NeatVision - Visual Programming for Computer Aided Diagnostic Applications

[Keynote Address]

Paul F. Whelan

Vision Systems Group
School of Electronic Engineering
Dublin City University
Ireland

With the ever-increasing capabilities of medical scanners, the quantity and quality of data to be handled is increasing significantly. Computer Aided Detection (CAD) / Diagnostics (CADx) is one possible way to deal with such information overload as it assists radiologist undertake their tasks in an increasingly pressurised work environment. This talk will begin by introducing a range of CAD / CADx applications undertaken by the Vision Systems Group at Dublin City University to illustrate how such systems can be employed in this support role.

It is clear that the development of robust and accurate CAD / CADx tools relies heavily on the incorporation of computer vision techniques into the imaging task. The development of such computer vision based CAD / CADx tools is not a trivial task and requires significant expertise and high quality easy to use development tools, and it is this latter issue that will be the main focus of this talk. One approach to this task is through the use of visual programming to develop the necessary computer vision modules for CAD / CADx, such as those dealing with the analysis of shape, colour (for standard imaging applications) and texture. Extracting useful information from images is a difficult task and as such requires a flexible application development environment. The visual programming environment outlined in this talk (NeatVision) is one such system. It aims to provide novice and experienced CAD / CADx developers with access to a multi-platform (realised through the use of Java) development system. The NeatVision environment provides an intuitive interface, which is achieved using a drag and drop block diagram approach (see Figure 1). Each image processing operation is represented by a graphical block with inputs and outputs that can be interconnected, edited and deleted as required. NeatVision (Version 2.1) is available free of charge and can be downloaded directly via the Internet, see Figure 2.

While users may have had some prior programming language development experience, the level of competence can vary significantly. A number of difficulties arose from using a standard programming language (such as ‘C’). From a technical perspective, it is clear that the support and maintenance of such libraries of functions for a wide range of operation systems is impractical. The multi-platform capabilities of Java led us to consider this as a viable alternative. But more importantly from a development point of view, we wanted to avoid the situation whereby novice developers spent a significant proportion of their time on the issues relating to the actual programming language. Instead we want the focus to be on the development of novel CAD / CADx approaches.

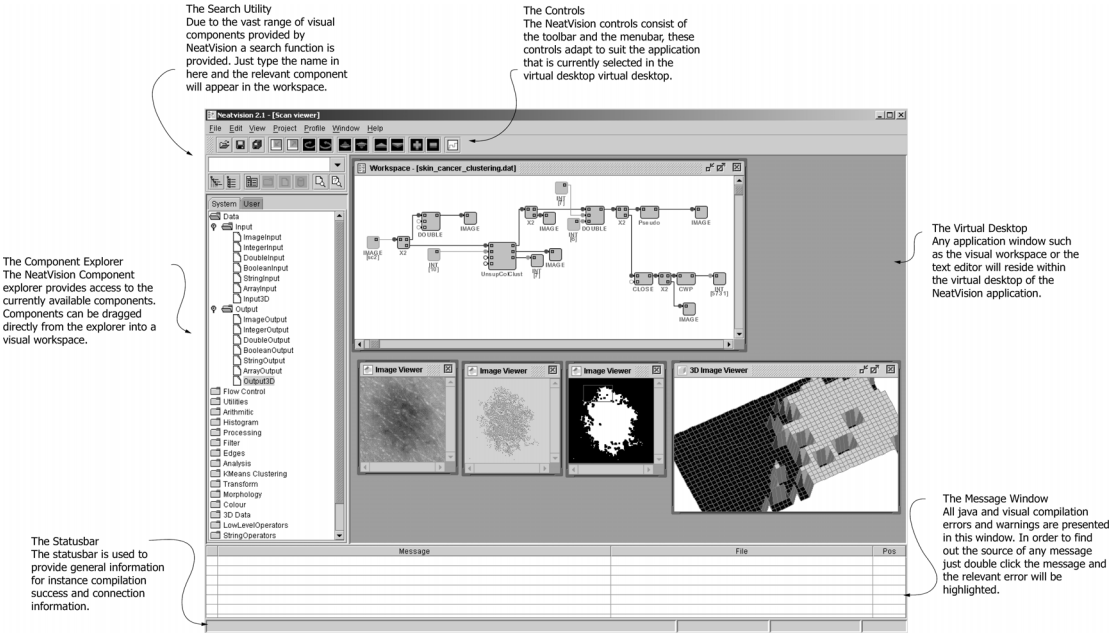

Figure 1: Key features of the NeatVision environment.

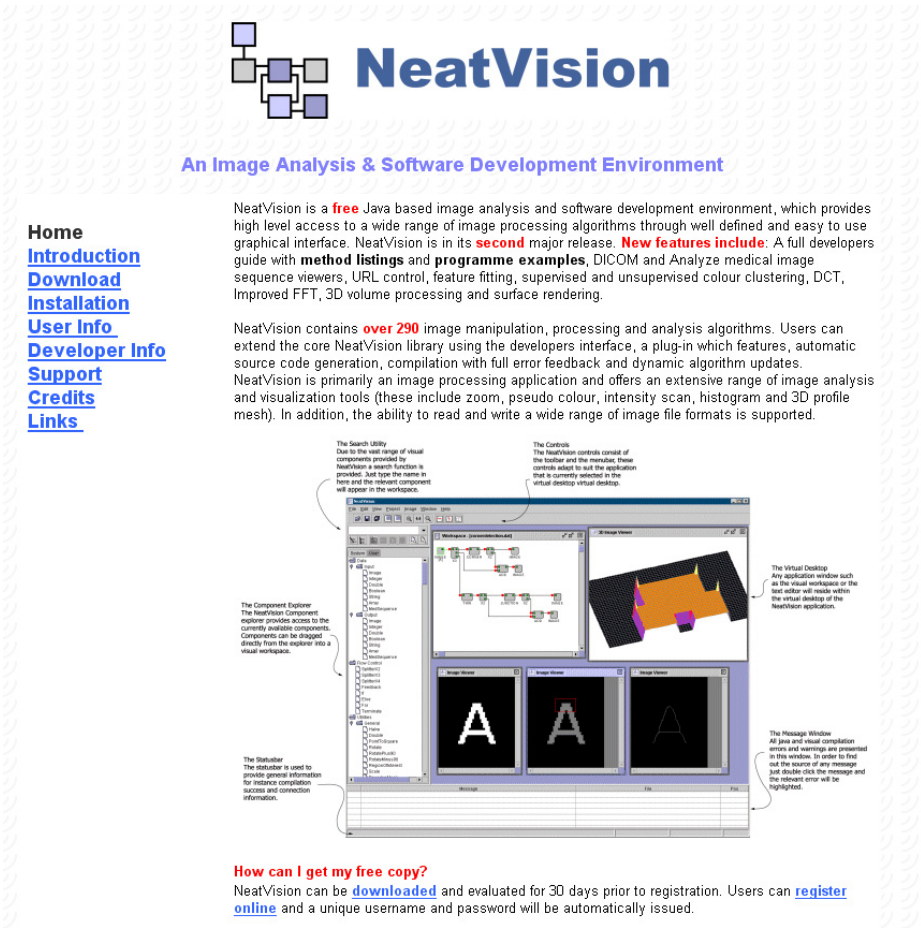

Figure 2: NeatVision.com web site.

This talk will also outline a number of CAD / CADx sample applications developed using the NeatVision environment. These will include: CT colon region segmentation (Figure 3), brain region segmentation and measurement, biliary tree region extraction for MRCP (Magnetic Resonance Cholangiopancreatography) and the calculation of the ejection fraction from MR cardio images. By examining these applications we clearly illustrated the power and flexibility of NeatVision as a CAD / CADx development tool.

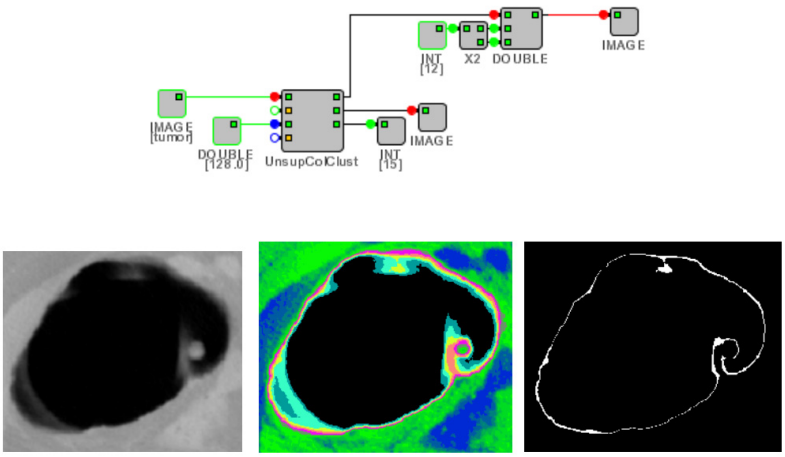

Figure 3: Sample NeatVision application. (Top) NeatVision workspace. (Bottom left) Original DICOM image. (Bottom middle) Pseudo colour display of the regions automatically clusters using an unsupervised approach. (Bottom right) A single cluster region is selected and isolated.

Acknowledgments: This research work was done in conjunction with Robert Sadleir and Dr. Ovidiu Ghita was financed in part by the EU Fifth Framework Programme (IST: Accompanying Measures, Project OSMIA - Open Source Medical Image Analysis) and Science Foundation Ireland (SFI).

Key References:

NeatVision: Image Analysis and Software Development Environment. Available at http://www.neatvision.com 2005; Accessed May 3.

Whelan PF, Sadleir RJT and Ghita O, (2004) "Informatics in Radiology (*info*RAD): NeatVision: Visual Programming for Computer-aided Diagnostic Applications" Radiographics 2004 24: 1779-1789

Sage D and Unser M, Teaching Image Processing Programming in Java. IEEE Signal Processing Magazine 2003: Nov:43-52

Whelan PF and Molloy D, "Machine Vision Algorithms in Java: Techniques and Implementation", Springer-Verlag, London, 2000 (Reprinted in 2001)

Sadleir RJT, Whelan PF, MacMathuna P and Fenlon HM, "Informatics in Radiology (infoRAD): A Portable Toolkit for Providing Straightforward Access to Medical Image Data" Radiographics. 2004 Jul-Aug:24(4):1193-1202

NeatMed Medical Imaging Application Programmers Interface. Available at http://www.vsg.dcu.ie/DICOM/ 2005; Accessed May 3.

OSMIA - Open Source Medical Image Analysis, EU Fifth Framework Programme (IST: Accompanying Measures). Available at http://www.eeng.dcu.ie/~whelanp/osmia/ 2005; Accessed May 3.