Pinkdev
SDK for Image Processing Operators

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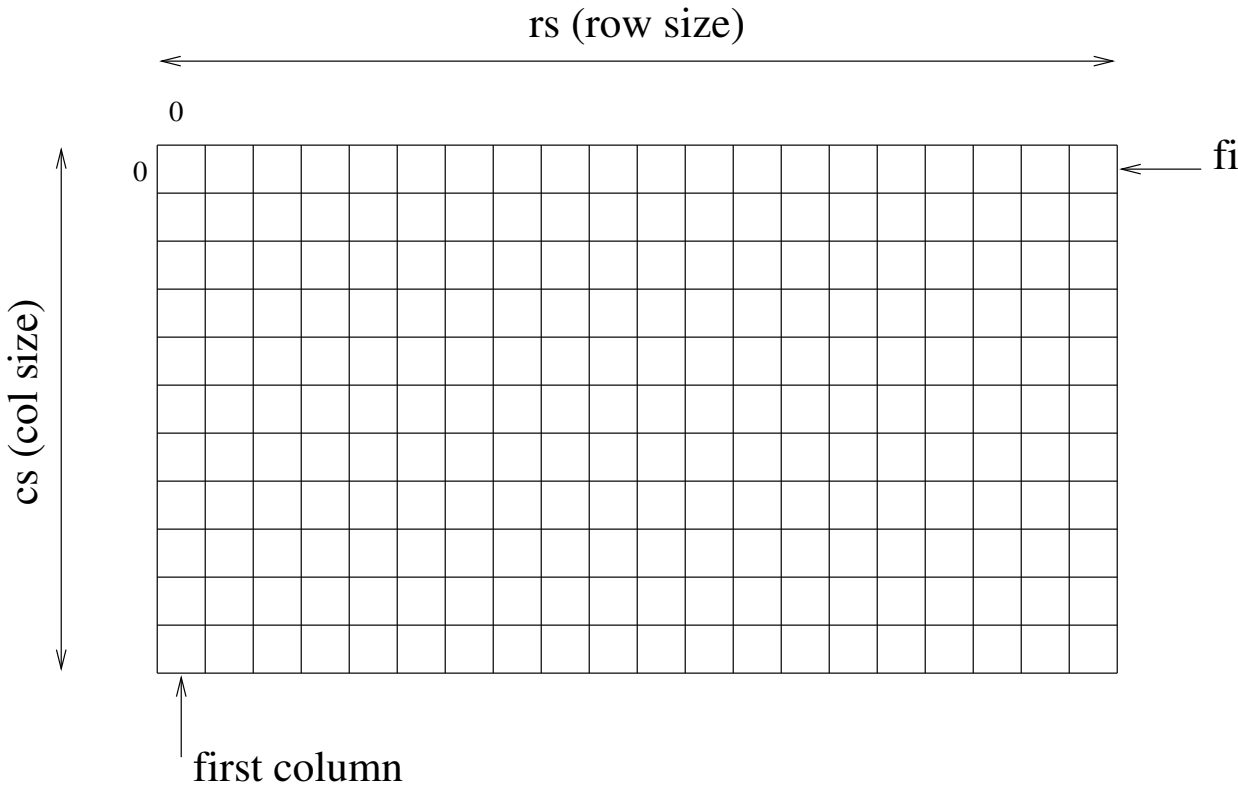
1 Introduction

This environment aims at facilitating the development of your first image processing operators. It includes features such as input/output that allows reading and writing grey-scale images, under the **pgm** format. pgm stands for Portable Gray Map, and this is the name of a standard format. Pinkdev also proposes a data structure allowing to manipulate image pixels, once an image is loaded into memory.

To visualize images, any standard tool can be used. We recommand **imview**, but are not sure it is available everywhere at ESIEE. You can install it at home, following this link `http://hugues.zahlt.info/Imview.html`.

2 xvimage structure

An image is seen as a rectangular table, with two dimensions of *pixels* or picture elements. The intensity of each pixel (its grey level) es thus given by a byte (unsigned char, value between 0 and 255).



In memory, an image is stored in a structure of type **xvimage**:

```
struct xvimage {
  char *name;
  uint32_t row_size;                    /* Size of a row (number of columns) */
  uint32_t col_size;                    /* Size of a column (number of rows) */
  uint32_t depth_size;                  /* Number of planes (for 3d images) */
  uint32_t data_storage_type;           /* storage type for disk data */
  void * image_data;                    /* pointer on raw data */
};
```

While using this structure, the array **imagedata** is a one dimensional array whose size depends on the size of the image to store. If the image is of size $m \times n$, then **imagedata** is of size mn. Pixels are stored in this array in the following order.

```
pixel 0 of line 1
pixel 1 of line  1
...
pixel row_size-1 of line  1
pixel 0 of line 2
...
```

3 Accessing a pixel

To access a pixel we first need to get the address of the array that contains the pixels:

```
ptrimage = (unsigned char *)(image->imagedata);
```

Then, to access the i^{th} pixel of the j^{th} row, we can use the following:

```
ptrimage[j * rs + i]
```

4 An example

Here is an example of a **laddconst** function that add a constant value to the greyscale value of each pixel, unless such an operation will overflow 255. The source code is located in: `src/lib/laddconst.c`, the header file is: `include/laddconst.h`:

```
/* ajoute une constante a une image  - seuil si depassement */
/* Add a const to an image - thresholding if overflow */
/* Michel Couprie - janvier 1999 */

#include <stdio.h>
#include <stdlib.h>
#include <laddconst.h>
#include <mcimage.h>

/* ==================================== */
int laddconst(struct xvimage * image, /* input: image to process */
                                      /* output: modified image  */
              int constante           /* input: value to add */
             )
/* ==================================== */
{
  int indexpixel;
  unsigned char *ptrimage;
  unsigned long newval;
  int rs, cs, N;

  rs = image->row_size;
  cs = image->col_size;
  N = rs * cs;

  /* ------------------------------------------------------- */
  /* computing the result */
  /* ------------------------------------------------------- */
  ptrimage = (unsigned char *)(image->imagedata);
```

```
  for (indexpixel = 0; indexpixel < N; indexpixel++)
  {
    newval = (int)(ptrimage[indexpixel]) + constante;
    if (newval < NDG_MIN) newval = NDG_MIN;
    if (newval > NDG_MAX) newval = NDG_MAX;
    ptrimage[indexpixel] = (unsigned char)newval;
  }

  return 1; /* Everything went fine */
}
```

Of course, we need a main to compile this fucntion. The main has to do the three following operations: to read the image from a file, to call the **laddconst** function, and to store the result in another file.

5 Reading image files

Reading an image from a file with the pgm format is dont thanks to a call to the function **readimage**:

```
struct xvimage * image;
char *filename;
...
image = readimage(filename);
```

This function returns a NULL pointer if the reading did not run correctly. The function **readimage** is defined in `src/lib/mcimage.c`, while the header is in `include/mcimage.h`.

6 Writing an image file

Writing an image in the **pgm** format is done thanks to a call to the function **writeimage**:

```
struct xvimage * image;
char *filename;
...
writeimage(image, filename);
```

The function **writeimage** is defined in `src/lib/mcimage.c`, while the header is in `include/mcimage.h`.

7 Allocating a structure xvimage

In a call to **readimage**, a **xvimage** structure is automatically allocated. To allocate an **xvimage** structure without a call to **readimage**, we can use the function **allocimage**:

```
  struct xvimage * image;
  int rs, cs;
  ...
  image = allocimage(NULL, rs, cs, 1, VFF_TYP_1_BYTE);
```

To free the allocated memory, we can use the function **freeimage**:

```
  freeimage(image);
```

The functions **allocimage** and **freeimage** are defined in `src/lib/mcimage.c`, while the headers are in `include/mcimage.h`.

8 An example

Here is a main that calls the function **laddconst** (source: `src/com/addconst.c`):

```
/* Call to laddconst */

#include <stdio.h>
#include <mcimage.h>
#include <laddconst.h>

/* ================================================================ */
int main(int argc, char **argv)
/* ================================================================ */
{
  struct xvimage * image1;
  int constante;

  if (argc != 4)
  {
    fprintf(stderr, "usage: %s in1.pgm constante out.pgm \n", argv[0]);
    exit(0);
  }

  image1 = readimage(argv[1]);
  if (image1 == NULL)
  {
    fprintf(stderr, "addconst: readimage failed\n");
    exit(0);
  }
  constante = atoi(argv[2]);

  if (! laddconst(image1, constante))
  {
    fprintf(stderr, "addconst: function laddconst failed\n");
```

```
    exit(0);
  }

  writeimage(image1, argv[3]);
  freeimage(image1);

} /* main */
```

9 Directories

doc : documentation
include : header files (.h)
obj : object files (.o)
bin : executables
src/com : sources of the programs that will be run from shell
src/lib : sources of the basic (mcimage) and processing functions