F20DL and F21DL: Part 2, Machine Learning
Lecture 9. Revision

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Covered ML Algorithms:

We had 4 major groups of ML methods

- ▶ Bayesian Probabilities,
- ▶ Unsupervised learning (Clustering) and
- ▶ three major Supervised Learning Methods:
  - ▶ Decision trees,
  - ▶ Linear Regression,
  - ▶ Neural Nets.

Depth and breadth

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Depth: Lectures/tests were covering a few algorithms carefully, in each small detail

Breadth: Courseworks were there to encourage you to go broader (check other algorithms and platforms), and wider (using the big data set, optimisation methods, additional programming languages). At MSc level – own mini-research investigation

- It was a lot of work, but it was "high intensity" training: it was worthy of effort.

General feedback on CW

- Very impressive
- No submission fell lower than B: the class understood main concepts
- Top marks went well beyound the call of duty with programming and algorithm analysis

To check feedback

one of your team members will have all marking rubrics available; others – just a mark. Please share the info.

Breadth? Not really: You will not be asked about anything that is not given in the slides

Depth? There will be problem-solving questions as in the test

Exam primary goal is to CHECK you, not TRAIN you

just testing your INDIVIDUAL knowledge and understanding (something that could not be done in CW or tests, when you consulted web resources)

- ▶ 10th December, 13.00
- ▶ 2 hours
- ▶ Diana and I will be with you in the room, you can ask any non-technical questions
- ▶ I will arrange that you have paper copies of tables for convenience: just to scribble on.
- ▶ Just like in your test, exam will assume you draw some solutions on paper, but enter answers electronically (cf. exercise with decision trees)
- ▶ Do not bring calculators: they will be embedded into the screen
- ▶ 2 hours are calculated from the time you are logged in, so do not worry if loading takes time

Exam layout

- ► 100 points for grabs
- ► 4 questions, 25 points each
    - ► Question 1 (25 points max): cf Diana's revision lecture
    - ► Question 2 (25 points max): cf Diana's revision lecture
    - ► Question 3 (25 points max): Unsupervised learning: Bayes learning and clustering
    - ► Question 4 (25 points max): Supervised learning: Decision trees and Neural Nets

- ► Three components of exam: bookwork, problem solving, stretch for best students

Question 3.1. Bayes Nets

1. Bookwork:
   - Formulas for unconditional, conditional, Bayesian probabilities
   - Bayesian networks: architecture, factorisation table

2. Problem Solving:
   - Test 1: questions 1 - 5.
   - Naive Bayes Net – archirecture

1. Bookwork:
   - Hard versus soft clustering
   - k-means algorithm (in detail)
   - EM algorithm: general idea

2. Problem Solving:
   - Test 2: questions 1 - 6.

1. Bookwork:
   - Algorithms "Decision tree learner/classifier"

2. Problem Solving:
   - Test 3: questions 1 - 7.

Exercise in class: decision trees from data

▶ Draw a tree (given some conditions)
▶ Describe its leftmost/rightmost shallowest branch

Question 4.2 Neural Nets

1. Bookwork:
   - One Neuron learning: potential, value, error signal, gradient descent learning rule
   - Algorithm "Backpropagation Learner"

2. Problem Solving:
   - Test 4: Questions 7-20

▶ Last lecture you asked a question about momentum (in neural nets)

Gradient descent learning rule

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$\Delta w(t) = \eta \times gradient + momentum \times \Delta w(t-1)$

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$\Delta w(t) = \eta \times gradient + momentum \times \Delta w(t-1)$

- we used $e(t) \times v_{in}(t)$ for gradient in manual calculations
- So, with momentum, our formula would become...
- $\Delta w(t) = \eta \times e(t) \times v_{in}(t) + momentum \times \Delta w(t-1)$

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    - etc – gradient ascent from easy to difficult, across all 4 sections.

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- There will be a small proportion of non-MCQ questions (20 marks out of 100) – on 1st half of the course

You have been a

- strong
- creative
- enthusiastic

students to work with.
Good luck in the exam!
You are trained well to pass (just do a systematic revision).