

Algorithm Validation Toolkit AVT2EXT

SCR

Algorithm Validation Toolkit Programming Guide

R1.0

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Fabian Moerchen

Philipp Hussels

Bob Schwanke

Jie Zheng

Lawrence Tarbox¹

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¹ Washington University, St. Louis, MO.

History

Document History			
Version/ Status	Date Issue	Author	Change and Reason of Change
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R0.2/RC	17-Mar-10	Fabian Moerchen	Release Candidate
R0.3/RC	26-Mar-10	Fabian Moerchen	Merged revision with Bob and added customization
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R1.0	3-Jun-10	Robert Schwanke	Released

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1 Introduction

1.1 Purpose of the document

The Programming Guide describes how to build AVT from the source code and how to customize certain aspects of AVT.

1.2 Requirements

The following environment is required to build AVT.

- AVT installation package from [SCR](#).
- Ant-1.8.0 or later from [Apache](#)

1.3 Third party software installation and configuration

The following third party software is required to build AVT.

- Install Ant
 - Add ANT_HOME environment variable pointing to your Ant installation directory (Right click on My Computer, Select Properties, Select Advanced, Select Environment Variables, Select New, enter ANT_HOME and folder).
 - Add the subfolder bin of your Ant installation directory to the environment variable PATH (Right click on My Computer, Select Properties, Select Advanced, Select Environment Variables, Select PATH, Edit, add bin folder).

1.4 Changing Java Code and Rebuilding AVT

The following steps describe how to rebuild the AVT software after changing the Java source code.

- Install AVT (see Installation guide) into C:\AVT
- Make changes to the Java source code.
- Open a command prompt in C:\AVT\ and type ant build-all

The installation of AVT will now use the newly compiled code.

1.5 Changing C++ Code and Rebuilding AVT

A small portion of AVT is written in C++ because it is closely connected to third-party code written in C++. Most of this code involves XIP scene graphs or the R server client interface.

The AVT code is compiled into a small number of DLL's:

- **AvtUtil.dll** (used in four applications)
- **MVTStatistics.dll** (used in MVT)
- **RConnection.dll** (used in MVT)

The following steps describe how to build the AVT software after changing the C++ source code.

- Install Microsoft Visual Studio 2005 for C++ and service package 1, if you haven't already.
- Install AVT (see Installation guide) into C:\AVT
- Open the Microsoft Visual Studio solution for the component you wish to modify. It is located at C:\AVT\AVTUtil\src**.sln
- Make changes to the C++ source code.
- Rebuild the corresponding.dll.
- Copy the rebuilt dll into each of the places that you find it in C:\AVT**.dll

If you have only modified these dll's, there is no need to re-run ant to rebuild the system. These dll's will link in automatically when you run startup.bat.

2 Customizing AVT

2.1 Installing a scene-graph algorithm in AE

In order to install a different segmentation algorithm to replace the ITK/VTK algorithm used in AE, one needs to:

1. Wrap the segmentation algorithm as an Open Inventor engine, which at least should have one input and one output.
 - a. Volume ROI - the mandatory input field

To contain the ROI of the tumor stored in two bytes per voxel. The data type would be `SoXipSFDDataImage` or `SoITKSFDDataImage`;
 - b. Segmentation mask - the mandatory output field

To contain the segmentation binary volume mask stored in one byte per voxel. The data type would be `SoXipSFDDataImage` or `SoITKSFDDataImage`;
 - c. Seed points - the optional input field

To contain the user inputs to indicate the location of the tumor. The data type is `SoMFVec3f`.
2. Connect the algorithm engine to the scene-graph
 - a. Open the "AlgorithmExecution.xip" in AE folder;
 - b. Add the algorithm engine to the scene-graph;
 - c. Open the "Seg_Algorithm" node by double clicking;
 - d. Connect the inputs fields:
 - connect the "roiVolume" field in "Seg_Algorithm" to the "Volume ROI" field in the algorithm engine if "Volume ROI" is `SoXipSFDDataImage`, otherwise apply the "roiITKVolume" field;
 - - (optional) connect the "seedPoints" field in "Seg_Algorithm" to the "Seed points" field in the algorithm engine;
 - e. . Connect the output field:
 - - connect the "Segmentation mask" field in the algorithm engine to the "image1" field in the "Mask_Switch" if the algorithm output is `SoXipSFDDataImage`, otherwise connect to the "input" field in "SoItkImageToXipMask" node;
3. Save the modified scene-graph with the name "AlgorithmExecution.xip", and copy it to AE folder;
4. Copy the algorithm engine dll to AE folder, and add it to the "extensions.xml"

Then the AE is equipped with the new segmentation algorithm.

2.2 Disabling and configuring tools in IA

In order to configure UI parameters in IA, one needs to:

1. Open the "Preferences.xml" in IA/config folder;
2. Configure the w/l presets
 - Change the "Name" attribute in the "Preset" tag;
 - Change the "WindowWidth" attribute in the "Preset" tag;
 - Change the "WinodwCenter" attribute in the Preset" tag;
3. Configure the line style of the overlaid tumor contour in three MPR views
 - Change the "LineWidth" attibute in the "ContourDisplayStyle" tag;
 - Change the "LinePattern" attribute in the "ContourDisplayStyle" tag;
4. Configure the edit drawing line style in the axial view
 - Change the "LineColor" as RGB in "EditDisplayStyle" tag;
 - Change the "LineWidth" in "EditDisplayStyle" tag;
 - Change the "LinePattern" in "EditDisplayStyle" tag;
5. Configure the RECIST line style in the axial view
 - Change the "LineColor" as RGB in "RECISTDisplayStyle" tag;
 - Change the "LineWidth" in "RECISTDisplayStyle" tag;
 - Change the "LinePattern" in "RECISTDisplayStyle" tag;
6. Configure the WHO line style in the axial view
 - Change the "LineColor" as RGB in "WHODisplayStyle" tag;
 - Change the "LineWidth" in "WHODisplayStyle" tag;
 - Change the "LinePattern" in "WHODisplayStyle" tag;

2.3 Configuring tools in MVT

In order to configure statistical UI parameters in MVT, one needs to:

1. Add the statistical method in statistical list
Open the "Statistics.xml" in MVT/config folder:
 - a. Add the "Item" tag under the "Items" attribute;
 - b. - Add the "Data" attribute to one of the following measurements:
 - NominalGT RECIST
 - Annotation RECIST
 - RECIST Difference
 - NominalGT WHO
 - Annotation WHO
 - WHO Difference
 - NominalGT Volume
 - Annotation Volume
 - Volume Difference
 - Relative Volume Difference
 - Surface Distance (Average)
 - Surface Distance (RMS)
 - Surface Distance (Maximum)
 - Volume Overlap
 - c. - Add the "Method" attribute to "Mean" or "SD"
2. Add the outlier method in outlier list

- . Open the "Outliers.xml" in MVT/config folder:
 - a. Add the "Item" tag under the "Items" attribute;
 - b. Add the "Data" attribute to one of the following measurements:
 - NominalGT RECIST
 - Annotation RECIST
 - RECIST Difference
 - NominalGT WHO
 - Annotation WHO
 - WHO Difference
 - NominalGT Volume
 - Annotation Volume
 - Volume Difference
 - Relative Volume Difference
 - Surface Distance (Average)
 - Surface Distance (RMS)
 - Surface Distance (Maximum)
 - Volume Overlap
 - c. Add the "Scaling" attribute to "Top 25%", "Top 50%", "Bottom 50%", or "Bottom 25%".
- 3. Add the plot method in plotting list
 - . Open the "Plotting.xml" in MVT/config folder:
 - a. Add the "Item" tag under the "Items" attribute;
 - b. Add the "Chart" attribute to one of the following plotting types:
 - Bland_Altmann
 - Scatter
 - Histogram
 - c. - Add the "Data1" and "Data2" attributes to one of the following measurements:
 - NominalGT RECIST
 - Annotation RECIST
 - RECIST Difference
 - NominalGT WHO
 - Annotation WHO
 - WHO Difference
 - NominalGT Volume
 - Annotation Volume
 - Volume Difference
 - Relative Volume Difference
 - Surface Distance (Average)
 - Surface Distance (RMS)
 - Surface Distance (Maximum)
 - Volume Overlap

Note: for Histogram plot, only "Data1" is validity.
 - d. Add the "Title" attribute to define the title of the chart;
 - e. Add the "Legend" attribute to turn on/off the chart legend for Bland_Altmann and Scatter chart;

2.4 Adding and suppressing independent variables

In order to add an additional DICOM Attribute as an independent variable to the AD one needs to

1. Add a database column to the GENERAL_IMAGE table
2. Map this column with Hibernate using the file dicom.hbm.xml to a new method of the class GeneralImage using the (numeric) DICOM Attribute Tag as the tag meta attribute.
3. To add this DICOM Attribute to the list of search criteria displayed in the XIP Host™ query tabcard²
 - a. Edit the the xipHost/src/edu/wustl/xipHost/dicom/DicomUtil.java file.
 - b. Add a line to the constructEmptyAttributeList() method for the desired DICOM Attribute, following the pattern used for the other DICOM Attributes in the list.
 - c. Save the file, and rebuild.
4. In order to add independent variables to MVT, some source code modifications are needed .
 - a. Open “StatisticalDesigner.java” in “com.siemens.cmiv.avt.mvt.ui” package;
 - b. Add the independent variables to the definition of “Independent_Vars” variable;
 - c. Open “MeasurementVariabilityPanel.java” in the default package;
 - d. Add the independent variables value AD query implementation in the “getMRegressionVariables” function;

For additional AIM tag no changes are needed to the AD API and Implementation, as the API offers querying by XML tag element name and attribute name. To add an AIM tag to the XIP Host™ search criteria:

1. Edit the xipHost/src/edu/wustl/xipHost/avt2ext/AttributePanelAim.java file
2. Locate the constructor for AttributePanelAIM
3. Add a call to searchCriteria.put(“TextToDisplay”, ”); replacing “TextToDisplay” with the wording that should appear in the GUI for the new criteria, to the constructor. The call should be placed with the other searchCriteria.put calls, in the order that it should appear in the GUI.
4. Add a call to labelPath.put(“TextToDisplay”, “XPathStatement”), where “TextToDisplay” matches the text used in the searchCriteria.put call, and “XPathStatement” is the XPath statement that will find the item of interest in an AIM object.
5. Save the file, and rebuild.

In order to suppress an independent variable one needs to

1. Open “StatisticalDesigner.java” in “com.siemens.cmiv.avt.mvt.ui” package;
2. Remove the independent variable from the definition of “Independent_Vars” variable;

Software Used in Development

The following software was used to develop AVT. Some of it is redistributed with AVT, but is not itself considered part of the AVT source code.

² Note that the XIP Host™ GUI allows the user to search for any arbitrary DICOM Attribute tag in AD, even without changing the search criteria Attribute list.

Item	Description
Programming languages	C++, Java
Compilers	MS Visual C++ 2005 with SP2 Java 6 SDK, preferably jdk1.6.0_10 or greater. <i>Note: A higher version of compiler(or yet another compiler) can be used if its output executables or binaries are compatible.</i>
Base libraries	MS VC++ 2005 library Java Runtime Environment (JRE) 1.6 OpenGL v 2.0
Application libraries	Open XIP v /branches/feb09 Revision 2863 Open Inventor v 2.40
Development Platforms	Windows XP Professional SP2
Tools	SVN Ant System install/upgrade tool: IzPack Document tools: MS Office 2003

The license spreadsheet below documents the licenses behind all the third-party jar files in AVT.



AVT-jar-Licences-Fin
al_100520.xls