Maynooth University
National University of Ireland Maynooth

OLLSCOIL NA hÉIREANN MÁ NUAD

THE NATIONAL UNIVERSITY OF IRELAND MAYNOOTH

JANUARY 2017 EXAMINATION

CS401

Machine Learning & Neural Networks

Dr. D. Charles, Dr. A. Winstanley, Prof. B. Pearlmutter

Time allowed: 2 hours

Answer at least four questions
Your mark will be based on your best ***four*** answers

All questions carry equal marks

[25 marks]

1 A small package containing an extremely valuable diamond has been shipped in the regular parcel post. You are a criminal determined to intercepting that package and steal that diamond. You expect it to arrive in particular a parcel post sorting station today. Each day 5,000 such small packages are sorted. You have taken the place of a postal worker, and surreptitiously placed a small scanner able to detect a diamond inside a package on the sorting line. Your diamond detector correctly identifies a package with a diamond in it 98% of the time and a package without a diamond in it 99.5% of the time. Your detector pings that it found a diamond in a particular package, which you grab and slip into your pocket.
What is the probability you have actually snagged the diamond?

[25 marks]

2 Why is k-means often used to preprocess speech data prior to feeding it into an HMM?

[25 marks]

3 What is "dropout" and why is it often used in deep learning?
Explain its effect on optimization with reference to the Hessian matrix.

[25 marks]

4 How can you tell if a support vector machine is likely to get good generalization? If this were a problem in practice, what would you try to change to improve the generalization rate?

[25 marks]

5 What would you do if the deep network you were training on an image processing task in which the classification should be invariant to scaling or rotation was highly non-invariant to scaling or rotation?