

BPS-29

A SOFTWARE ENVIRONMENT FOR DIGITAL IMAGE PROCESSING

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The Operating Unit I.E.I.P.I., which participates in "P.F.I., P2, obiettivo Territorio", has designed and implemented the software system GEPITER for digital image analysis and processing. GEPITER is running on a GOULD SEL Concept 32/27 mini-computer, under UNIX Operating System, and it is mainly composed by high-level FORTRAN 77 modules: other languages have been used to implement programs for special peripherals management.

GEPITER is a modular system, which can be expanded or modified without performing hard reconfigurations.

The whole software has been designed and realized looking at a pre-defined data processing standard, in order to create a well defined environment for the study and analysis of digital image properties.

To do that I/O operations, memory management (block dimensions and allocations) and data banks stored onto mass memory have been conformed to a set of common rules.

Data files are mainly handled by two kinds of organizations:

- a) vector format, with sequential organization (magnetic tapes, digitized data or raster-to-vector converted data);
- b) raster format, with random access organization (TV or line scanner data, pre-processed data).

Because of the system flexibility data can be also coded in different ways, e.g. chain-code, run length and so on: in fact modules and process

ing procedures are completely free from remaining structures and interface programs can always be added in order to convert data among the different formats.

GEPITER structure is subdivided into two operating environments:

- a) a management or supervision environment;
- b) an executive environment (modules and procedures).

Two main tasks are performed by supervisor: interactive interfacing between system and user; scheduling of modules or operations needed to satisfy user's requests.

The interactive part of supervisor is hierarchically organized in selectable code tables, subdivided into separate semantic areas. The user may execute the single elaborations or procedures, without peculiar hardware or software knowledge, but simply by choosing amongst the codes presented in the ordered tables.

The first interaction level is the root table, where the possible primary operation classes are contained; the other levels on the contrary define more and more the requests specialization.

At the last request level the supervisor ends its first task and recalls from system packages the requested module or procedure: at this point the supervisor becomes an interface towards the running program: each program will then interact directly with the user.

At the end of the current execution the control returns to the waiting supervisor which satisfies the following user request: the user may request another operation pertaining to the actual table or may select another table.

Each possible error of the running program doesn't abort the work session because it is recovered by supervisor.

Overlays or other programming techniques may be performed by each running module.

The primary operation classes, corresponding to modules and thematic procedures, are subdivided according to the following list:

- a) processing modules
- b) special modules
- c) thematic processing
- d) libraries.

Primary class a) is subdivided into:

- a.1) data acquisition (raster mode, by means of TV camera, line scanner, flying spot scanner, frame memory, vector mode, by means of joystick or tablet);
- a.2) pre-processing (convolutions, filters, operators, radiometric and geometric transformations);
- a.3) analysis (statistics, segmentations, logical and arithmetic operations, signal processing);

a.4) result production (2D/3D graphic displays, plotter outputs, pictorial displays).

Special modules are composed by:

- b.1) utilities (data transmission to or from peripherals, prints, etc);
- b.2) special system commands (transparent execution of system functions);
- b.3) users (definition of user's environments inside global GEPITER'S environment)

Primary class c) contains:

- c.1) photodensitometry packages;
- c.2) multispectral image data processing packages.

The last class contains a log of scientific and utilities libraries, which can be properly used by expert users.