# EEL806: Minor I

August 29, 2013

Maximum Marks: 20

1. Two points on a plane are represented by the coordinates $(5, 15, 5)$ and $(6, 9, 3)$ in a homogeneous coordinate system. What is the distance between them in Cartesian space? **[3]**

2. Suppose you are asked to extend the background subtraction problem mentioned in class to a 3-way classification of pixels: background, foreground, and shadow (since shadows, if present, tend to get erroneously classified as foreground). Suggest both a discriminative and a generative model for this problem. You should clearly specify what your data and world states are, what is the assumed form of their probability distribution(s) in each case, and what are the parameters to be learnt. Also briefly state how you would carry out inference in each model. **[5]**

3. Consider a 2D Haar Filter as shown in figure below. White cells indicate value $+1$ and black cells indicate value -1.
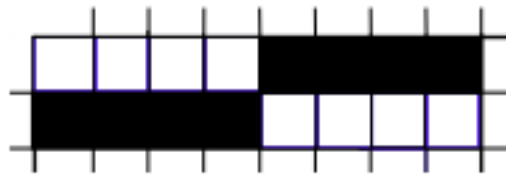
   (a) Show that this Haar filter is separable to two 1D components. **[3]**

   (b) How many arithmetic operations do you need to compute the convolution for every image pixel, assuming that an integral image is available, when you use it (i) as a single 2D filter, and (ii) as a combination of two 1D filters? **[4]**

4. (a) Illustrate the RANSAC algorithm with the example of finding the parameters of translation of an object in 3D space. Assume that you know the initial position (x_i, y_i, z_i) and final position (x'_i, y'_i, z'_i) for a set of N points. **[3]**

   (b) What is the specific advantage of the RANSAC algorithm? **[2]**