ELIESER : User Manual

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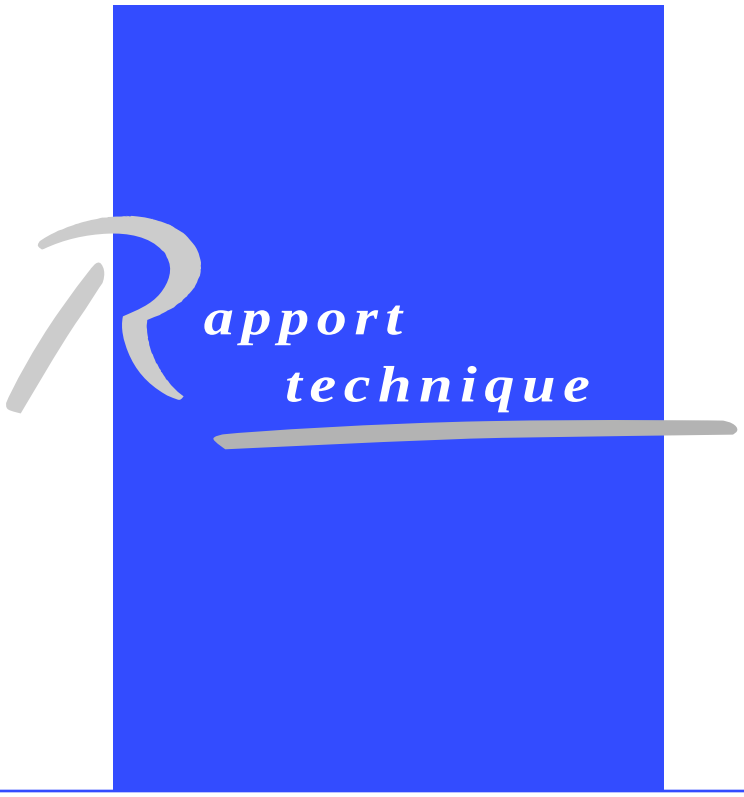
ELIESER : USER MANUAL

Nicolas MERLET , Josiane ZERUBIA

N° 0180

Septembre 1995

PROGRAMME 4



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ELIESER : USER MANUAL

Nicolas MERLET * , Josiane ZERUBIA **

Programme 4 — Robotique, image et vision
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Abstract: ELIESER (Extraction de Lignes sur ImagEs Satellite avec une Energie par Regions) is a software for detecting lines on satellite images. It has been developed jointly at INRIA Sophia-Antipolis and at the Hebrew University of Jerusalem, and implemented using Motif © in a package (iview) developed at INRIA. We present herein its interface.

Key-words: ELIESER, Motif, lines detection, satellite images

(Résumé : tsvp)

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ELIESER : MANUEL UTILISATEUR

Résumé : ELIESER (Extraction de Lignes sur ImagEs Satellite avec une Energie par Régions) est un programme de détection de lignes sur images satellitaires. Il a été développé conjointement à l'INRIA Sophia-Antipolis (France) et à l'Université Hébraique de Jérusalem (Israel), et intégré sous Motif © dans un système (iview) développé à l'INRIA. Nous en présentons ici l'interface.

Mots-clé : ELIESER, Motif, détection de lignes, images satellitaires

1 Introduction

ELIESER (Extraction de Lignes sur ImagEs Satellite avec une Energie par Regions) is a software for detecting lines on satellite images. It is based on dynamic programming, an optimization method which consists of defining a potential depending on the local characteristics of the image, and of performing an iterative summation-minimization process. More precisely, ELIESER extends the F* algorithm of Fischler in two directions.

First, the potential is defined on several points ([1],[2]). This allows to combine in the same cost the notions of contrast, grey-level and curvature. Second, ELIESER uses an automatic method [3] for defining the potentials as the inverse of the conditional probabilities of contrast and grey-level along initial line segments.

A deposit of ELIESER has been made at the APP [4]. It has been developed jointly at INRIA Sophia-Antipolis and at the Hebrew University of Jerusalem, and implemented using Motif © in a package (iview) developed at INRIA.

2 Getting started

When running the package, a first menu appears (Fig. 1). One should click with the mouse on **Load**.

Figure 1: Initial menu

Then, a temporary window appears for selecting the input file. It is similar to the one appearing in Fig. 4 and it offers the possibility of navigating through the directories as well.
When writing the name of a directory (ended by /*) in the **Filter** window and pressing the **Filter** button, the content of this directory appears in the **Files** window. Alternatively, one may choose a directory by clicking the **left button** of the mouse on one of the directories in the **Directories** window and pressing the **Filter** button. Selecting a file may be obtained by clicking the **left button** of the mouse on one of the files in the **Files** window or by writing its path and name in the **Load image** window. Note : in Fig. 4, the window is used for an other purpose and the **Load image** window is called there **Output image**.
When a file has been selected, the choice is validated by pressing the **Ok** button.
Scrolling the content of the various windows up and down may be obtained by moving the mouse (with **middle button** pressed) on the right vertical bar, or by clicking the **middle button** on the arrows which figure at the top and bottom of the bar.

After selecting the input file, a second menu appears, which displays the image as well (Fig. 2). One should click with the mouse on **Utilities**. A temporary menu appears, where the ELIESER software is activated by clicking on **Roads detection**.

When ELIESER has been selected, its menu is displayed (Fig. 3), and the information needed for running it can be provided by the user, or automatically.

Figure 2: Image menu

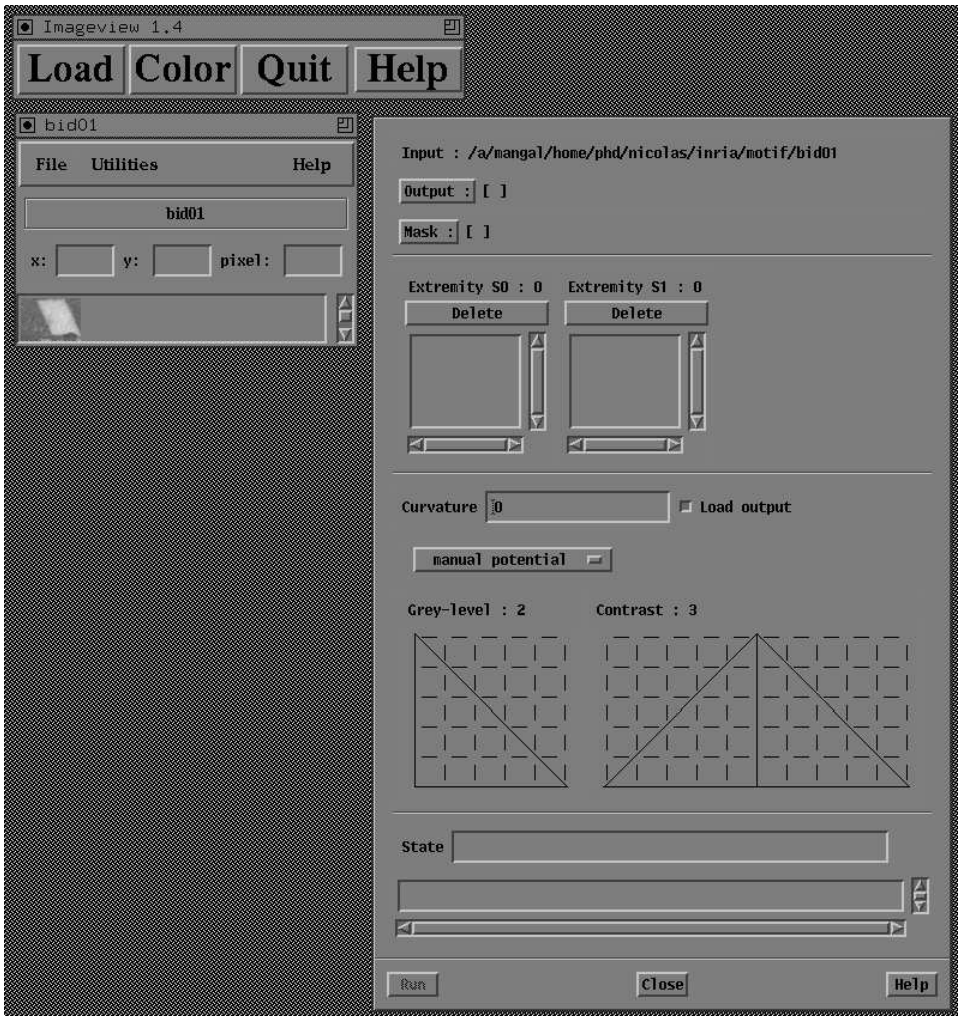

Figure 3: ELIESER menu

3 Selecting the files

First, the name of the output file should be provided. One clicks on **Output** and selects a file in a temporary window (Fig. 4). Please see **2- Getting started** for explanations on how to select a file. The output image will contain the initial image, on which the detected lines are shown in white.

A mask may be selected similarly, by clicking on **Mask**, according to the application. No mask may be selected as well.

If a mask is used, it should be a binary image where the non-zero values show regions where the roads should not go, such as the sea, or such as regions outside of the camera field. In the following, the potential should have low values on the roads and for the characteristics of the roads, and high values in regions where the roads should not go through. When a mask is used, an infinite value is given to the potential on these regions.

Fig. 5 shows the menu of ELIESER after an output image has been selected, and when no mask is used.

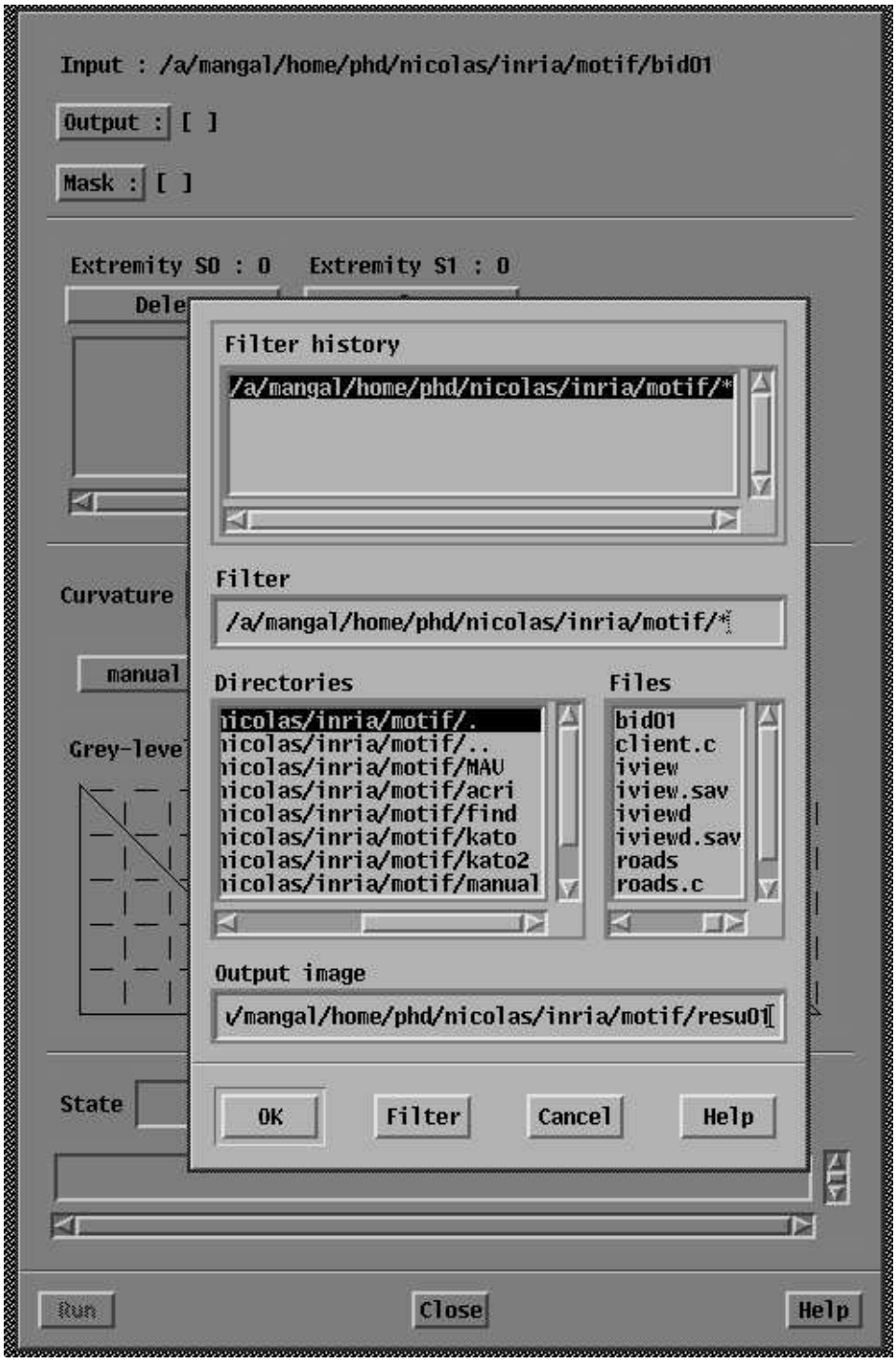

Figure 4: Selecting an output file

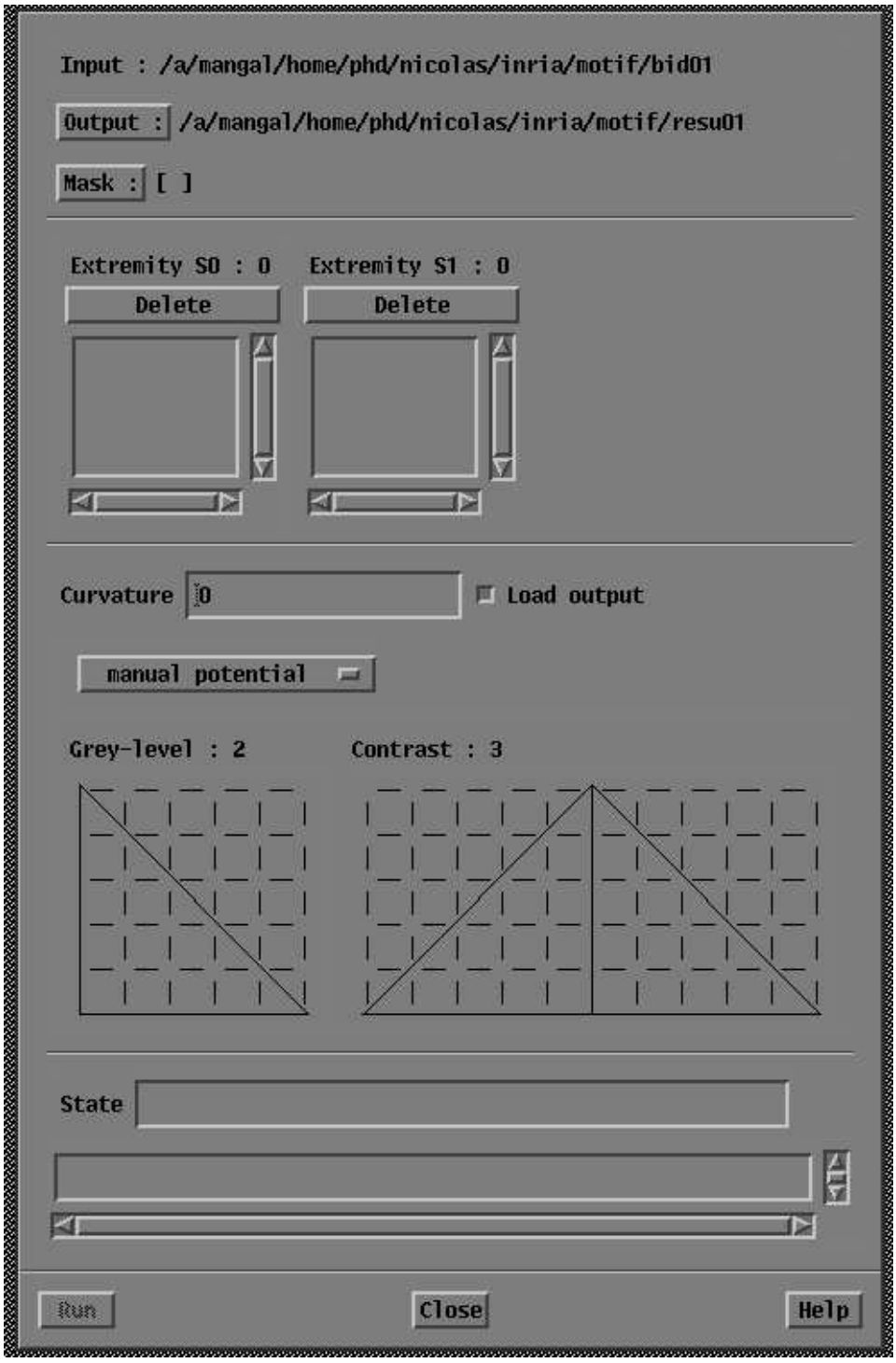

Figure 5: ELIESER menu after selecting the output

4 Selecting the extremities

The extremities of the lines should then be selected. We partition the extremities in two sets of points S_0 and S_1 where each road or line sought has one extremity in S_0 and the other one in S_1.

The number of points in the set S_0 (or S_1) appears after **Extremity S0** (or **Extremity S1**). Initially, zero appears at both locations. In the following we present only the part of the menu which we deal with at each step, while Fig. 5 shows the complete menu of ELIESER.

For adding an extremity, one should move the mouse **on the image**, position it on the desired point, and click on the **left button** of the mouse for adding this point to S_0 and on the **right button** for adding it to S_1. The coordinates of the selected point, which appear in the small windows x and y of the image menu, are then copied in the windows of S_0 or S_1 of the ELIESER menu. The number appearing after **Extremity S0** (or **Extremity S1**) is automatically updated. Fig. 6 shows the image menu and the part of the ELIESER menu which deals with the line extremities.

When many points are selected, one may wish to scroll up and down the array of points, by moving the mouse (with **middle button** pressed) on the right vertical bar, or by clicking on the arrows which figure at the top and bottom of the bar.

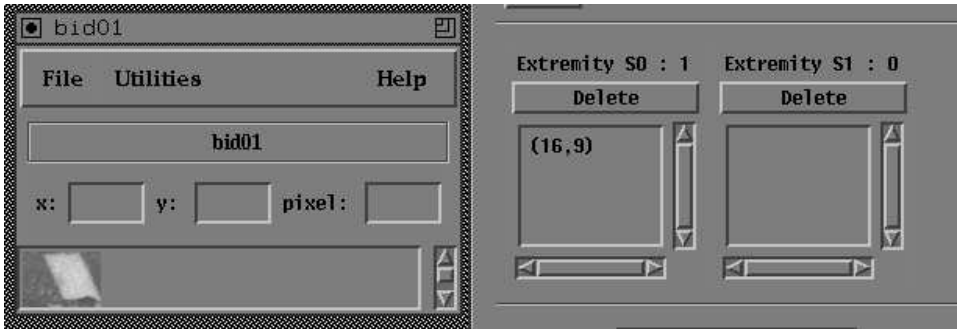

Figure 6: Adding a point to S0

For removing an extremity, one should move the mouse **on the array of points** of S_0 (or S_1), position the mouse on the desired point, and click twice on the left button of the mouse. This point is then marked in negative (Fig. 7).

Then, one should click on the **delete** button corresponding to S_0 (or S_1) (Fig. 8). The point vanishes from the array, and the number appearing after **Extremity S0** (or **Extremity S1**) is automatically updated.

The program may be run only after an output file has been specified, and after at least one point has been selected for S_0 and one point for S_1.

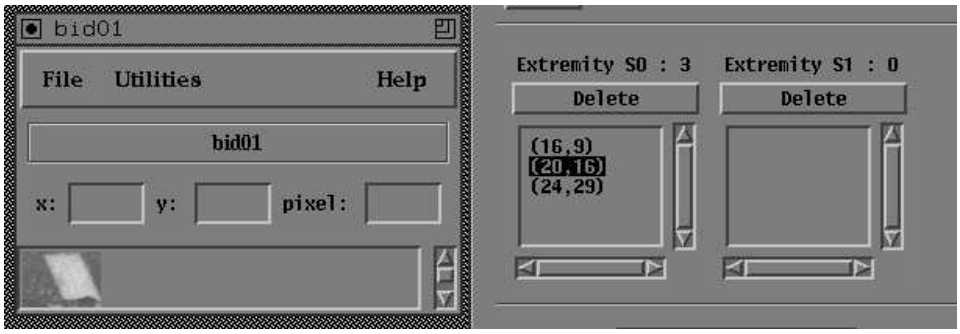

Figure 7: Marking a point of S0

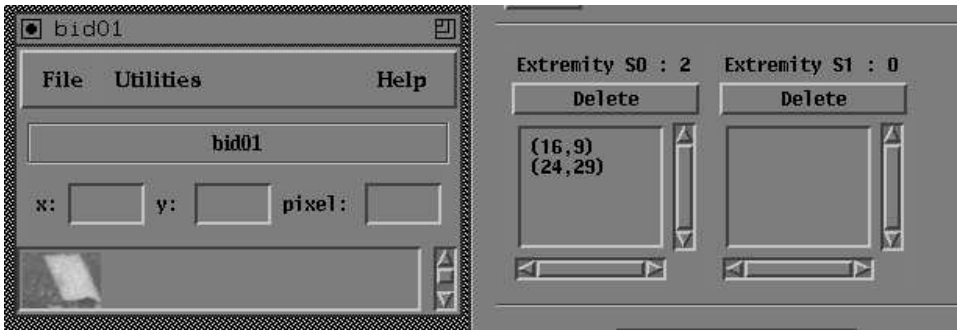

Figure 8: Deletion of the marked point of S0

5 Defining the potential

Below the extremities, we should define the potential in the menu. The general potential is the sum of three components : the curvature potential, the grey-level potential, and the contrast potential.

One may write a value for the **Curvature** constraint (Fig. 9). Initially it is equal to a default value.

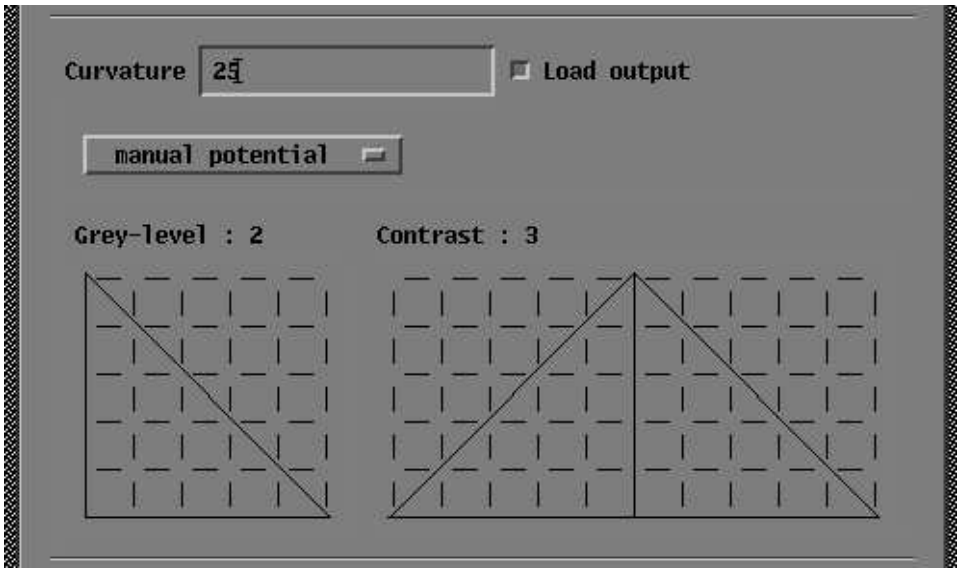

Figure 9: Manual potential

On the same line as the **Curvature**, there is a button **Load output**. If it is not pressed, the result of the computation will be displayed on the screen, otherwise it will not be displayed.

We will consider only defining the potential of grey-level in the following, since defining the potential of contrast is done in the same way.

There are two possibilities :

- defining the potentials manually. This is the initial configuration : a standard potential is provided, the same for any input image (Fig. 9).
- defining the potential automatically. It is then computed from statistical information around the extremities (the extremities S_0 and S_1 have to be defined

first). It is activated by clicking on **manual potential** and selecting **automatic potential** in the pop-up menu (Fig. 10). Returning to the manual potential is obtained in the same way, by clicking on **automatic potential** and selecting **manual potential** in the pop-up menu.

The x-axis represents the grey-levels from 0 to +255 in the left graphic, and the contrast from −255 to +255 in the right graphic. The y-axis represents the values of the potential for these values of grey-level and contrast.

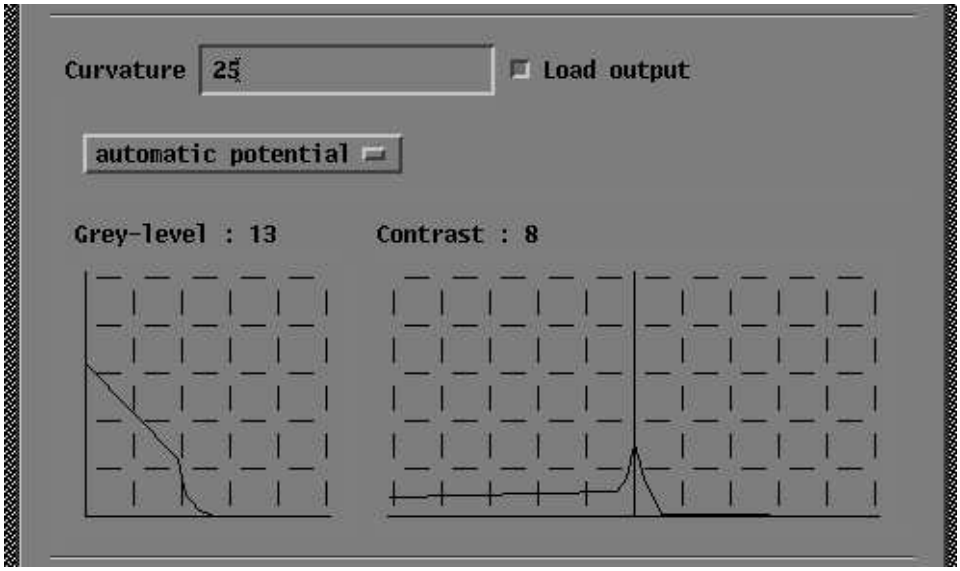

Figure 10: Automatic potential

In both cases (manual or automatic), the potential functions are approximated as piecewise linear functions, and are perfectly defined by the small number of extremities F_i of the corresponding segments. This number of extremities appears after **Grey-level** (or **Contrast**), above the graphics. It is possible to add or remove such points F_i, to change the shape of the potentials.

For adding a point, one should move the mouse **on the potential curve** and click on the **left button**. If a point already exists at the same abscissa as the desired point, then the value of the potential is changed, but the number of F_i points appearing after **Grey-level** (or **Contrast**) remains the same. Otherwise, the potential is changed and the number of points is incremented automatically (Fig. 11).

For removing a point, one should move the mouse **on the potential curve** and click on the **right button**. It is not necessary to point exactly at the desired F_i point, since the point which is removed is the closest F_i point to the selected point anyway (Fig. 12). The number of F_i points appearing after **Grey-level** (or **Contrast**) is updated automatically.

It is not possible to remove the points at the extremities of the curves (0 and 255 for the grey-level potential, -255 and $+255$ for the contrast potential), only to change the value of the potential there, and the number of F_i points is always greater or equal to two.

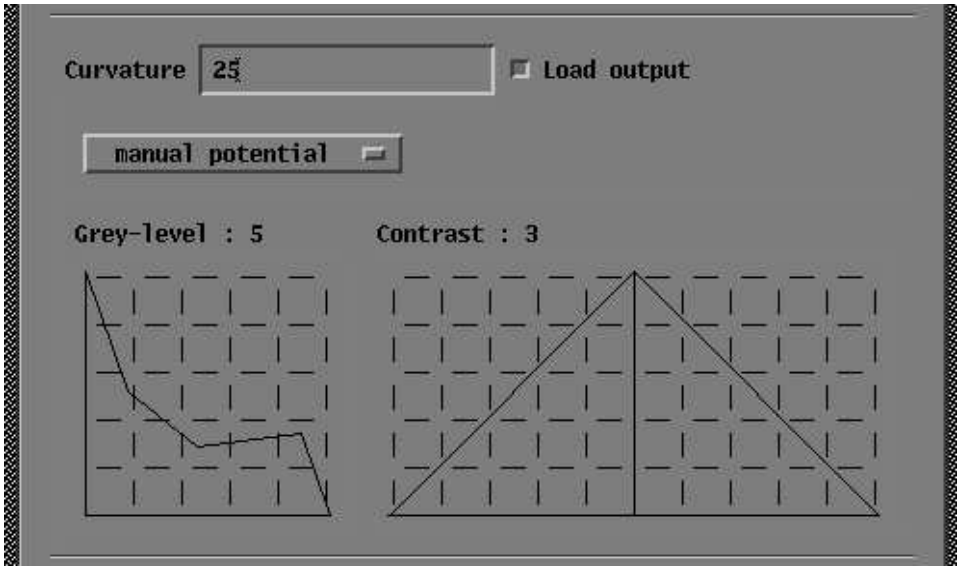

Figure 11: Adding points to the potential

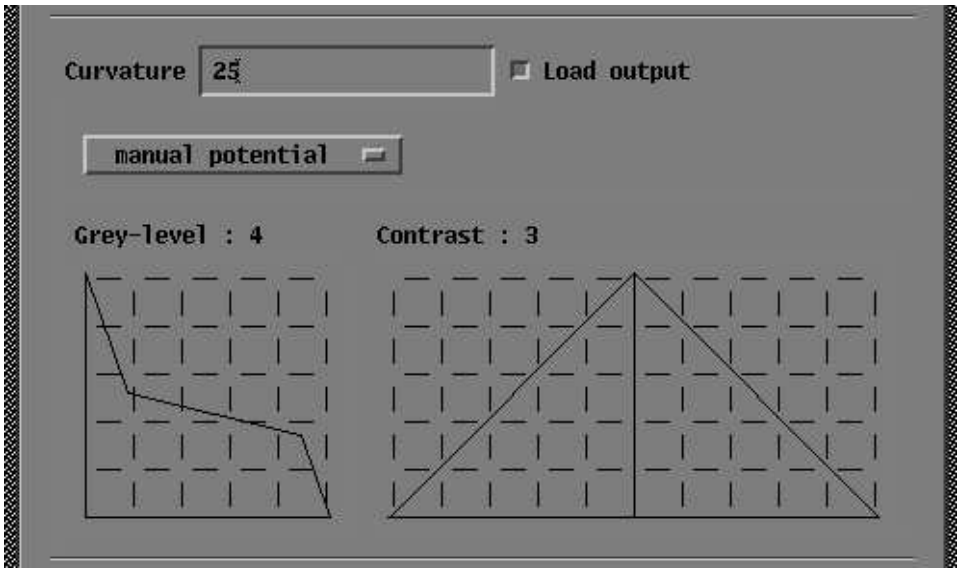

Figure 12: Deleting points from the potential

6 Controlling the execution

When all the necessary data have been provided to the menu, one may click on **Run** (below the graphics of the potentials), which runs ELIESER (Fig. 13). The resulting information is printed in the **State** window, while temporary information is printed during the computation in the window below. The temporary information may be scrolled up and down by pressing the **middle button** of the mouse on the right vertical bar, or by clicking on the arrows which figure at the top and bottom of the bar.

If **Load output** has not been pressed, a new Image menu appears then, showing the image computed by ELIESER.

Clicking the **Close** button closes the ELIESER menu, while clicking the **Help** button displays a help window.

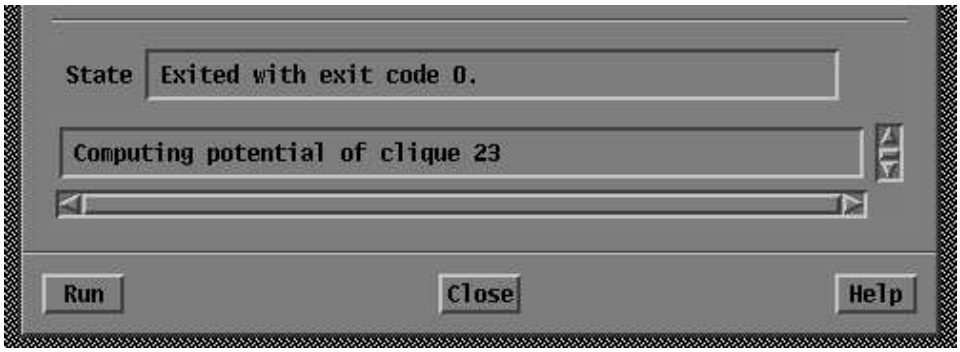

Figure 13: Controlling execution

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