VSG Technical Report
OSMIA-4.4(i)

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1. Assessment of OSMIA

The latest version of Tina (Tina 5) [2] addressed the major shortcomings associated with Tina 4 [1], namely the separation between the computational engine (tina-libs) and the interface tools (tina-tools). Thus, the direct consequence of this library segregation is the fact that it offers the possibility to fully integrate Tina 5 into NeatVision development environment using a mechanism based on the peer-class (or proxy class) concept [7,8]. A full description of this process can be found in the report describing the integration of Tina 5 libraries into NeatVision 2.1 development environment [4].

We have used Tina 5 libraries in the development of new medical applications [9] and also in the implementation of Tina 4 applications using Tina 5 that are made part of NeatVision environment. Our experience with Tina 5 can be summarised as follows:

- The software was downloaded with ease through CVS and the software installation went smoothly for Unix platforms.
- Some work was required in order to compile the software under Windows (Windows 2000 – Visual C++ 6.0) due to inconsistencies between Windows and Unix compilers (math.h, dirent.h, fnmatch.h). These problems were rectified in the latest release by DCU – Voxar - ISBE.
- A relative large number of warnings were generated during the compilation/building process. Their numbers have been constantly narrowed with the latest releases.
- A number of initialisation problems (e.g. nema_read_image – to cover for empty seq) were easily fixed.
- The software documentation is not yet available and we have used the on-line documentation associated with Tina 4 [1].
- The code is not properly commented and this make difficult to understand code's functionality and fix potential bugs.
- A large number of static variables are present and they may create re-entry problems.
- Tina supports only a small number of image file formats. Popular image formats such as bmp, gif and jpeg would be a very useful addition.
- Tina 5 software needs to be extensively tested before the final version is released.
- Our assessment of Tina 5 is positive and we have found that it is advantageous to use Tina libraries in the development of machine vision and medical applications.
- We have found extremely important the co-operation with other OSMIA members and this collaboration led us to implement new software components (clustering, adaptive smoothing, etc) or new algorithms (ejection fraction calculation). Another important benefit is the fact that NeatVision package has been enriched with a new development tool and several medical applications that were initially developed in Tina have been made part of NeatVision environment.
- Several packages have been added to Tina 5 libraries by the DCU team as a result of this collaboration - PGH 2D object recognition (ISBE – DCU) and optical flow (UoWO – DCU - ISBE). These applications have been also made part of the NeatVision 2.1 environment.

- OSMIA project offered the opportunity of making Tina libraries available to Java programmers, thus increasing the attractiveness of this package to a larger number of users.
- As we have mentioned before, OSMIA not only offered us the chance to add extra functionality to NeatVision but also gave us the opportunity to exchange new ideas with other OSMIA partners. Therefore, we are committed to continue this collaboration beyond the term of this project.

2. Examples of OSMIA integration in NeatVision

Tina 4 integration into NeatVision has been carried out for Unix platforms and has been documented in the technical report D4.1 [4]. The following application tools have been made part of the NeatVision environment:

- Stereo tool
- NMR segmentation

Tina 5 integration into NeatVision has been fully documented in the technical report D4.2 [5] where the interface of tina-libs in Java [6] has been made by using proxy classes that have been made available to NeatVision environment. The following Tina and DCU applications have been made part of NeatVision environment:

- Nema and Aiff reader
- Stereo rectification
- Coil correction
- Smart ROI – aorta tracking
- Ejection Fraction calculation

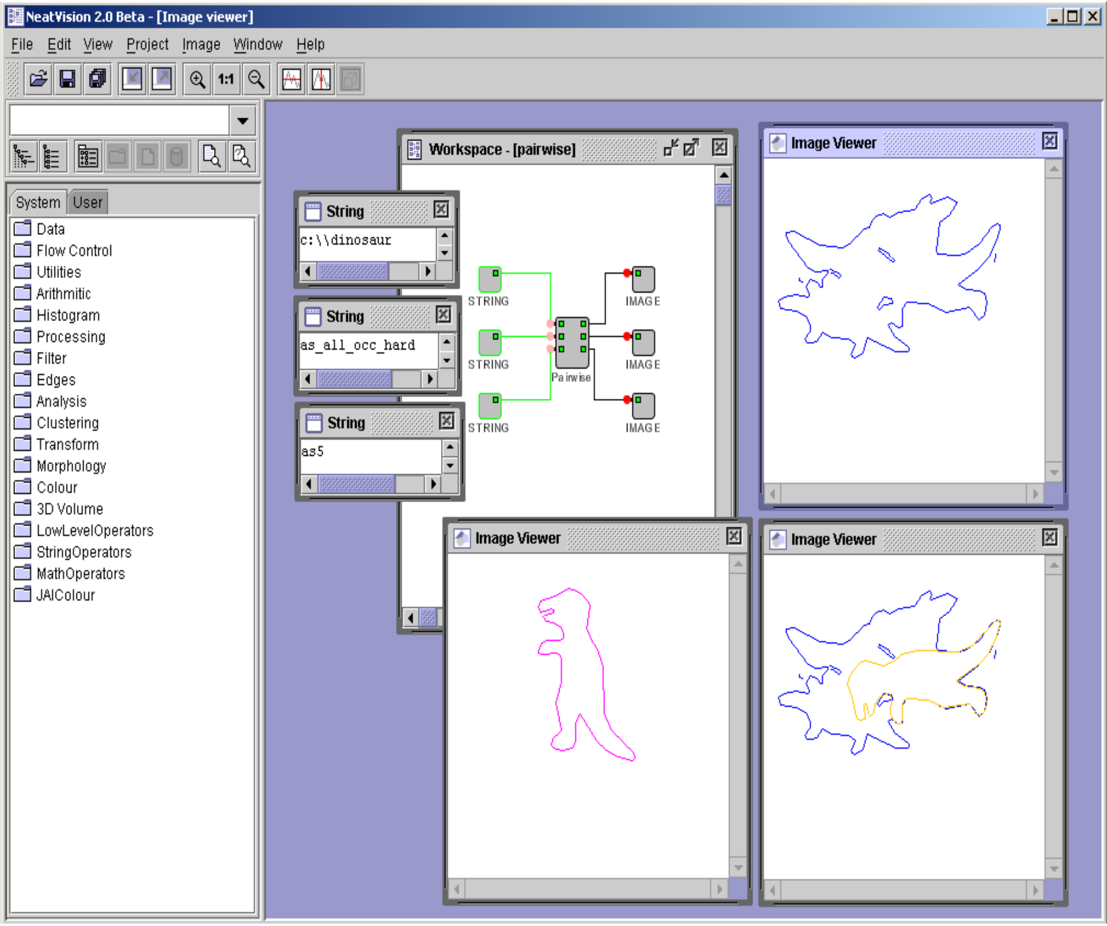
3. Examples of software resulting from collaboration between OSMIA members

3.1 Pairwise geometric histograms

The PGH (pairwise geometric histograms) tool [10] is a powerful 2D object recognition algorithm that is able to accommodate distortions in input data such as scale variation or incomplete description of the scene objects. In Tina 4 the algorithm has been developed as an application tool where elements of the graphical interface were required to run execute the algorithm on Unix platforms (Solaris and Linux). For a number of years VSL-DCU has been actively involved in the development of new image processing techniques that are applied in the development of machine vision systems and currently a new research topic, namely autonomous navigation is under development.

Due to its characteristics such as robustness to scale variation and incomplete definition of the outline of the scene object the PGH algorithm is of particular interest to us. Thus, our aim was to have the PGH algorithm free of any machine dependent calls. The work involved a clear separation between the console program that is used to execute the tool (which has to be platform dependent and written by the user) and the computational part that has been made part of the vision library. This work has been the result of collaboration between ISBE and DCU and has been committed through the CVS to tina-libs/vision library.

The PGH tool has been made part of NeatVision and the workspace required to execute the tool is illustrated below.



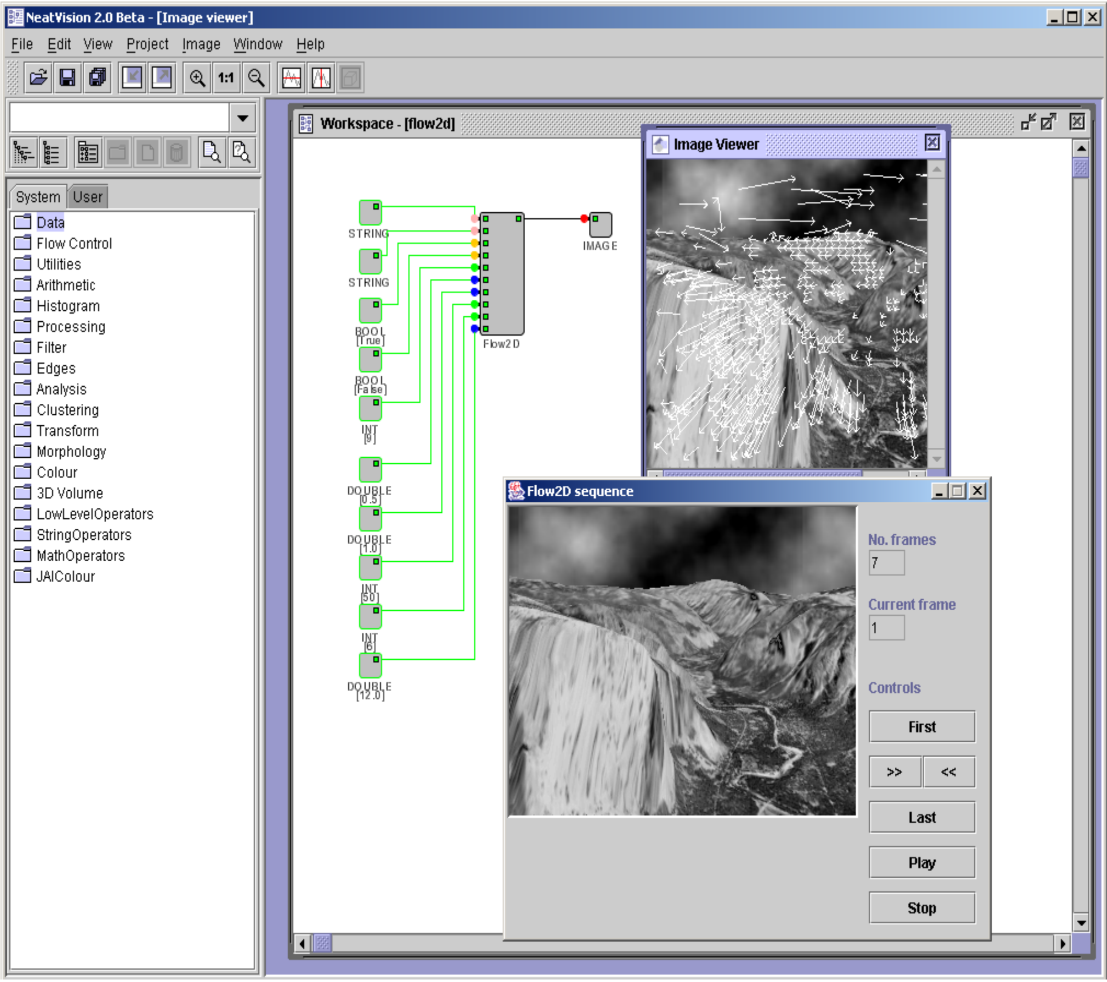
3.2 Optical Flow

One of the most difficult problems in processing sequence of images is the estimation of image motion which is defined as a projection of moving 3D objects on the image sensor. The image displacement contained in a time-ordered image sequence can be approximated by employing optical flow techniques [11]. Prof. John Barron has developed and implemented many 2D and 3D optical flow algorithms, including 2D optical flow for 3D corn seedling growth measurements from front and side views of the plant, 3D range flow (3D optical flow on a surface) to measure the 3D optical flow on moving plant leaves and 3D optical flow (volumetric flow) to compute 3D motion of weather storms from 3D Doppler radial velocity datasets). More recently, he has extended two 2D optical flow algorithms into 3D and is attempting to use them to monitor heart motion in gated cardiac MRI data [12].

VSL is currently involved in the development of a system able to flag potential heart diseases, the optical flow techniques can be used to prototype new algorithms or to compare its performance against the existing algorithms based on image segmentation or energy-based implementation that attempt to recover the movement of ventricular walls.

The developed optical flow techniques (Lucas-Kanade and Horn-Schunck) have been adapted to be included in Tina 5 libraries by Prof. Barron and the DCU team and they were committed through the CVS.

The optical flow techniques have been made part of NeatVision and the workspace required to execute the application is illustrated below.



Acknowledgements

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