http://mipav.cit.nih.gov
Medical Image Processing, Analysis & Visualization in Clinical Research

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Requirements for an Image Quantification and Visualization Application

- **Portability**
  - cross-platform or platform-independent execution

- **Data format independence**
  - access to images: DICOM, Analyze, TIFF, Raw, …

- **Extensibility**
  - plugins and/or scripts

- **Scalability**
  - foundation to support the growth to larger and more intricate data structures

- **Usability**
  - coherent graphical user interface (GUI)
Java applications can be "written once and run anywhere", significantly reducing cross-platform development and maintenance.
Data Independence

- DICOM file reader/writer
- DICOM Query/Retrieve and “Catcher”
- Comprehensive file format support/conversion
- MIPAV XML file format
Extensibility

Plugins and Scripts

- **Plugins**
  - Functions written in Java using the MIPAV API.

- **Scripts**
  - Use MIPAV to record and save function(s) applied to image dataset(s).
  - Apply the script to any number of image datasets using the script wizard.
Scalability

• Model Image is an n-dimensional structure.

• Algorithms can support up to 4D datasets.

• Viewers support 4D dataset with fusion.
Usability

- GUI elements
- Scripting system
- Command-line tools
Functional Overview

GUI

Views – with data fusion
- 2D planar,
- “Lightbox”,
- Cine (movie),
- Multi-planar,
- 3D tri-planar,
- Surface render, (supports 3D texture mapped volume rendering
- Volume render

VOIs
- 32K Manual and automated contouring

Algorithms
- Filtering
- Segmentation/classification
- Measurement/quantification
- Registration/fusion
- Utilities
- Plugins

Data (Image) types: n-dimensional structure
- (boolean, byte, unsigned byte, short,
- unsigned short, int, long, float, double, Complex, ARGB)

PACS
- DICOM 3.0: Query/Retrieve, Catcher

File types
- (Raw, Analyze, DICOM 3.0, GE, Siemens, Bruker, Interfile,
- Micro cat, MINC, MRC, FITS, Cheshire, AFNI, TIFF, JPEG, GIF,
- BMP, AVI, QuickTime, Biorad, Ziess LSM510, XML, and more)
Opening Images
# Opening Images

![Image Preview]

## File List

<table>
<thead>
<tr>
<th>File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell2_0_3D0000.tif</td>
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<tr>
<td>Cell2_0_3D0001.tif</td>
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<tr>
<td>Cell2_0_3D0002.tif</td>
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<tr>
<td>Cell2_0_3D0118.tif</td>
</tr>
<tr>
<td>Cell2_0_3D0119.tif</td>
</tr>
</tbody>
</table>

## Dimensions

- **Slices (Z):** 5
- **Channels (C):** 1
- **Time points (T):** 4

## Sequences

- Z.C.T
- Z.T.C
- C.Z.T
- C.T.Z
- T.Z.C
- T.C.Z

## Subsampling

- **Enable**: unchecked
- **Width**: not specified
- **Height**: not specified
- **Force 8-bit**: unchecked

## Image Preview

![Image Preview]

**Image dimensions**: 324x324

**Window**: 0.1, 1, 10

**Level**: -255, 255
Opening Images
Saving Image As (use suffix)
```java
int destExtents[] = new int[2];
destExtents[0] = image.getExtents()[0];    // X dim
destExtents[1] = image.getExtents()[1];    // Y dim

// Make a result image of Unsigned byte type
resultImage = new ModelImage(ModelStorageBase.UBYTE, destExtents, “Result Image”, null);

int length = destExtents[0] * destExtents[1];
for (int i = 0; i < length; i++)
   destImage.set(i, i%256);

ViewJFrameImage imageFrame;
ModelLUT LUTa = new ModelLUT(ModelLUT.COOLHOT, 256, dimExtentsLUT);
   imageFrame = new ViewJFrameImage(resultImage, LUTa, new Dimension(610,200), userInterface);
```
Algorithms

- Filters
- Calculation
- Registration
- Transformation
- Surface extraction
- Classification/Segmentation
Download and Setup

2. Fill in form
3. Install (e.g. installMIPAV.exe)

** Nightly download - lastest changes but might have bugs.
** Archived releases also available.
Memory Allocation

General Rules

• Do not exceed the computer’s physical RAM. For example, if the computer has 1GB do not exceed approx 800MB.

• For 32-bit Windows systems do not exceed 1,400MB
Memory Usage

Press to recover memory
MIPAV Program Options
Digital Image Communication in Medicine (DICOM).

American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) formed a joint committee in 1983 to develop a standard in Digital Image Communication in Medicine (DICOM).

1. Promote communication of digital image information, regardless of device manufacturer

2. Facilitate the development and expansion of picture archiving and communication systems (PACS) that can also interface with other systems of hospital information

3. Allow the creation of diagnostic information databases that can be interrogated by a wide variety of devices distributed geographically.
DICOM Model

Imaging Workstation (MIPAV)
(Devices: PC, MAC, UNIX workstation)

Query
Images
Receiver

Image Processing & Visualization

DICOM Server

Images
Patient Database

Internet

PACS

Imaging Device
DICOM communication interface
DICOM

Access to image header information
DICOM File Browser
XML Schema File Format
XML Schema File Format
XML Schema File Format

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<!DOCTYPE XIFAV header file -->
<image xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  filename="junk.raw" xmlns=""/>
<Dataset-attributes>
  <Image-offset>0</Image-offset>
  <Data-type>short</Data-type>
  <Endianness>Little</Endianness>
  <Extents>512</Extents>
  <Extents>512</Extents>
  <Extents>55</Extents>
  <Resolution>0.703125</Resolution>
  <Resolution>0.703125</Resolution>
  <Resolution>10.0</Resolution>
  <Slice-spacing>0.0</Slice-spacing>
  <Units>Millimeters</Units>
  <Units>Millimeters</Units>
  <Units>Millimeters</Units>
  <Compression>zipped</Compression>
  <Orientation>Axial</Orientation>
  <Subject-axis-orientation>Right to Left</Subject-axis-orientation>
  <Subject-axis-orientation>Anterior to Posterior</Subject-axis-orientation>
  <Subject-axis-orientation>Inferior to Superior</Subject-axis-orientation>
  <Origin>-171.5</Origin>
  <Origin>-180.0</Origin>
  <Origin>-315.0</Origin>
  <Modality>Computed Tomography</Modality>
```
Image Attributes

![Image Attributes GUI](image)

- **Image name (without suffix):** .4
- **Image modality:** Computed Tomography
- **Image rotation order:** Little rotation, Big rotation

**General**
- **1st dimension:** 0.78125
- **2nd dimension:** 0.78125
- **Slice thickness:** 25

**Resolutions**
- **Unit of measure:** MILLILITERS

**Orientation/Origin**
- **Axial**

**Transform matrix**
- **Matrix:** Source Anatomical
- **Transform ID:** Source Anatomical
- **Identity:** 1.0 0.0 0.0 0.0 1.0 0.0 0.0 0.0 1.0
- **Left:** Save, Identity, Insert, Composite, Decompose

Volume of Interest (VOI)
Lookup Table (LUT)
Multi-planar and Lightbox
Image Fusion

The **loading** of two images into the same frame controls blending between the two images.
Structural MRI and Functional MRI
Animation Tool
Masks and Surfaces
Scripting - Record

The script is now recording. Your actions will appear below.

ImageCalculator("input_image_1 ext_image $image1", "input_image_2 ext_image $image2", "do_output_new_image boolean true", "operator_type int 0", "data_type_clip_mode int 0", "advanced_op_string string null")
Scripting - Run
Bug Report

Image slice index [total number slices=18]


Report a bug

Information
Your name
Your email address
Version of MIPAV you are running
Platform you are operating (ex. PC)
Operating System you are using
Windows 7
How urgent is this bug? When do you need it fixed by?

Bug Description
Unexpected Output
Title
Please give a detailed description of the bug encountered

Attachments
Browse
Create New Image
MIPAV

- Visualization
- Processing
- Macros/Plugins
- Quantification
- Ubiquitous file reader
- File writer
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