Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin
Ollscoil Átha Cliath | The University of Dublin

EE4C16/EE5M16

FACULTY OF ENGINEERING, MATHEMATICS & SCIENCE

SCHOOL OF ENGINEERING

Electronic & Electrical Engineering

Sample Exam

Machine Learning with Applications in Media Engineering (EE4C16/EE5M16)

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Instructions to candidates:

Answer FOUR (4) questions.

Please answer questions from each section in separate answer books.

Materials Permitted for this Examination:

New Formulae & Statistic Tables

Graph Paper

Non-programmable calculators

Question 1

1. Explain what an epoch is in DNN training.

[3 marks]

2. Explain what over fitting and under fitting are in the context of Machine Learning. Name a few techniques used in DNNs to mitigate overfitting.

[6 marks]

3. Explain the steps involved in Gradient Descent. How it is used to train DNNs?

[6 marks]

4. What is the historical importance of AlexNet?

[5 marks]

5. A big retail company contacts your team to design a system that can recognise the make and type of each car on their supermarket car parks.
   You are the Tech Lead on this project. Make a project plan discussing the technical challenges, your proposed solutions. Also discuss any non-technical issue that mi

[12 marks]

Question 2

1. Consider a binary classifier with the following confusion matrix:

	actual: 0	actual: 1
predicted: 0	TN=16	FN=4
predicted: 1	FP=10	TP=70

Comment on the performance of the classifier.

Question 3

1. Remember that one question (25 marks) will be a short essay on the keynotes from Xilinx and Intel.

[25 marks]

Supporting material

Assuming $\mathbf{a}, \mathbf{b}, \mathbf{A}$ are independent of $\mathbf{w}$, below is a list of useful gradient computations:

$$\begin{aligned}
\frac{\partial \mathbf{a}^\top \mathbf{w}}{\partial \mathbf{w}} &= \mathbf{a} \\
\frac{\partial \mathbf{b}^\top \mathbf{A}\mathbf{w}}{\partial \mathbf{w}} &= \mathbf{A}^\top \mathbf{b} \\
\frac{\partial \mathbf{w}^\top \mathbf{A}\mathbf{w}}{\partial \mathbf{w}} &= (\mathbf{A} + \mathbf{A}^\top)\mathbf{w} \qquad \text{(or } 2\mathbf{A}\mathbf{w} \text{ if } A \text{ symmetric)} \\
\frac{\partial \mathbf{w}^\top \mathbf{w}}{\partial \mathbf{w}} &= 2\mathbf{w} \\
\frac{\partial\ \mathbf{a}^\top \mathbf{w}\mathbf{w}^\top \mathbf{b}}{\partial\ \mathbf{w}} &= (\mathbf{a}\mathbf{b}^\top + \mathbf{b}\mathbf{a}^\top)\mathbf{w}
\end{aligned}$$