

Student Notes
for
LARSYS
software system:
An Overview

*LINEGRAPH *SEPARABILITY
*PICTUREPRINT

*HISTOGRAM

LARSYS

*CLASSIFYPOINTS

*IDPRINT

*STATISTICS

*PRINTRESULTS

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NOTE TO THE STUDENT: This set of notes is designed to accompany an audio tape, a set of display materials and three sample decks, labeled A, B and C. The presentation runs about 45 minutes and is intended as an overview or introductory treatment of the LARSYS software system.

If you have not done so already, begin this minicourse by listening to the audio tape and following the instructions given on the tape. Music on the tape will be your cue to turn off the tape and perform some activity.

PREREQUISITES: Some background in remote sensing and pattern recognition is assumed. Specifically you should be able to:

1. Define "remote sensing."
2. Identify three types of measurable electromagnetic field variations that are used in remote sensing.
3. Given a graph showing relative spectral response vs. wavelength for various ground covers, plot their associated points on the λ_1, λ_2 plane.
4. Given a plot of training samples associated with different classes of ground cover, classify an unknown point using a specified decision rule.
5. Outline and/or discuss the basic operation of an airborne multispectral scanner.
6. Given a block diagram of a pattern recognition system, discuss the following terms: receptor, feature vector, categorizer, and decision rule.
7. State two conditions a class must meet in order to be useful.

This background material is included in Unit I of the LARSYS Educational Package, entitled An Introduction to Quantitative Remote Sensing. If you do not feel you have met these prerequisites, you may want to reread sections of the Introduction or get additional suggestions from your instructor.

OBJECTIVES: When you have completed this minicourse, you should be able to:

1. List, without regard to the particular format used, the information contained on a multispectral image storage tape.
2. Name the three types of control cards used in running LARSYS programs.
3. Describe the output of at least four of the LARSYS processing functions which are described in this overview.

RETURN TO THE TAPE

WHAT IS LARSYS?

LARSYS - A GROUP OF COMPUTER PROGRAMS DESIGNED TO:

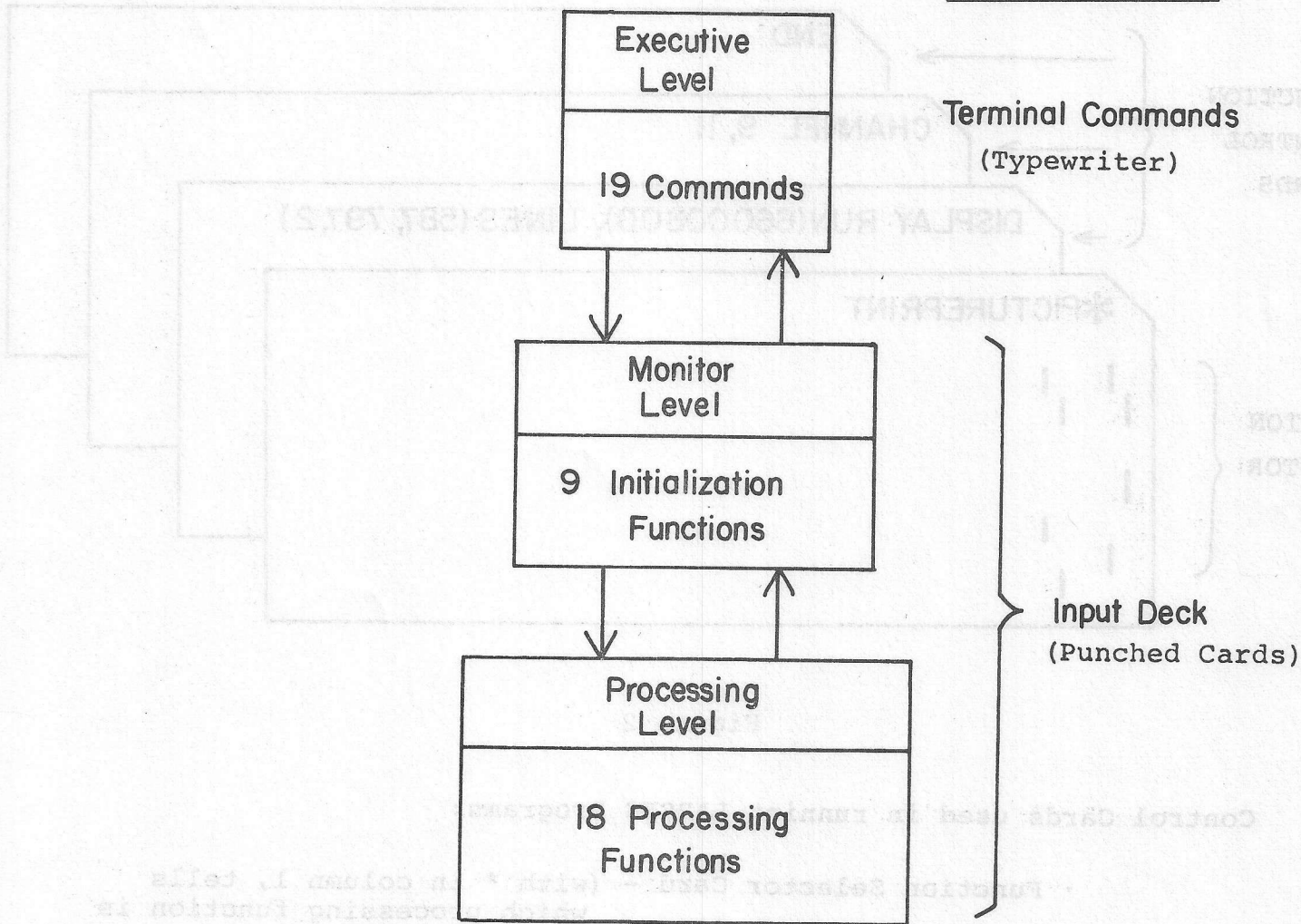
Access

Manipulate

Analyze

a very high volume of data.

Communicated By:



The LARSYS Organization

Figure 1

TYPES OF INFORMATION ON MULTISPECTRAL IMAGE STORAGE TAPE

- Identification Information *run #, col*
- Calibration Information
- Data Addresses
- Data Values for each element of the ground scene

LARSYS can be used to obtain ID Information
from a Multispectral Image Storage Tape

LARSYS can produce Alphanumeric Pictorial Printouts

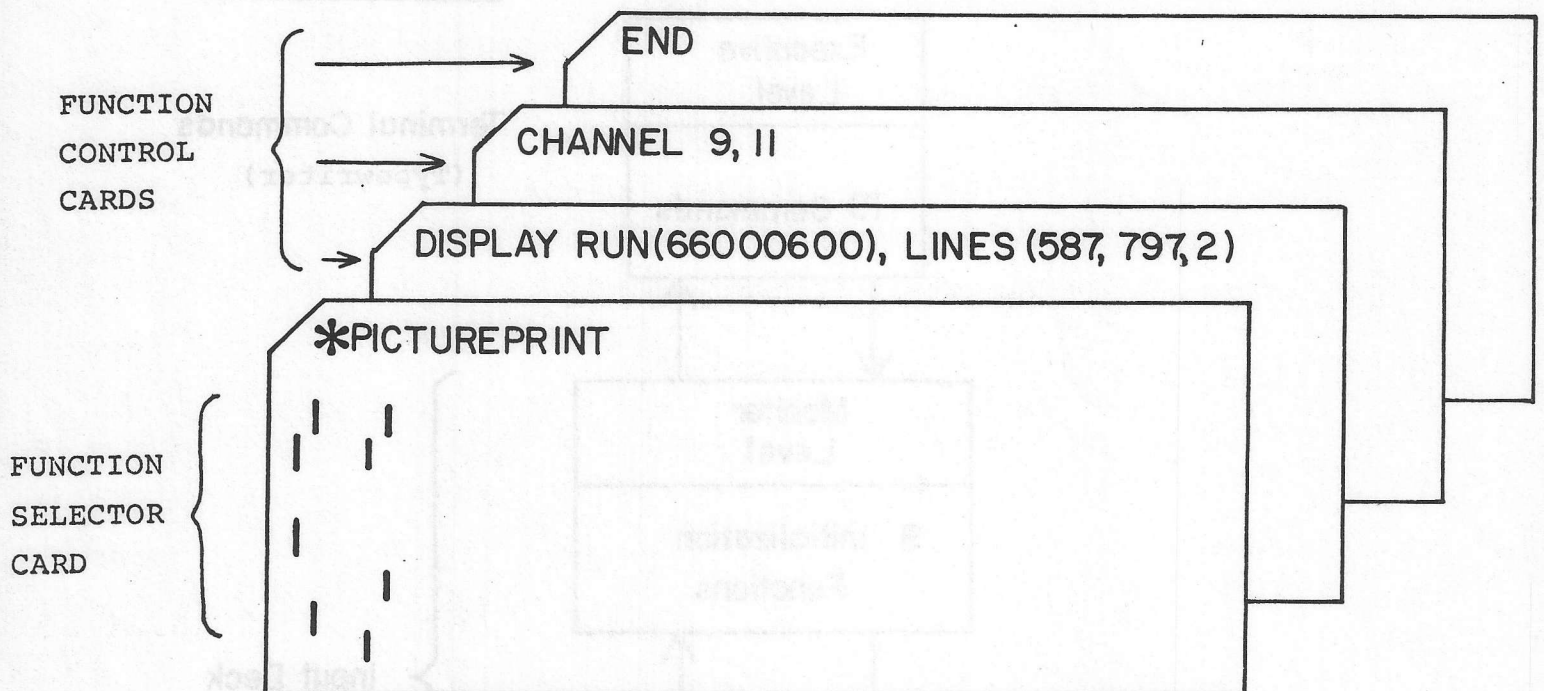


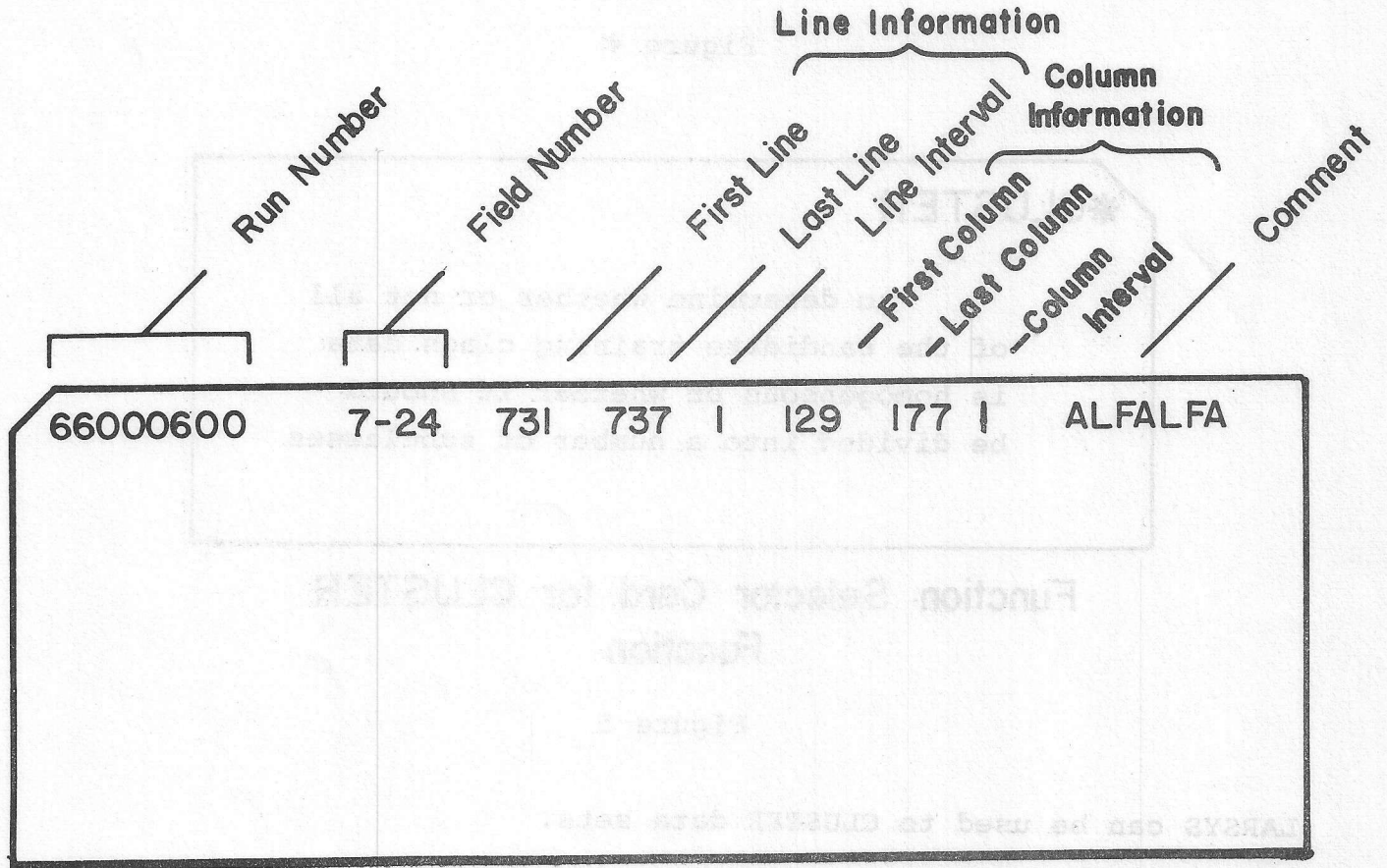
Figure 2

Control Cards used in running LARSYS Programs:

- ① • Function Selector Card - (with * in column 1, tells which processing function is desired)
- ② • Function Control Cards - (key word begins in column 1, card contains data addresses, computation options, type of output desired, etc.)
- ③ • Initialization Function Cards - (with hyphen in column 1, used for "housekeeping" functions such as putting identification comments on output)

THE ANALYST USES REFERENCE DATA TO -

- Locate Training Fields (typical data samples) and Test Fields (to evaluate accuracy of classification results)
- Establish Field Boundaries (by comparing gray scale printout with aerial photograph)



SAMPLE OF FIELD DESCRIPTION CARD

Figure 3

***LINEGRAPH**

to produce graphs of
specified lines (or columns)
of data -- see Display 8

**Function Selector Card for LINEGRAPH
Function**

Figure 4

***CLUSTER**

to determine whether or not all
of the candidate training class data
is homogeneous or whether it should
be divided into a number of subclasses

**Function Selector Card for CLUSTER
Function**

Figure 5

LARSYS can be used to CLUSTER data sets.

The typical output includes:

- Maps of candidate training fields
- Statistics for candidate training classes
- Information about separability
of candidate training classes
- Histograms of data points associated
with a cluster (optional)

***STATISTICS**

to calculate the statistics
for data fields and data classes
in any set of channels

**Function Selector Card for STATISTICS
Function**

Figure 6

LARSYS can provide means, standard deviations, and correlation matrices of data fields and classes.

The STATISTICS processing function produces the statistics deck needed for the SEPARABILITY and CLASSIFYPOINTS processing functions.

LARSYS can provide Histograms of data from individual fields of data and from classes (groups of data fields).

The STATISTICS processing function provides:

- Mean and standard deviation vectors
- Correlation matrices
- Statistics decks
- Histograms
- Coincident spectral plots

LARSYS assists in determining the degree of SEPARABILITY of classes.

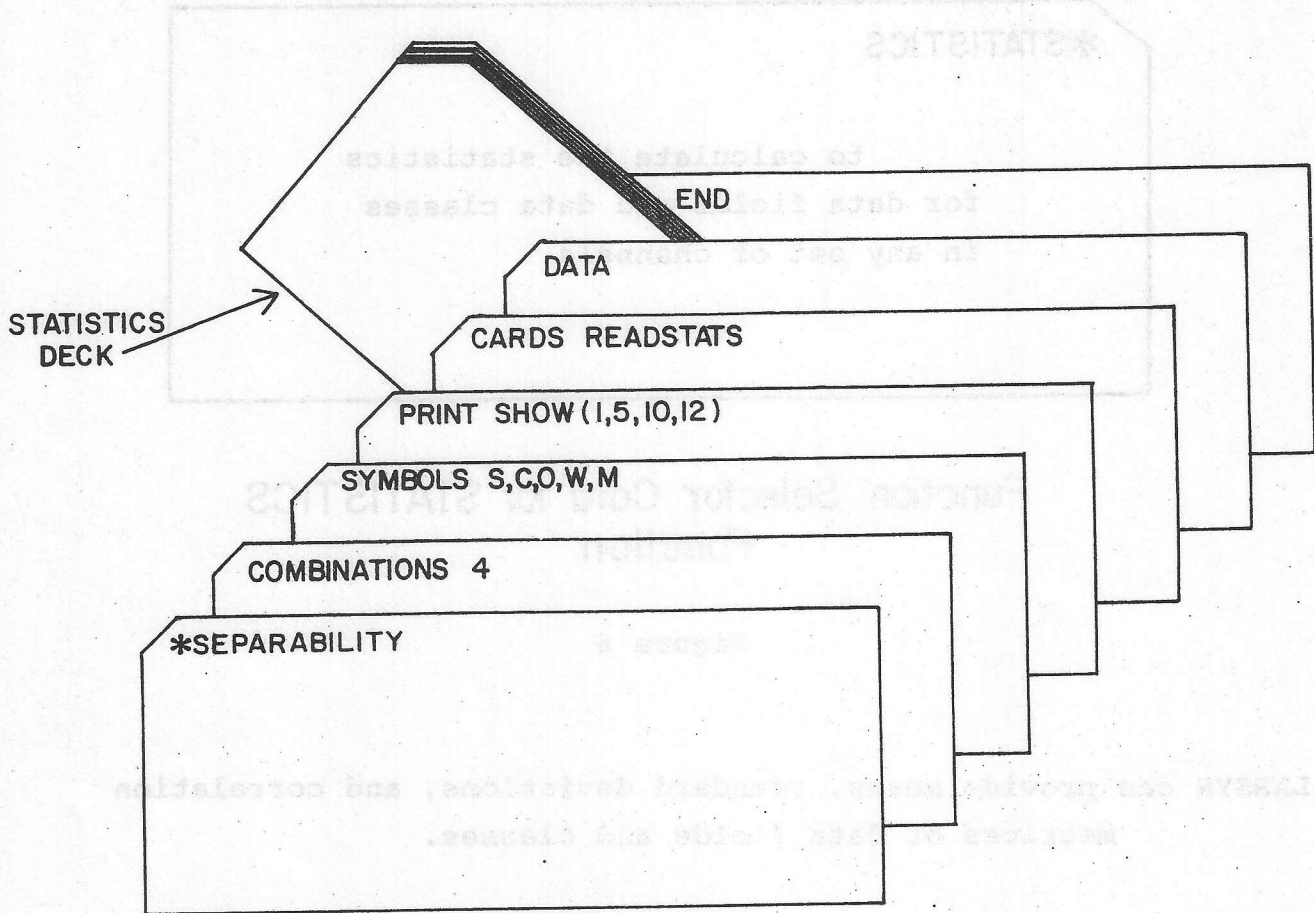


Figure 7

LARSYS helps select the best set of features.

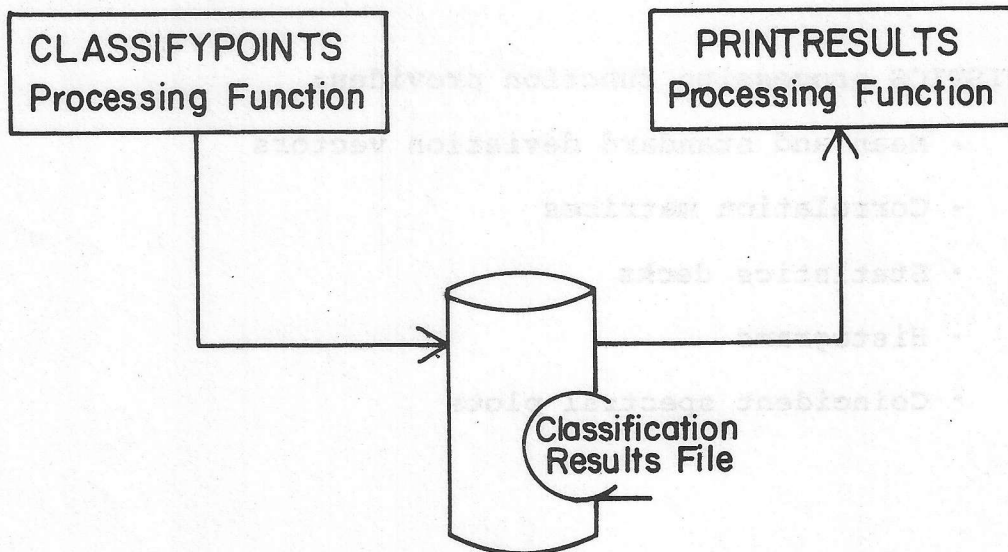


Figure 8

LARSYS can be used to classify data.

Results are displayed in map or tabular form.

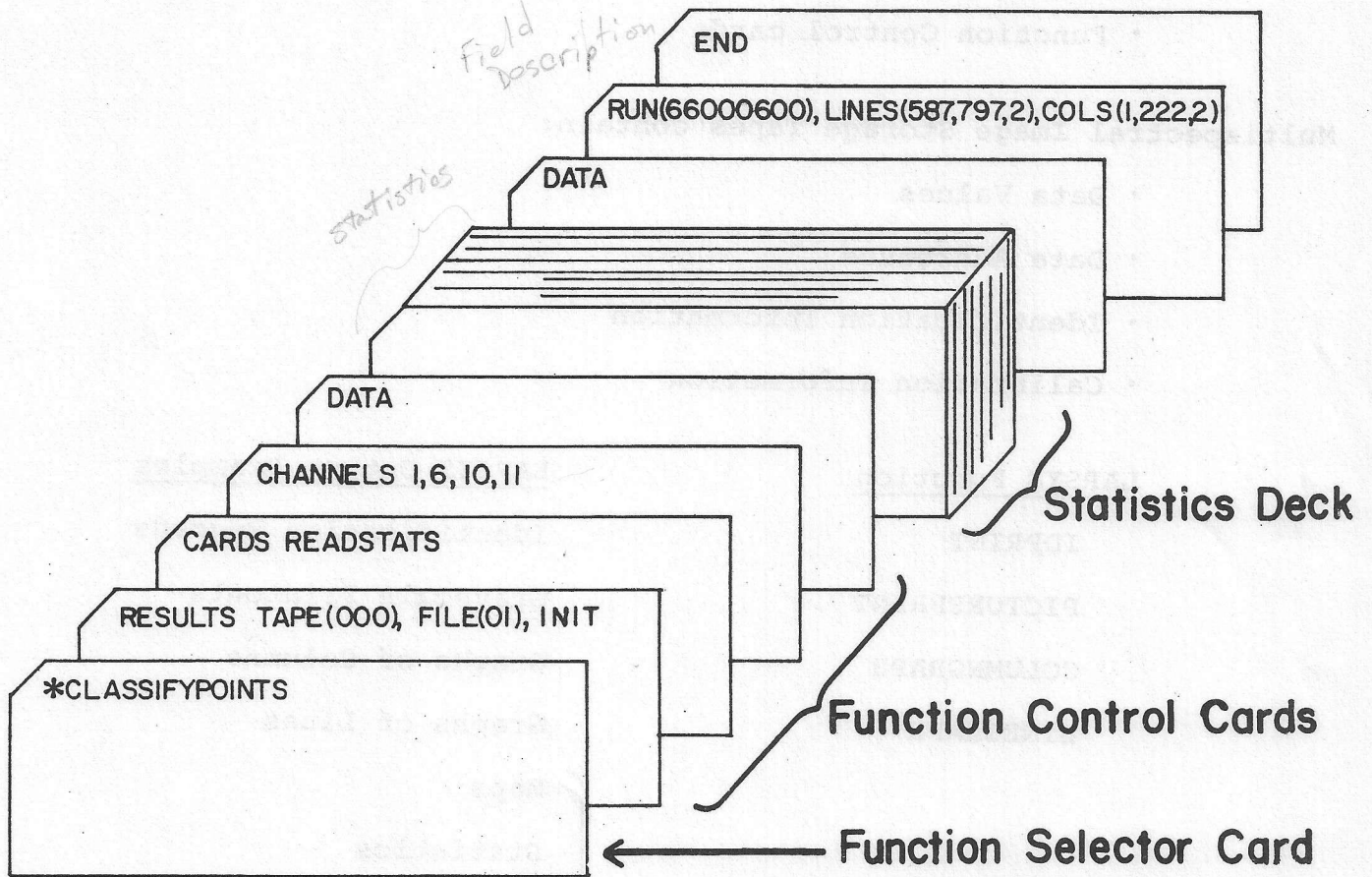


Figure 9

S U M M A R Y

LARSYS uses three types of control cards

- Initialization cards
- Function Selector cards
- Function Control cards

Multispectral Image Storage Tapes contain:

- Data Values
- Data Addresses
- Identification Information
- Calibration Information

LARSYS Function

IDPRINT

PICTUREPRINT

COLUMNGRAPH

LINEGRAPH

CLUSTER

STATISTICS

SEPARABILITY

CLASSIFYPOINTS

PRINTRESULTS

LARSYS Output Examples

Identification Records

Grayscale Printouts

Graphs of Columns

Graphs of Lines

Maps

Statistics

Separability Information

Histograms (optional)

Histograms

Spectral Plots

Mean and Correlation
Matrices

Statistics Deck

Statistical Distances
between class pairs

Classification File

Classification Maps and
Performance Tables

Remember, this is an "overview." You are not expected to learn the details of the data processing procedure at this stage in your study.

Self-Check

A. The data source for the LARSYS processing functions is the Multispectral Image Storage Tape. It contains the following information:

- 1.
- 2.
- 3.
- 4.

B. What are the three types of control cards used in running LARSYS programs?

- 1.
- 2.
- 3.

C. Briefly describe the output of at least four of these Processing Functions.

*IDPRINT

*PICTUREPRINT

*COLUMNGRAPH, *LINEGRAPH

*CLUSTER

*STATISTICS

*SEPARABILITY

*CLASSIFYPOINTS

*PRINTRESULTS

(Check you answer with DISPLAY 25)