E7.3 10639
CR-132098

20 May 1973

PROGRESS REPORT #4

ON

AUTOMATIC PHOTOINTERPRETATION FOR PLANT SPECIES AND STRESS IDENTIFICATION (ERTS-A1)

ERTS

Proposal Number MMC 647

Principal Investigator Number PR 202

Contract Number NAS 5-2186

(E73-10639) AUTOMATIC PHOTOINTERPRETATION FOR PLANT SPECIES AND STRESS IDENTIFICATION (ERTS-A1) Progress Report (Honeywell, Inc.) 6 p HC $3.00 CSCL 08F

N73-24398

Unclas
G3/13 00639

Prepared by: L. Kirvida

Approved by: G. D. Swanlund

Honeywell, Inc.
Systems and Research Division
2600 Ridgway Parkway
Minneapolis, Minnesota 55413

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SUMMARY

During the course of this program, we are using density and texture for delineating Forest Species in two Minnesota Areas. The smaller Cloquet site is being used to evaluate the texture algorithms and overall procedures. The first available coverage (Oct. 7) was used. We are now applying these techniques to the Chippewa National Forest which is about six times as large. An October and January coverage will be used.

II

CLOQUET FOREST CENTER - Single Coverage

We have completed a test run on an October 7 coverage of the Cloquet Forest Center (U of M School of Forestry test site). Density and texture were used for training on 4000 acres and testing on 40,000 acres. When training and testing on the same 4000, performance is as follows for five classes:

1. 74% classification accuracy using density from the four MSS bands as features, one acre resolution element.

2. 86% accuracy using density and texture based on 18 acres.

3. 99% accuracy using density and texture based on 70 acres.

4. 88 to 90% accuracy using textures alone (based on 70 acres) depending on the algorithm. The performance quoted in 2 and 3 above was obtained with the Slant transform for texture measurements.

5. A comparison of performance has been made between the Fast Fourier, Walsh and Slant Transforms. A curve depicting the classification accuracy as a function of number of features is shown in Figure I. The Slant Transform provides the best performance.

6. We are in the process of evaluating the Karhunen Loev transform on the same data set.

7. We are also planning on evaluating a matched filter representation of the data. Arrangements were made with Prof. Jullien at the University of Windsor to provide us with recursive digital filter components as features at no cost.

8. We are evaluating the benefit of clustering algorithms on the Cloquet data set.

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A computer classification was run for the whole 40,000 acre Cloquet area. (i.e. training on 4000 acres and testing on 40,000 acres). The classification map was color coded on a photograph which can be visually compared with the ground truth. A confusion matrix was obtained by cross correlating the classification map with the ground truth. This is a rather tedious task since we cannot read data depecting the areas directly into a computer. We coded the five class areas on magnetic tapes obtained from transparencies scanned on the Optronics. This process results in registration errors which showed up on our results.

We obtained a correct classification of 45% using density from 1 acre samples. This figure is deceptively low because 9,641 errors out of the total of 19,178 errors were made misclassifying hardwood into the other four classes. Hardwoods occur in a striated pattern so that misregistration causes havoc. The other classes tend to be globular so misregistration is not as fatal. On removing the hardwood class, correct classification of 60% is obtained. This is in comparison to 74% obtained when testing and training on the same samples.

CHIPPEWA NATIONAL FOREST

The October coverage of the Chippewa National Forest has been extracted from the ERTS digital tape. It has been written out on the film writer and enlarged to the same scale as the ground truth 1:60,000. Training areas have been extracted from the photo. Fourteen classes have been identified. The training set of all classes amounted to 25,500 acres out of a total area of 220,500 acres.

We received the January 5th coverage of the Chippewa Forest. We are in the process of writing this data out on the film writer. The intent is to form a feature vector from the October and January coverage. This will require registration between the two images which will be performed manually, i.e., by aligning landmarks on both images.

The classification of the Chippewa National Forest will provide a link with a user management unit. Hopefully this will strengthen the justification for continued satellite coverage.

We plan on completing the classification of the Chippewa Forest using the October and January coverages the next reporting period. The October coverage 1076 - 16370 had two bad bands, however the two good bands were in the visible and IR region so that the data is useful. The January coverage is being extracted from 1166 - 16373.

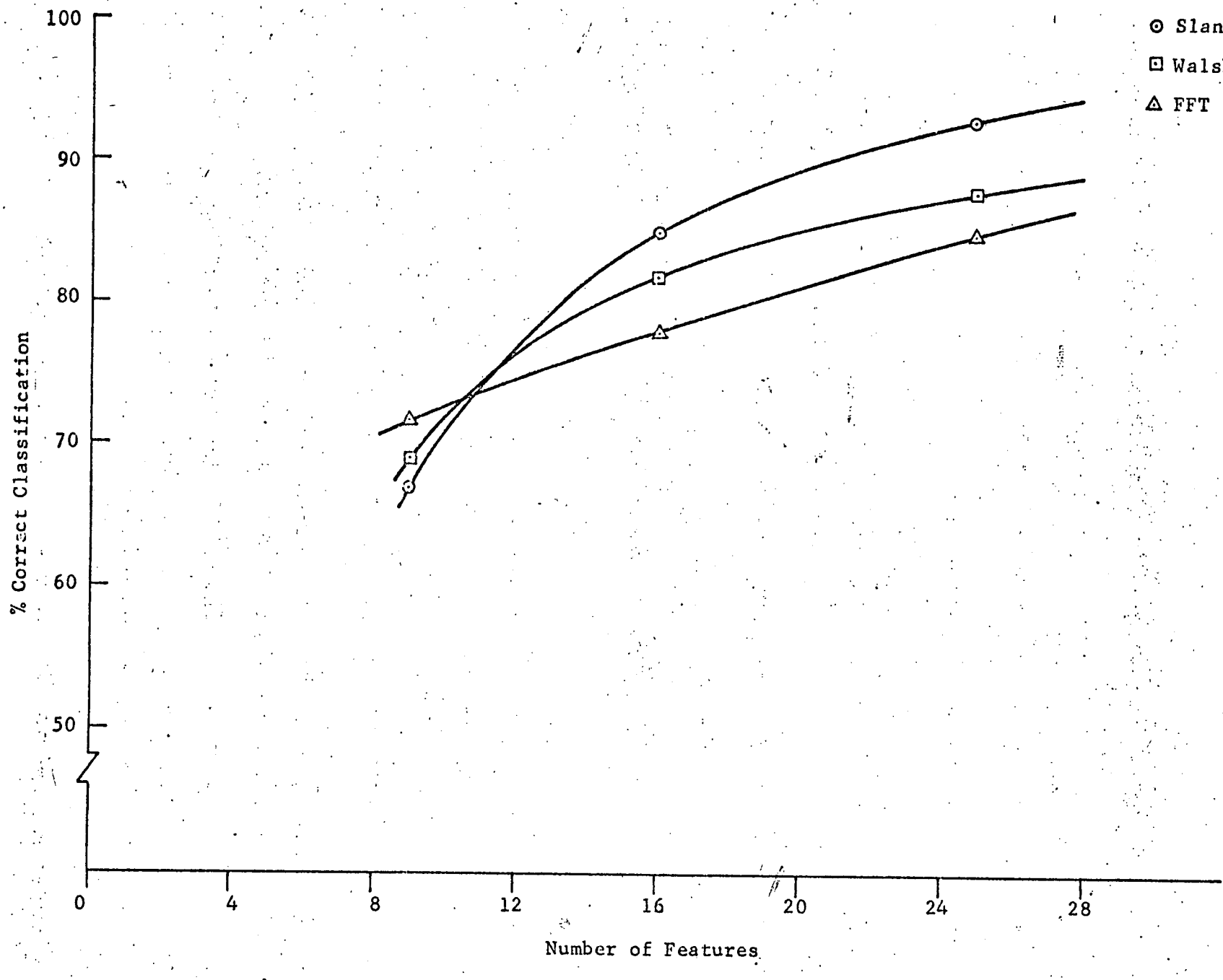

Figure 1. Comparison of Texture Algorithms