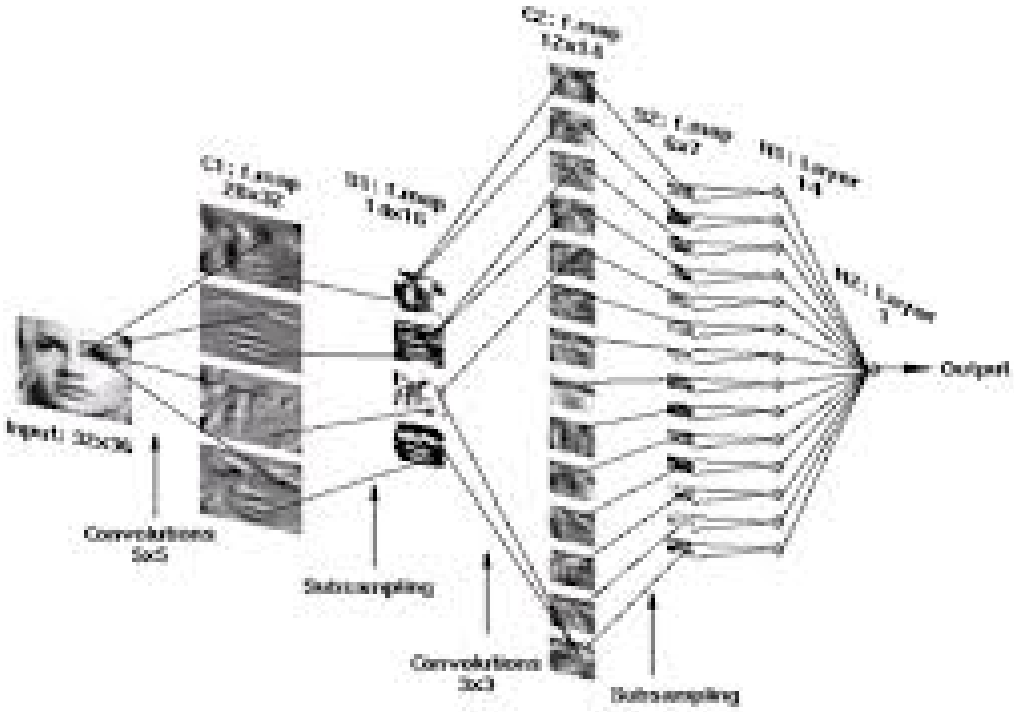
Advanced Machine Learning

Course Outline



Course Details and Topics

Course Structure

- Lectures
  - 15:00 Tuesday 35/1001
  - 11:00 Wednesday 02/1089
  - 15:00 Friday (was 02A/2077—needs to be changed)
- Assessment
  - 80% exam
  - 20% Problem Sheets

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Problem Sheets

- I am changing the assessment from a group project to problem sheets
- I will give out two problem sheets each worth 10%
- They will help you understand the mathematical material
- They should prepare you for the exam

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What's in the Course

- This course is going to cover the core principles and mathematics behind machine learning
- It is not going to explicitly teach different machine learning algorithms
- We are not looking at advanced algorithms but cover the principles
- There are very good implementation available (e.g. scikit-learn)
- Along the way though we will meet (often many times) particular algorithms

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Topics

- Learning Theory
  - ⋆ Bias-Variance
  - ⋆ Overfitting, structure and regularisation
  - ⋆ Ensembling, bagging and boosting
- Mathematics
  - ⋆ Function Spaces: Kernel Methods and Gaussian Processes
  - ⋆ Linear Algebra, embeddings, positive definiteness, subspace, determinants

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Topics Continued

- Optimisation
  - ⋆ Newton/Quasi-Newton Methods: convergence rates
  - ⋆ SGD, momentum, ADAM
- Constrainted Optimisation
  - ⋆ KKT conditions
  - ⋆ Duality Linear/Quadratic Programming
  - ⋆ SVMs
- Convexity
  - ⋆ Convex sets: linear constraints, PD matrices
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