

ANALYSIS OF THE SCANNER DATA
IN A SIMULATED OPERATIONAL SYSTEM MODE

Data Taken on July 30, 1968

Data taken by the Michigan scanner system over two flight lines in Tippecanoe County on July 30, 1968 was digitized, calibrated and reformatted (Information Note 080768) and ready to be analyzed on August 1, 1968 at 8:00 a.m.

Attention was first concentrated on flight line 21, Area C. The gray-scale printouts of channels 9 and 11 were obtained. With the help of slides, maps and other associated ground truth information, field boundaries, roads, and other delimiting features were drawn on an acetate overlay placed on the gray-scale printout. Training fields were chosen based on notes made in the process of collecting ground truth. (A list of the types of information recorded during the collection of ground truth is shown in the Appendix.)

The data fell roughly into seven classes: soybeans, corn, stubble (oat and wheat), diverted acres, pasture, water and trees. The fields were histogrammed to determine whether the data were approximately Gaussian. The fields in each particular class were tested with a separation algorithm to see if more than one subclass was needed for each class. The divergences were based on four features since this was the number that was to be used in the classification, as predetermined through studies of the July 1966 aircraft data. The final grouping resulted in 11 subclasses: 2 soybeans, 1 corn, 2 stubble, 2 diverted acres, 2 pastures, 1 water, and 1 trees.

The separation algorithm was used again, this time to pick the channels to be used in the classification. Channels 2 and 4 were

not considered. They are high-gain versions of channels 9 and 11, respectively, and are to be used in tests of digitization precision. After a weight factor of 0 was applied to the combination of subclasses belonging to the same class and a maximum divergence of 350 was used, channels 3, 7, 10, and 12 were shown as the best set of four.

A classification of a 4-mile section of flight line 21 was obtained by 4 p.m., August 1. Using the 7 classes, 83.3% correct recognition was obtained on the training samples. When the classes stubble, diverted acres and pasture were grouped as one class, mixture, the per cent recognition increased to 90.5%.

On the basis of these statistics, the sections where flight lines 21 and 25 intersected were classified. Results showed that the statistics obtained from Area C could not be directly applied to these areas.

At 5:00 p.m., the same procedure was begun for a section of flight line 25. Because of the different agricultural situation, only three or four classes were needed: soybeans, corn, mixture (consisting of diverted acres, stubble, pasture) and trees. Trees were then omitted in subsequent passes because of their inadequate representation in the data.

The following results were obtained:

<u>Pass</u>	<u>Feature</u>	<u>Class</u>	<u>Subclasses</u>	<u>% Correct Recognition</u>
1	1,7,10,12	Corn, Soybeans, Mixture, Trees	2 Corn, 2 Soybeans, 1 Stubble, 1 Mixture, 1 Trees	85.7
1	1,7,10,12	Row crops, Mixture, Trees	(same as above)	93.8

2	1,7,10,12	Corn, Soybeans, Mixture, Trees	2 Corn, 2 Soybeans, 1 Stubble, 1 Forage, 1 Mixture, 1 Trees	80.2
3	1,7,10,12	Corn, Soybeans, Mixture	2 Corn, 2 Soybeans, 1 Stubble, 1 Mixture	91.6

The first pass was completed at 11:00 a.m. on August 2, 1968, the second at 3:00 p.m. and the third at about 5:00 p.m. A time table is shown below. The "operational" phase of the analysis of the data was halted at 5:00 p.m., August 2, and normal schedules and machine priorities were re-established.

<u>Date</u>	<u>Time</u>	<u>Comments</u>
8/1/68	8:00 a.m.	Work on gray-scale printout of C1 was begun.
8/1/68	4:00 p.m.	First classification results were obtained.
8/1/68	5:00 p.m.	Work on gray-scale printout of flight line 25 was begun.
8/2/68	11:00 a.m.	First pass - flight line 25.
8/2/68	3:00 p.m.	Second pass - flight line 25.
8/2/68	5:00 p.m.	Third pass - flight line 25.

In summary, during this operational analysis test period of less than 48 hours, approximately 50 flight line miles of data were digitized, calibrated, and reformatted, and two fairly satisfactory classifiers were designed. It was not possible to test them extensively, however, due to the variable cloud conditions which existed over the flight lines. In addition, a quantitative evaluation of the classifiers requires the determination of the field boundary addresses of many fields and this process will continue to be relatively very time consuming until the digital display system can be placed on line.

APPENDIX

Ground Truth - Voicewriter Instructions

1. Field Designation Twp. - Sec. - Field # e.g. 355-31-3

2. Cover Type - Crop Species

Corn

Soybeans

Oats

Diverted Acres - Oats/Red Clover

Diverted Acres - Oats/Red Clover and grass or weed mixture

Diverted Acres - Red Clover

Diverted Acres - Other (description)

Pasture - Grass Species

Pasture - Red Clover

Pasture - Timothy

Pasture - Timothy and Bluegrass

Pasture - Mixture

Stubble - Wheat

Stubble - Oats

Hay - Alfalfa

Hay - Red Clover

Hay - Alfalfa, Red Clover

Bare Soil

3. If corn, indicate if tasseled or non-tasseled; indicate color of tassel - yellow or brown; if not 100% tasseled, indicate approximate percentage of field that is tasseled.

4. If soybeans, indicate when they were drilled. If planted in rows, say nothing about type of planting.

5. If pasture, indicate if hog cattle or pony pasture. Also indicate approximate number of animals present.

Other Comments

- A. Unusual features such as pockets or areas of field that were drowned out - water standing in field, replanted areas within a field, erosion marks, alternating strips of weeds and grass, etc.
- B. Weedy areas - indicate if weeds are broad leaf, narrow leaves, color, etc. Indicate if weeds have been sprayed.
- C. Indicate any apparent field operations or treatments such as mowing, combining, spraying.
- D. If you have trouble describing a situation, shoot a picture of it, mark location on map and indicate on voicewriter that you took a picture.
- E. Mark location of large wooded areas as a field.