em2em
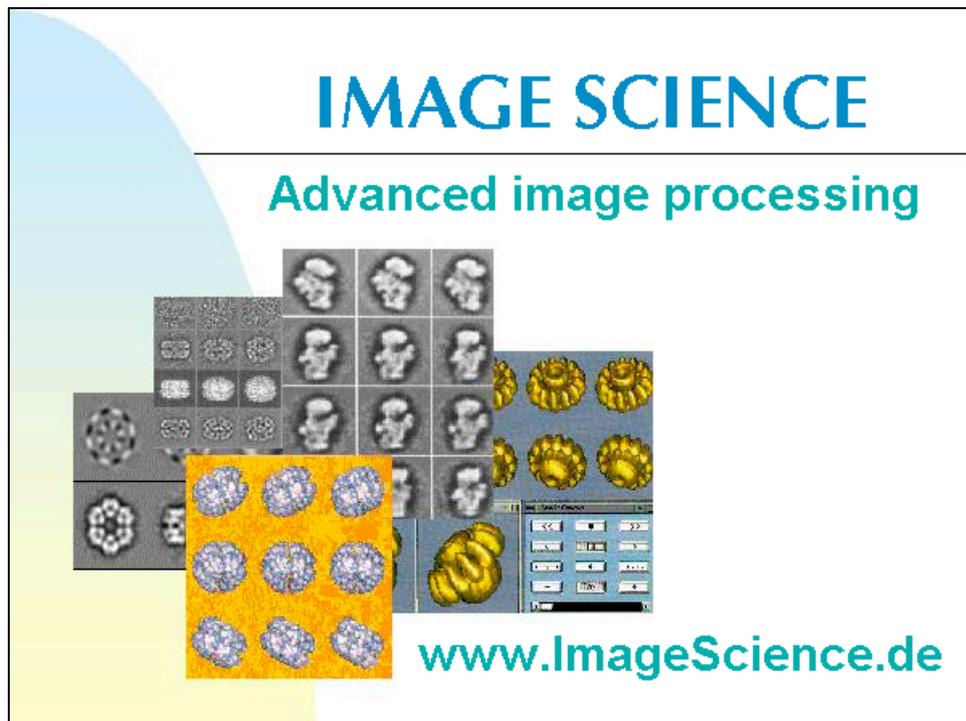

Program to convert images from/to formats
used in the "3DEM community"

DESCRIPTION

● **Formats currently supported:**

➤ BROOKHAVEN STEM   A format used to store STEM images. One data file actually contains two images: the large angle elastic scatter normalised signal, and the small angle elastic scatter signal (or bright field, if selected).

➤ CCP4   A format in use in X-ray crystallography to which the MRC format is largely but not completely compatible.

➤ DATA ONLY   Raw images; No header used

➤ DIGITAL MICROGRAPH 2   Gatan's dm2 format

➤ EM   Image data format used by the EM image processing system at the Max Planck Institute of Biochemistry (Martinsried, Germany) and by the TVIPS company (Tietz Image and Video Processing Systems, Gauting, Germany).

➤ FORMATTED   ASCII formatted files

➤ IMAGIC   Image analysis software package, developed by Marin van Heel. Commercially distributed by: Image Science, Berlin, Germany

➤ JPEG   JPEG is an acronym for the Joint Photographic Experts Group, which created this standard. For a long time this format has been the de facto file format for digital images/photography.

Note: Coloured JPEG images will be converted to grey scale images and exports are grey scale JPEG images.

Note: JPEG creates an 8-bit output file. The image is scaled to 256 densities values, which means that a normal 3DEM image is NOT described very accurately.

➤	KONTRON	Image format of the KONTRON ELEKTRONIK GmbH (Eching near München, Germany). This format is used in the IMCO/S system, for example.
➤	MDPP	Ross Smith's Micrograph Data Processing Program (N.Y.U. School of Medicine, NYU-MC)
➤	MEDIPIX:	Raw MEDIPIX images http://medipix.web.cern.ch/medipix/
➤	MRC	This is one of the oldest image formats in use in electron microscopy. It is a relatively rich file format, which allows for various data formats such as 8 bits integers, (raw byte data), 16 bit integers, 32 bit REALs and complex formats. One of the philosophies behind this data format is that it is compatible to the CCP4 format in use in X-ray crystallography (not completely true).
➤	OFFSET	Do not read any input header values, i.e. skip a specified number of bytes and read image densities only. Of course, the user has to know the image size and format.
➤	PIC	Image format used at the "Computational Bioscience and Engineering Laboratory", NIH, Bethesda (Alasdair Steven, Benes Trus)
➤	PIF	Portable image format for EM data Purdue University (Tim Baker)
➤	PGM	Portable grey map format
➤	POSTSCRIPT	PostScript is a page description language designed by Adobe Systems Incorporated. It provides a device independent standard for electronic printing. (Export only)
➤	RAW_IMAGE	See: DATA_ONLY
➤	RAW_IV	See: VOLUMETRIC
➤	SEMPER	Semper 6 Read/Write file format SEMPER is an image processing system

originally designed by O. Saxton (Cambridge, UK).

➤ SHF   GATAN's simple header file format

➤ SITUS   The map format of Willy Wrigger's docking program Situs

➤ SPIDER   The format(s) used by the SPIDER image processing system of Joachim Frank

➤ SUPRIM   Image format of the image processing system developed by J.P. Schroeter and P. Bretaudiere. The SUPRIM image format is also used in the PHOELIX image processing system written by B. Carragher, M. Whittaker and R. A. Milligan.

➤ TIA (EMISPEC)   TIA (Tecnai imaging and analysis) is the program used on FEI Tecnai and Titan microscopes for acquiring and displaying scanned images and spectra. It is based on ES Vision, originally created by the Emispec company, now taken over by FEI.

The format used here is for .ser files (series file format) and the information is taken from a web page on the original Emispec web site (www.emispec.com/Support/SeriesFileFormat.asp), now no longer in existence.

The format used relates to ES Vision 3.x, but is believed to have changed little with the current version of TIA.

(Import only)

➤ TIFF   Tagged Image Format: this has become one of the standard formats in desk-top publishing oriented image processing. Desk-top flat-bed scanners, for example, can all generate this image format.

Note: Coloured TIFF images will be converted to grey scale images and exports are grey scale TIFF images.

➤ RGB_TIFF   Read a coloured (RGB) TIFF file and store the three colour images as three 2D images (the red, the green and the blue image) in

4

the output file(s).

> **TVIPS**

Image formats used by the TVIPS (Tietz Video and Image Processing Systems) company, Germany. The two formats used are EM and TIFF with a specific tag.

> **VOLUMETRIC**

The rawiv/volumetric data format is used to represent 3D volumetric data of scalar fields defined on a regular grid.

> **X-PLOR**

Export only

Correction for byte swap:

Images from different workstations and operating systems can be converted automatically, i.e.

UNIX: SGI, SUN, HP, IBM, DEC (OSF, ULTRIX),

LINUX

VMS

Line-by-line conversion

The conversion is performed line-by-line, which allows huge images to be converted (no full image in-core).

Conversion of series of images

Stacks of images can be converted.

Ease of use

em2em is started with a simple command line call. Questions and options are prompted interactively.

Interactive help

"Help" or "?" is a legitimate answer to every question asked by the (IMAGIC) program. This option provides context sensitive help. em2em also suggests default answers.

Installation:

● **Java ®**

If em2em should run as a GUI window application Java® is required. Download and install the software according to the installation hints on the Java® webpages.

- Download Java® (Copyright Java®):
  java.sun.com/j2se/download.html

- Installation hints:
  java.sun.com/j2se/download.html

● **Install em2em**

- Linux / Unix / MAC OS X:

  Copy the em2em archive file (imagic_free.tar) to the wanted directory and double click it to uncompress the archive. Within a terminal window the command is: *tar -xf imagic_free.tar*

- MS Windows:

  Use a file archiver like 7-zip (www.7-zip.org) or WinRAR (www.rarlab.com) to uncompress the archive *imagic_free.tar*.

NOTE: If you are working with the IMAGIC image processing system em2em is already implemented and can be called with the command EM2EM or IMPORT-EXPORT.

How to use em2em:

Start em2em

- <u>UNIX/Linux/Mac OS X</u>   Start as GUI windows application: Double click the *em2em.sh* icon

    Start as a line-by-line program: Open a terminal/command window and type *em2em.sh -t*

- <u>MS Windows</u>   Start as GUI windows application: Double click the *em2em.bat* icon.

    Start as a line-by-line program: Open a MS-DOS console application/command window and type *em2em -t*

- <u>In IMAGIC</u>   IMAGIC-COMMAND: *import-export* or *em2em*

The user interaction

- Questions and options are all asked by em2em before the conversion starts.

- Don't hesitate to answer with **?** or **help** with provides context sensitive help.

- em2em suggests default answers (in square brackets).

Examples

Example: Convert a single 2-D image:

A typical session will look like this (example: convert an TIFF file *my_image.tif* to a IMAGIC file named *my_image_converted*:

Note 1:   For some questions em2em gives some default answers. These are the parameters, which are marked or already written into the answer boxes (em2em GUI version) or the parameters in square brackets (em2em command line version). If you do not answer these questions em2em will use these default values. When calling em2em once more (in the same working directory) the default values will be your last answers.

Note 2:   Some 3DEM image formats have a well-defined file extension. In such a case em2em does not ask for any extension (IMAGIC in the example above). If the extension is not fixed, em2em will ask for it. (In the example above: TIFF images can have the extension *tiff* or *tif*. So em2em asks for the extension).

8

Note 3:   For some options in em2em import and export format can be the same. This can be useful if the input image(s) come(s) from another operating system and you want to correct for byte shift / byte swap.

If header values have to be stored in the output file, which are not available in the import format em2em will ask the user to specify these values. For example:

Pixel size (in Angstrom)

Example: Convert a series of single 2-D images:

If the export image formats can store more than one image you can import a series of import images (let's say: *my_image_2.bmd … my_image_10.bmd*). In this case you can specify:

Import a set of single 2D image files

⦿ Yes   ◯ No

You are asked to specify the input root name and file number (option ROOTNAME_AND_NUMBER):

How to get import file names

    ROOTNAME_AND_NUMBER

Input root name (NO extension)

my_image_   🗁 Browse

Give (file) numbers (first#,last#)

2,10

Length of string for image numbers

0

Extension of the input files (usually: tif)

tif

or a text file containing the input file names (option FILE_OF_FILENAMES):

Example: Convert a 3-D volume:

A typical session will look like this (example: convert an 3-D volume stored in EM format into a SITUS file):

If the 3-D volume is stored in a series of single 2-D images (sections) a typical session will look like this: