Mats Rudemo, tel 0708 626472

Examination in Statistical Image Analysis, August 20, 2015

Course code Chalmers: TMS016, Gothenburg University: Statistisk Bildbehandling, MSA300

Written examination August 20, 2015, 8.30–12.30.

Literature and notes may be brought for this written examination. Neither pocket calculators nor computers are allowed at this examination. In the written examination there are two pages and two problems. You are supposed to answer both problems, and in the judgement they have the same weight. Answers may be given in English or Swedish.

Problem 1.

Figure 1 shows part of an image of a spruce trea forest photographed from an airplane about 560 m above the forest. For each trea the trea top is seen more or less clearly. One is interested in finding the positions in a horisontal plane of the trea tops. (We disregard here the vertical position of the trea tops).
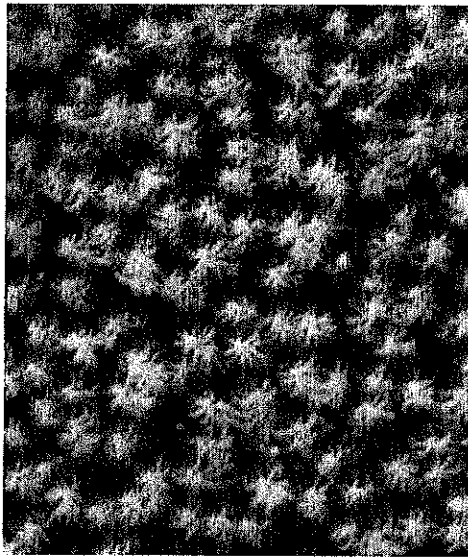

Figure 1: Part of a forest of spruce treas photographed from above.

a) Describe a method based on image smoothing for finding the trea top positions. To start with, disregard possible edge effects, that is problems associated with smoothing near the edges of the image.

b) Suppose now that you have found the trea top positions. Describe how you can test if the estimated trea top positions form a Poisson process with constant intensity. Looking at the image, do you expect that a Poisson process gives a good description of the data?

c) Discuss now how you may improve the smoothing discussed above in a) by taking care of edge effects in some way.

Problem 2.

Suppose now that in addition to the data in Figure 1 you have the true planar positions of the trea tops measured from the ground. One is interested in evaluating the method described above to estimate the trea top positions from images obtained from an airplane.

a) Suppose first that you for each estimated trea top can associate which true trea top it corresponds to. How can you then characterize the estimation method, for instance in terms of a distribution for the measurement error? Give suitable formulas.

b) Suppose now that you have the point process of estimated trea positions and the point process of true trea positions but you do not know which true trea top that corresponds to a given estimated trea position. Discuss how you can then characterize the accuracy of the method of estimating trea top positions from airplane images. If you wish you may start by assuming that there are equally many points in the two sets of estimated and true trea positions. Then you can proceed to the case that the two numbers may differ.