A COMPARISON OF SUPERVISED MAXIMUM LIKELIHOOD AND DECISION TREE CLASSIFICATION FOR CROP COVER ESTIMATION FROM MULTITEMPORAL LANDSAT MSS DATA

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Abstract

A case study where multitemporal Landsat MSS data is used for crop cover classification was used to compare standard supervised maximum likelihood with a simpler supervised binary decision tree based on coincident spectral plots. The results show clear improvements in overall accuracy by using the decision tree.

1. INTRODUCTION

In land cover classifications from both single date and multitemporal imagery, supervised maximum likelihood classification is widely accepted as a standard approach. Although maximum likelihood may be robust to distribution assumptions (ref), it is well recognised that there are drawbacks to the use of this algorithm. Most notably the assumption that each cover class is modelled by unimodal probability distributions and all are the same size. As this is frequently not the case this classifier is far from optimal for estimating land cover class areas. Furthermore, in the analysis of data with high dimensionality such as multitemporal Landsat data, the computational speed of the maximum likelihood classifier is reduced as the classification time increases as the square of the number of bands.

Alternative approaches to the analysis of multitemporal data have been suggested. Work by Richards (1984) has shown the value of using principal components transformation, and Engvall et al (1977) have been succesful in applying vector change detection to multitemporal Landsat data. Lee and Richards (1985) showed that a simpler automatic classifier based on seniority logic, similar to a linear decision tree, had distinct advantages over the maximum likelihood classifier in terms of computational speed whilst still maintaining similar levels of classification accuracy.

In this letter we propose an alternative supervised classifier based on a binary decision tree (Ref), manually designed from consideration of spectral coincidence plots. Similar hierachic approaches have been used succesfully elsewhere, for example in terrain classification, Eden et al (1984). Decision trees have the advantages of simplicity, robustness, flexibility to optimality criteria and most importantly are open to direct meaningful interpretation. Direct comarisons on the performance of a binary decision tree and the maximum likelihood classifier are made through the consideration of a multitemporal case study.

2. CASE STUDY

2.1 Test area and data selection.

A test site was established in an area of diverse cereal, oilseed and vegetable crop production in Southern England. The exact location was an area of 625 square kilometers centred on Framlingham, Suffolk. Around 1000 Ha of ground data was available in the form of farm records showing field boundaries and crop type. A search was conducted through the National tape archive for sequential Landsat data. There is generally poor temporal coverage with cloud cover and occasional scanner malfunctions severely limiting data availability. A series of useable images were located: 2nd November 1979 and 18th February, 12th April, 18th May, 4th June and 16th August, 1980. All are path 217, row 23 except the image from 4th June 1980 which is path 216, row 24.