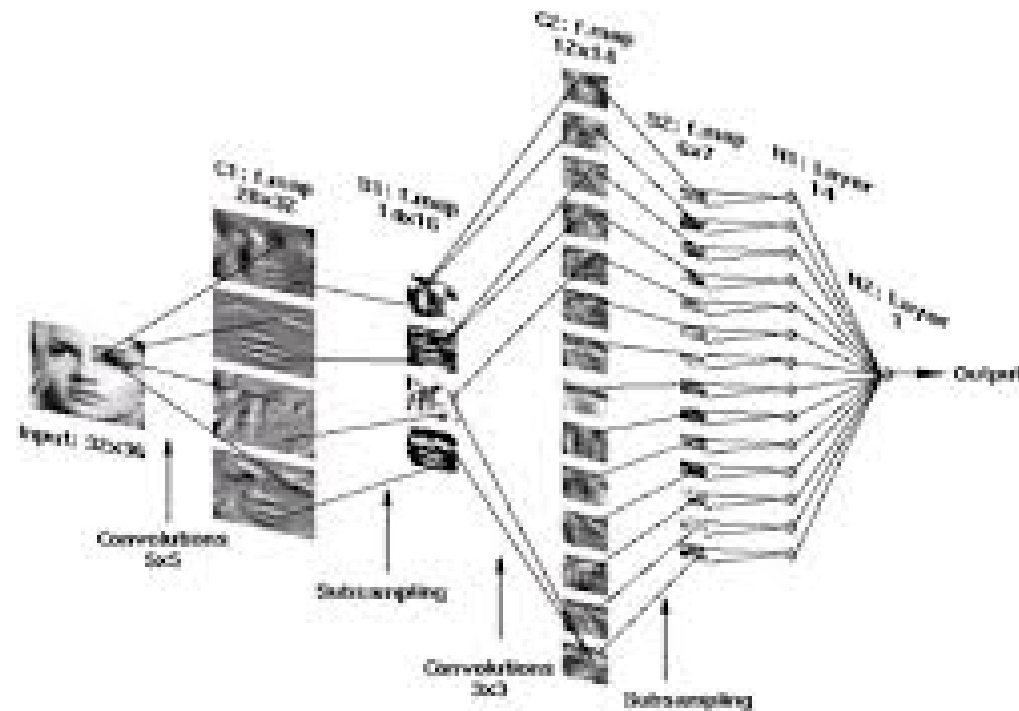


# Advanced Machine Learning

## *Course Outline*



## *Course Details and Topics*

# Course Structure

- Notes on Moodle and

<https://ecs-vlc.github.io/aice1005/>

<https://tinyurl.com/bddhrhcw>

- Lectures

- ★ 11:00-11:45 Tuesday, Building 35 room 1005

- ★ 16:00-16:45 Tuesday, Building 44 room 1041 (L/T A)

- ★ 15:00-15:45 Thursday, Building 44 room 1041 (L/T A)

- Assessment

- ★ 80% Exam

- ★ 20% Problem Sheet

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- I am going to provide many problem sheets
- One problem sheets will be marked and worth 20% (you will know which one this is)
- The other problem sheets are optional, but some small proportion of the questions will be on 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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# Cracking the Code

- Mathematics is the language of machine learning
- You can do machine learning without mathematics, but if you want to develop and understand advanced algorithms then you have no choice
- This course invites you on a journey to crack the code of mathematics for machine learning
- If this isn't a challenge you want, then this is probably not the course for you



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- Learning Theory
  - ★ Bias-Variance
  - ★ Overfitting, symmetry 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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- ★ Newton/Quasi-Newton Methods: convergence rates
- ★ SGD, momentum, ADAM

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- ★ Duality Linear/Quadratic Programming
- ★ SVMs

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  - ★ Expectations and MCMC
- Advanced Methods
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  - ★ VAEs and GANs
  - ★ Entropy and information theory
  - ★ Variational Approximation

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