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APPLICATION OF MODIFIED VICAR/IBIS GIS TO ANALYSIS OF JULY 1991 FLEVOLAND AIRSAR DATA

L. Norikane, Broek, B.*, and Freeman, A.

Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, CA 91109

*TNO-FEL
250g JG Den Haag
The Netherlands

1. INTRODUCTION

Three overflights of the Flevoland calibration /agricultural site were made by the JPL AIRSAR on July 3, July 12, and July 28, 1991 as part of MAC-Europe '92. A polygon map was generated at TNO-FEL which overlayed the slant range projected July 3 data set. Each polygon was identified by a sequence of points and a crop label. The polygon map was composed of 452 uniquely identified polygons and 15 different crop types.

Analysis of the data was done using our modified VICAR/IBIS GIS [1]. This GIS is an extension of the VICAR/IBIS GIS first developed by Bryant [2] in the 1970's which is itself an extension of the VICAR (Video Image Communication and Retrieval) image processing system also developed at JPL [3] .

The VICAR/IBIS GIS requires that all images be coregistered to a georeference image. The georeference image must contain uniquely identified polygons representing homogeneous areas such as counties or vegetation stands. After conversion to a ground range projection, the Flevoland polygon map was ideally suited for use as the required georeference image.

To integrate the AIRSAR data into the VICAR/IBIS GIS, we generated 5 VICAR-labeled ground range projected images for each frequency and each data set (or overflight). The image set consisted of HH, HV, VV, HHVV* phase, and HHVV* amplitude images. For each image, we also generated an "info" file which contained a table of conversions from pixel value to "actual" value such as radar backscatter or radians.

The images from July 12 and July 28 were coregistered to the July 3 images using a two step process: image rotation/scaling and image warping. Both steps use tiepoints which are selected by hand.

Once all images had been coregistered, the following statistics were calculated for each polygon, frequency, and data set: average HH, HV, and VV backscatter, average HHVV* phase and amplitude, correlation coefficient using the averaged statistics, odd-bounce, double-bounce, and volume scattering percentage contributions [4], and average incidence angle (per data set only). These data were stored in columns of the georeference info file.

For each data set, selected columns in the info file were written into a text file which served as input to a Bayes classifier [5]. Depending on the features selected, the classifier identified each polygon with a high degree of accuracy.

2. PRELIMINARY RESULTS

We attempted to classify each polygon into 1 of 9 classes. (6 of the original 15 classes were eliminated due to insufficient numbers of representative polygons.) To do this we used a Bayes classifier and assumed Gaussian distributions.

Different combinations of features from the July 3 and July 28 data sets were used to classify the polygons with varying degrees of success.

Figure 1 shows the results from using only C-band HH, HV, VV, HHVV* phase, and correlation coefficients from both data sets. Using only these features yielded good classification results (i.e. no polygon was misclassified more than 25% of the time).

Features used:

July 3 / C-Band HH, HV, VV, HHVV* phase, correlation coefficient
July 28 / C-Band HH, HV, VV, HHVV* phase, correlation coefficient

Actual Percent Classified As...

Crop Type	RAP	GRA	POT	WHE	SBT	COR	BAR	BEA	FRU
RAP	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GRA	0.0	87.5	4.2	2.1	4.2	2.1	0.0	0.0	0.0
POT	0.0	1.0	96.1	0.0	1.9	1.0	0.0	0.0	0.0
WHE	0.0	4.3	0.0	91.5	4.3	0.0	0.0	0.0	0.0
SBT	0.0	3.8	0.0	0.0	96.3	0.0	0.0	0.0	0.0
COR	0.0	6.3	6.3	0.0	12.5	75.0	0.0	0.0	0.0
BAR	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0
BEA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0
FRU	0.0	0.0	0.0	0.0	6.3	0.0	0.0	0.0	93.8

[RAP = rapeseed, GRA = grass, POT = potatoes, WHE = wheat, SBT = sugarbeet, COR = corn, BAR = barley, BEA = beans, FRU = fruit]

FIGURE 1

Other combinations of features have been tried. Results will be presented at the workshop.

From our analysis thus far, it is clear that there are more features available for classification than are truly needed. Additional work needs to be done in order to assess which features are highly correlated and thus not necessary for classification.

3. SUMMARY

We have successfully integrated the three 1991 Flevoland calibration/agricultural site AIRSAR overflight data sets in our modified VICAR/IBIS GIS. The images were successfully coregistered to a georeference image generated from a polygon map which overlayed the July 3 data set. Statistics and other information were accumulated and saved in the georeference info file. Selected columns from the info file were used as features in a Bayes classifier assuming Gaussian distributions. Using these features polygons were correctly classified at least 75% of the time in the example shown. Additional work needs to be done to assess which features are highly correlated and thus not necessary for classification.

4. ACKNOWLEDGEMENTS

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5. REFERENCES

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