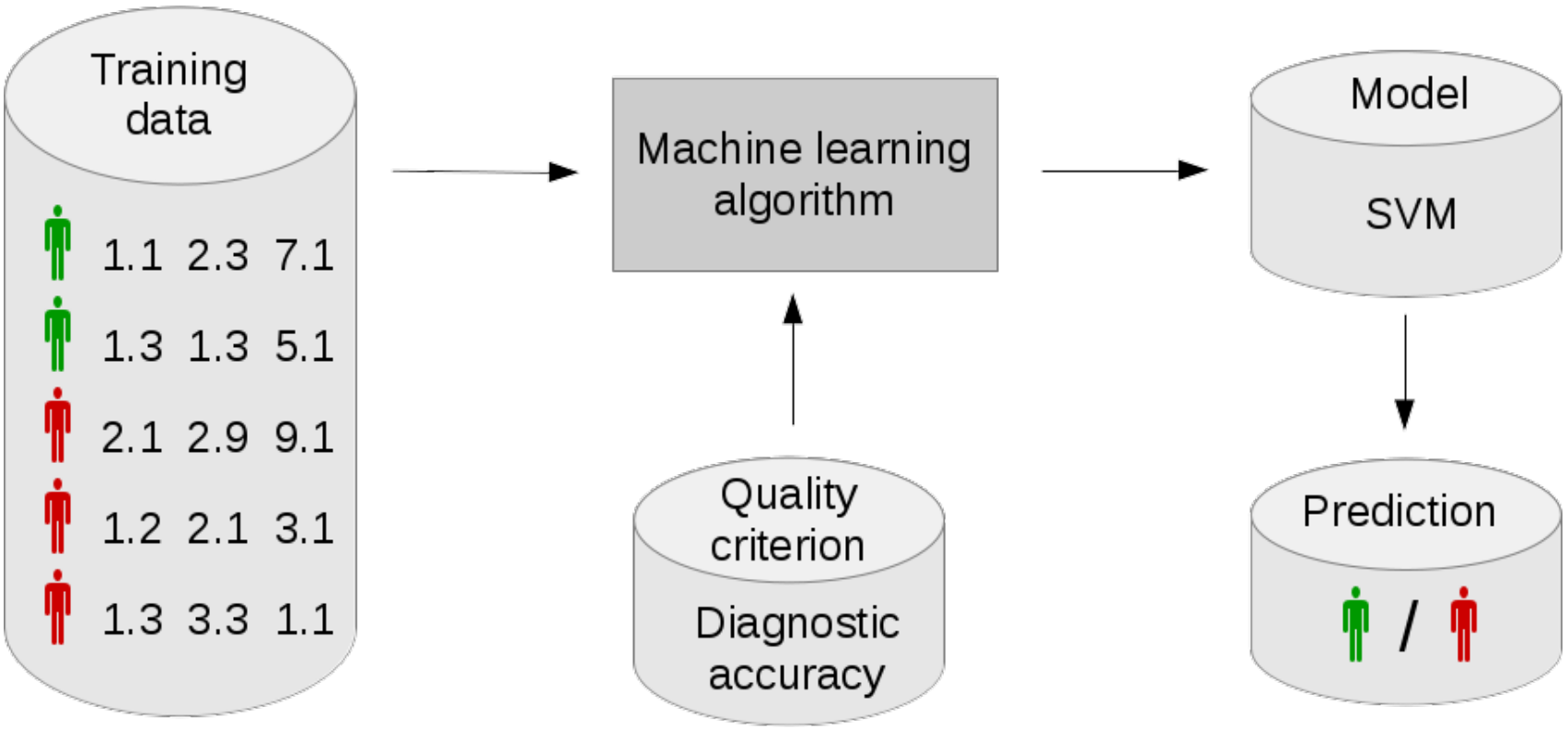

course overview
basic concepts and notations
supervised learning
basic models (kNN, decision tree)
over / underfitting + model selection
invited speaker
linear models
neural networks
deep learning
regularisation
SVMs and kernels
flipped classroom
ensemble methods
probabilistic learning
unsupervised learning
clustering
visualisation
preanalysis of data
model analysis
feature preparation
instance preparation
IDASM102 only

Outline of this Lesson

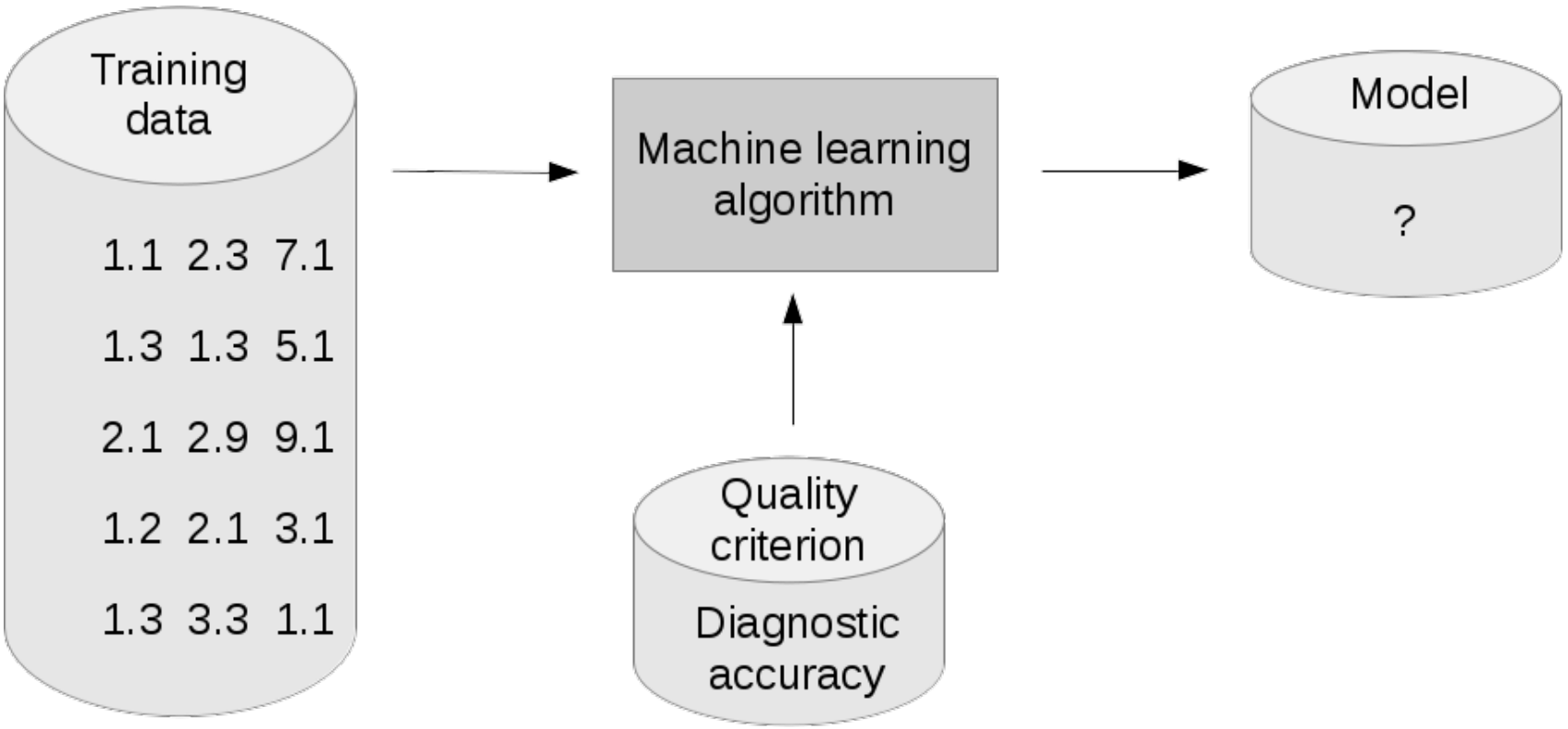
- generalities about unsupervised learning
- comparison with supervised learning

Generalities about Unsupervised Learning

Supervised Machine Learning



Unsupervised Machine Learning



Unsupervised Machine Learning

Objective

- find patterns/structure in data with (almost) no human interaction
- facilitates further analysis (e.g. global model vs. one model per profile)
- allows users to gain intel from data and to design research questions

Practical use

in practice, unsupervised learning requires human feedback

- the algorithms have no idea of what you are looking for
- several kinds of unsupervised analysis can be performed
  - clustering (find clusters of similar data)
  - density estimation (describe the distribution of data)
  - visualisation (project high-dimensional data on a computer screen)
- unsupervised learning is often an iterative process (trial and error)

Unsupervised Machine Learning

Unsupervised learning $\neq$ learning without objective function

- machine learning = optimise a model % an objective function
- the model and the objective function depends on the desired result

Examples of objective functions

- clustering: minimise intra-cluster distances
- density estimation: maximise likelihood of data
- visualisation: minimise information loss after projection

Comparison with Supervised Learning

Comparison Between Supervised and Unsupervised Learning

	supervised learning	unsupervised learning
goal	specified by target and context ($\pm$ objective tasks)	no ground truth (often user-defined and subjective)
objective f°	few (surrogates)	many (ill-defined problem)
aim	target prediction	knowledge discovery or intermediate learning step
feedback	provided by teacher in form of instance-target pairs	interactive (constraints, preferences, user validation)
model selection	validation-based	requires human feedback or subsequent learning steps
model test	test-based	requires human feedback or subsequent learning steps
interpretability	not always necessary (goal is to predict a target)	critical for knowledge discovery & feedback

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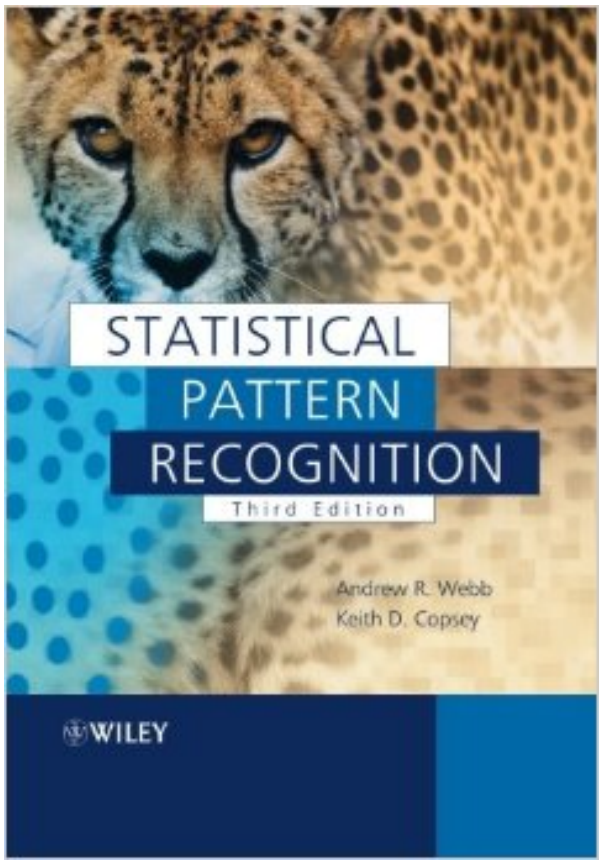
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PATTERN
RECOGNITION
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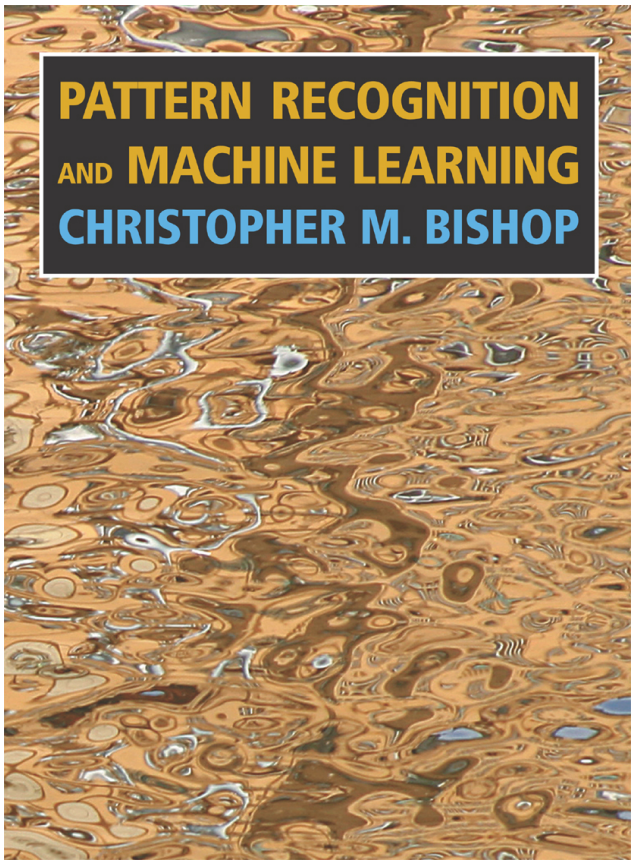
Andrew R. Webb
Keith D. Copsey
WILEY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