

# Fiji



# **Fiji Is Just ImageJ** **(batteries included)**

## **Fiji for users**

one free software package

many bundled plugins

advanced scripting languages

tutorials/documentation

coherent menu structure

## **Fiji for developers**

version control

build system

open source



# Some ImageJ History

## NIH Image

Apple Mac only

## ImageJ

Java - all platforms

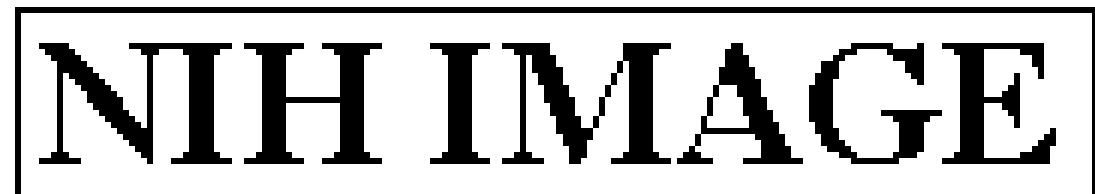
## ImageJA

Applet, Advanced

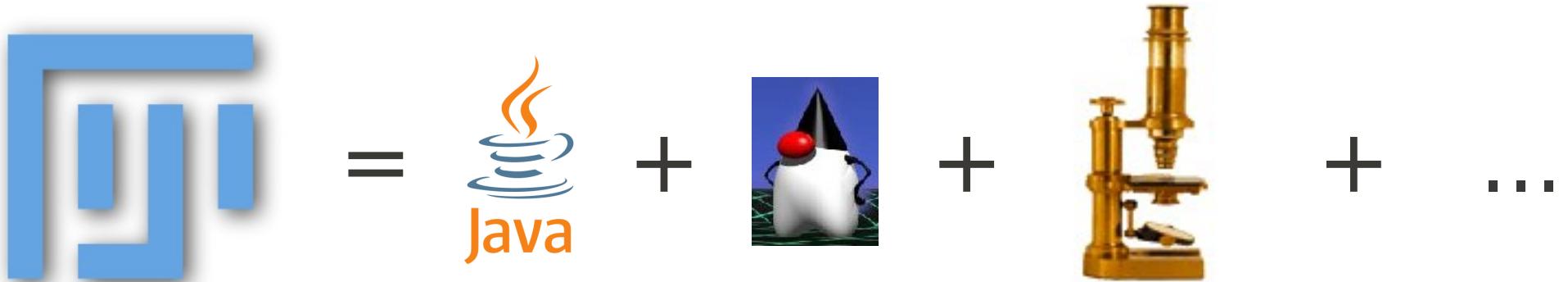
## Fiji

“installer for TrakEM2”

... and then much more



# Batteries Included !



## One software package

Java Runtime + Java3D,  
for Windows, Mac, Linux

32/64-bit

ImageJA

Plugins!

<http://fiji.sc/>

Fiji Is Just ImageJ

Fiji is an image processing package based on ImageJ. For users, Fiji is easy to install and update, bundles a set of plugins in a coherent menu structure (and updatable), along with comprehensive documentation. For developers, Fiji as an open source project is hosted on a Git source version control repository, with access to the source code of all internals, libraries and plugins, and eases the development and scripting of plugins.

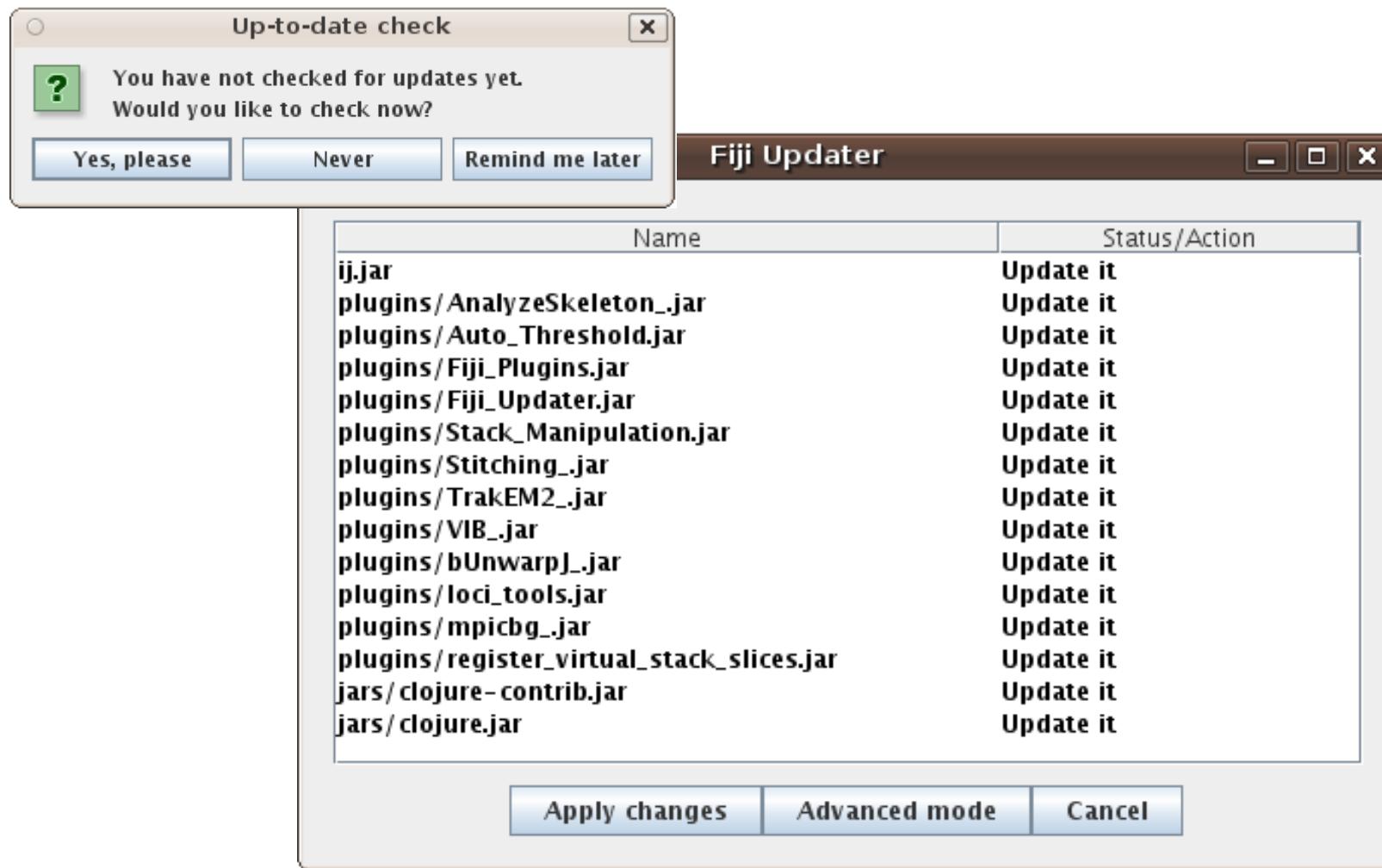
[Download Fiji now](#)

**News**

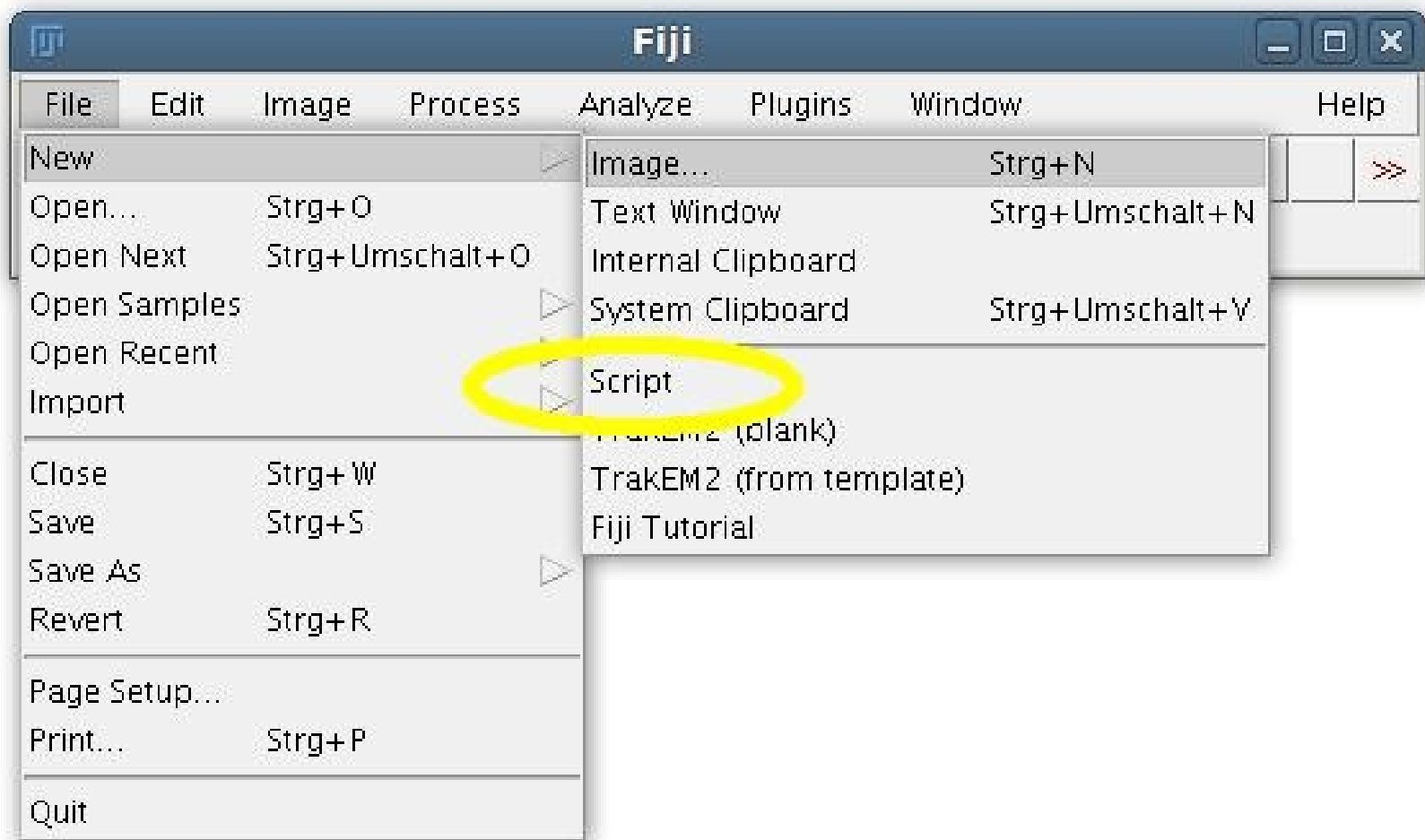
- 2010-03-01 - Fiji featured in Nature Methods review on visualization
- 2010-02-04 - Web Statistics and Fiji usage map
- 2010-01-21 - The Fiji Wiki got a new look
- 2009-12-17 - New Plugin: RATS (Robust Automatic Threshold Selection)
- 2009-12-04 - Updated TrakEM2 to version 0.7m

The Simple Neurite Tracer allows you to segment linear structures in 3D images by marking both ends in 3D and letting the tracer work out the rest.

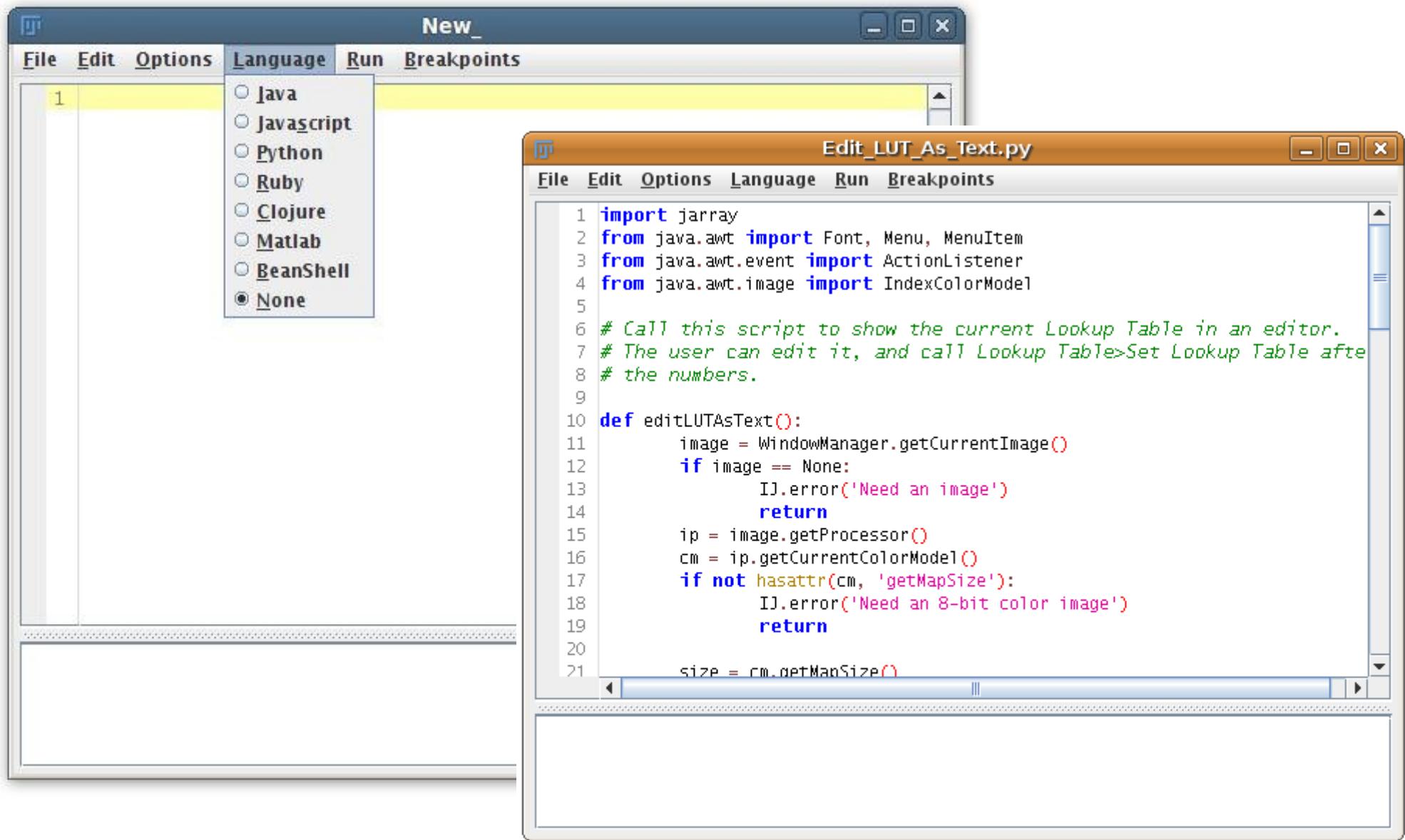
# Fiji Updater



# Script Editor



# Script Editor



# Advanced Users: Scripting

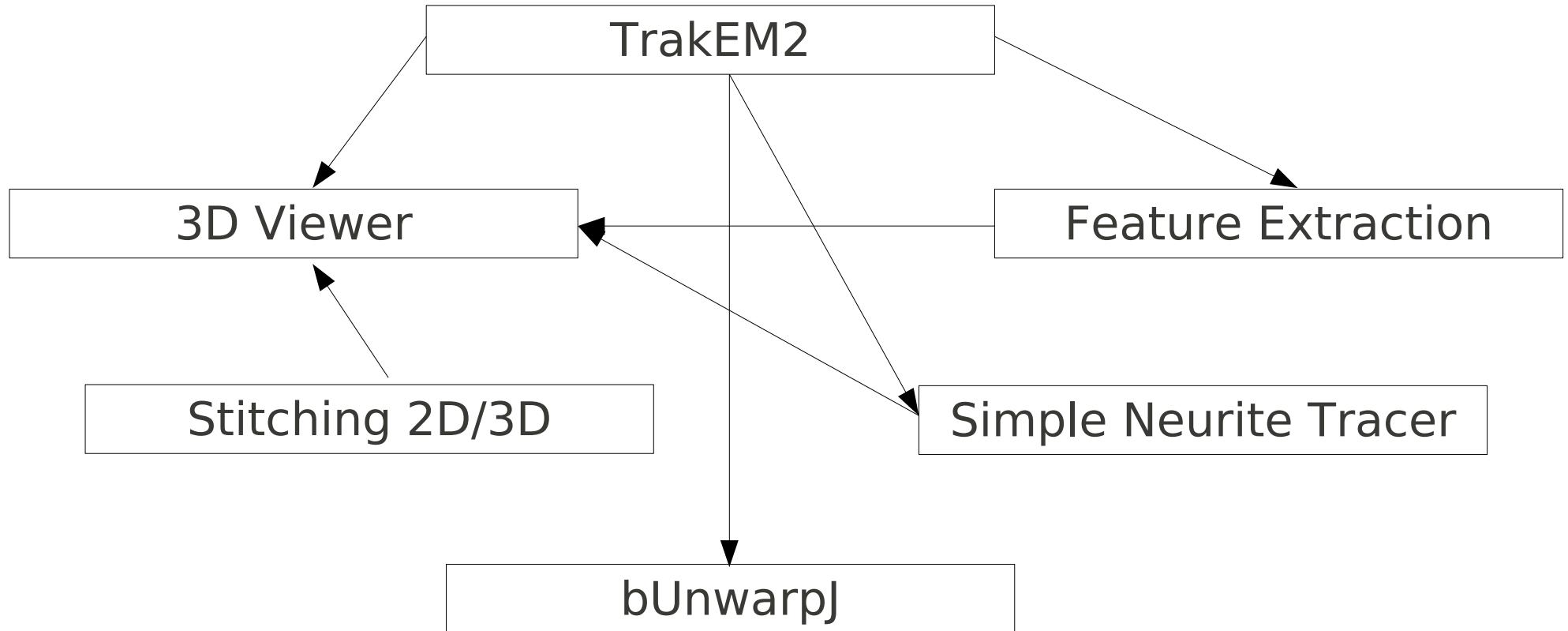
-  Jython
-  JRuby
-  Clojure
- Javascript 
- BeanShell 

## Why not use ImageJ's macro language?

- More Power
- Faster
- Quicker to test ideas
- Full access to Java classes
- Many users know Python, Ruby, Javascript

Example: Fiji Logo 3D – you cannot do that with macro language

# Fiji fosters collaboration and reuse



See also <http://fiji.sc/#Projects>

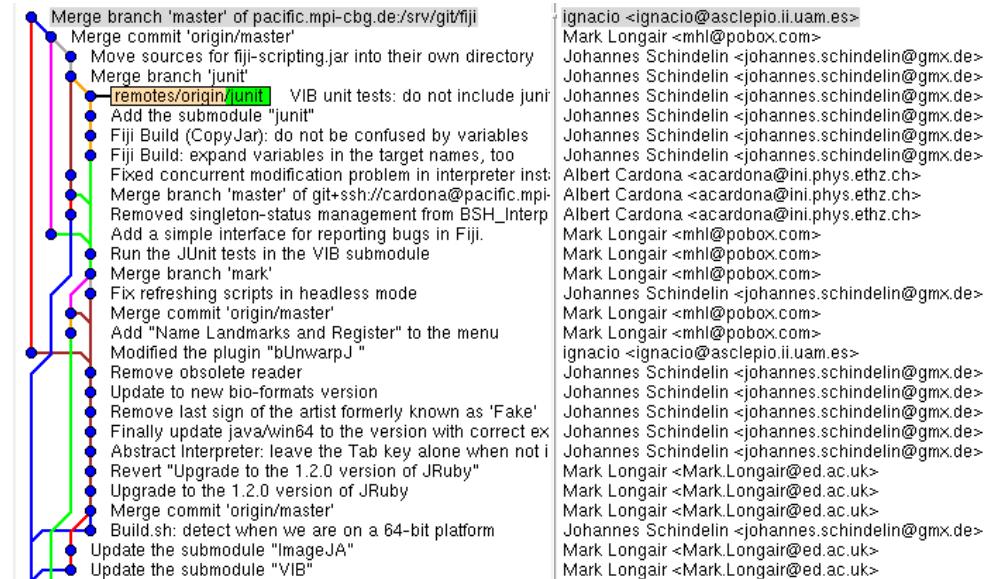
# Working together:

## Version Control

“before”



“after”



See also <http://fiji.sc/Git>

# Fiji Usage

## Fiji usage map



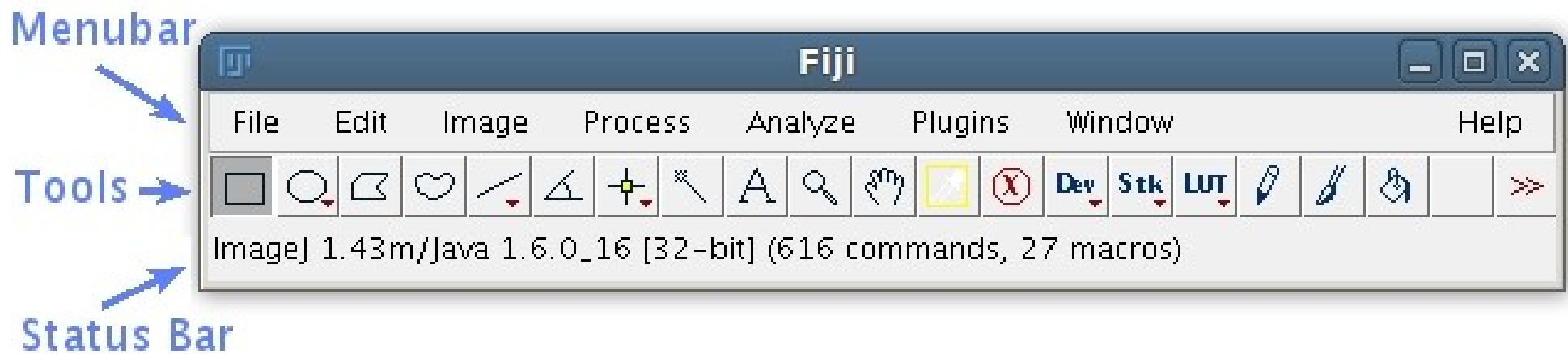
This page was produced using GeoLite data created by MaxMind, available from [MaxMind](#), downloaded from [ipinfodb.com](#)

# Purpose: Quantitative Image Processing

- We want answers, not pretty pictures
- Processing images means *stripping away information*, never *adding information*. We need to be careful to strip away information we do not want.
- At the end of the day, we want to convincing evidence. That means statistics.
- If we know how we want to analyze the images, we have a better idea how to prepare the samples and how to obtain the images.

# Getting started:

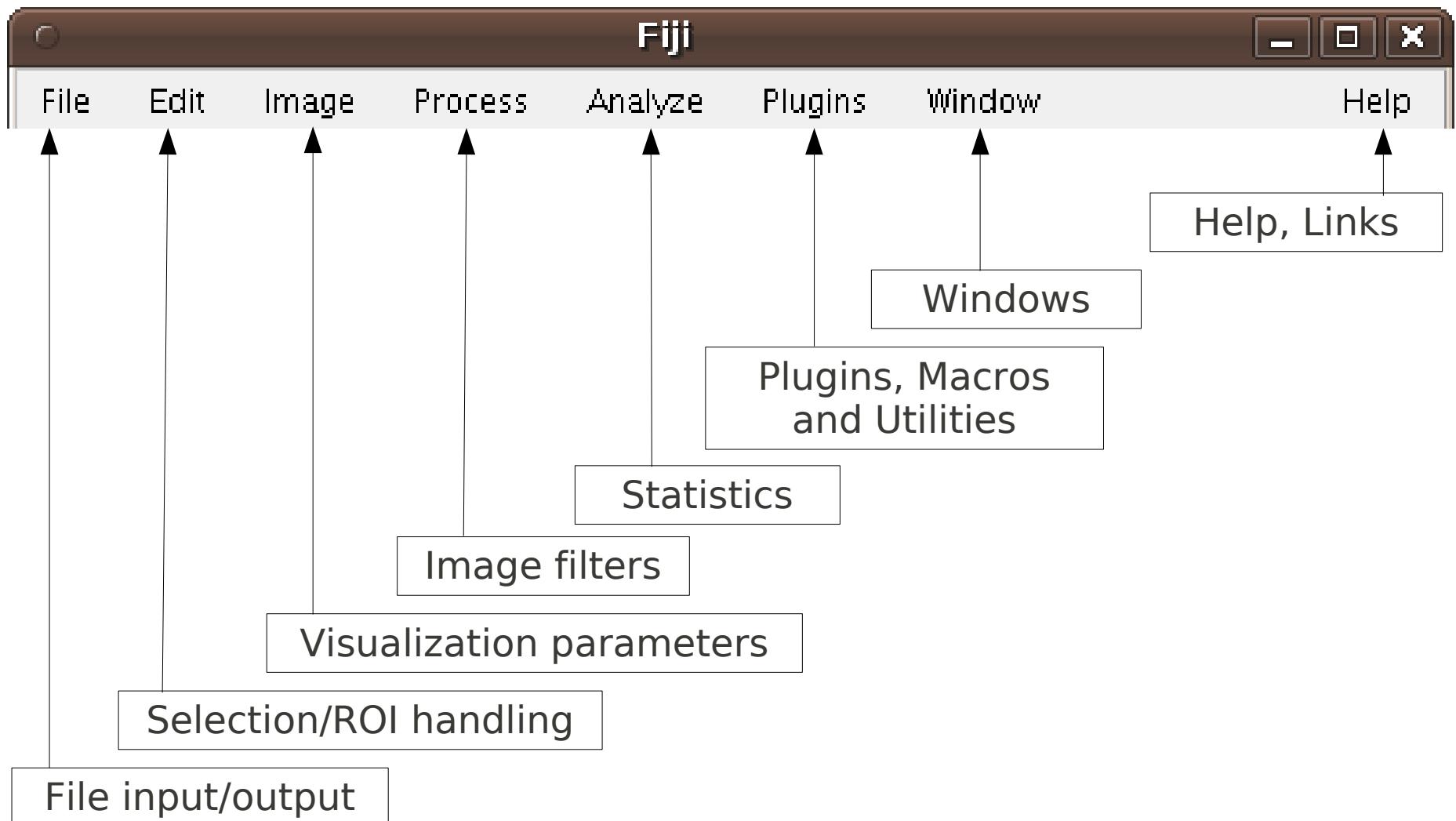
## The main window



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started:

## Overview of the menus

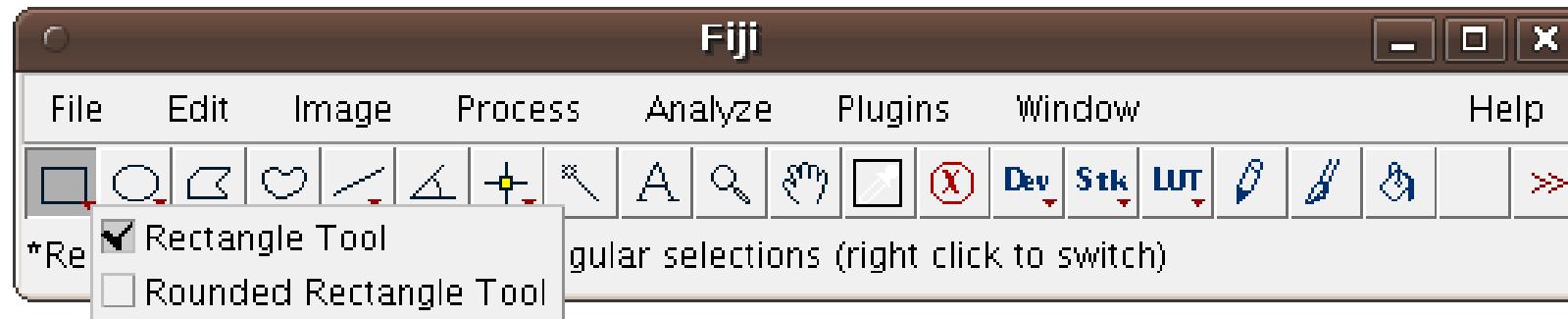


**See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)**

# Getting started:

## Tools, alternate tools & options

- Click on tool icons to switch to another tool
- Right-click on the little red arrows to select alternate tools:



- Double-click on tool icons to open option dialogs:

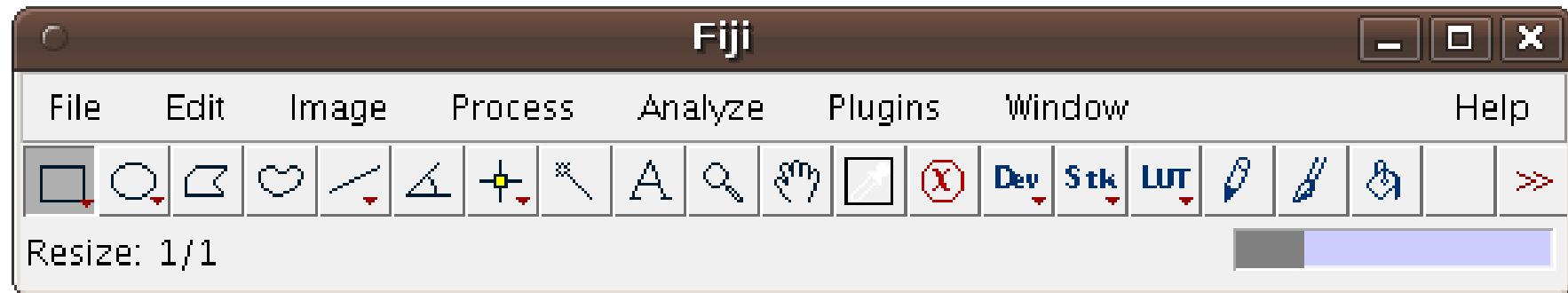


**See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)**

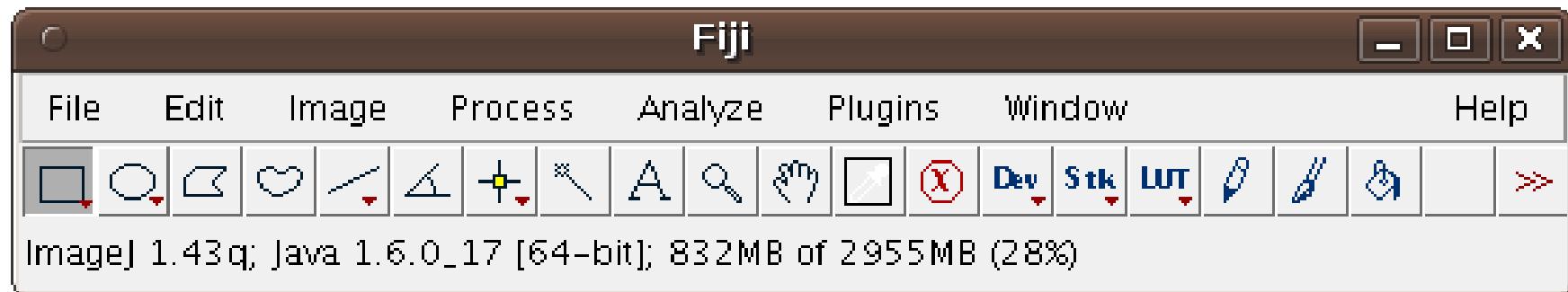
# Getting started:

## The status bar (messages & progress)

- The status bar shows information about long-running processes:



- Clicking in the status bar shows information about memory consumption:



**See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)**

# Getting started:

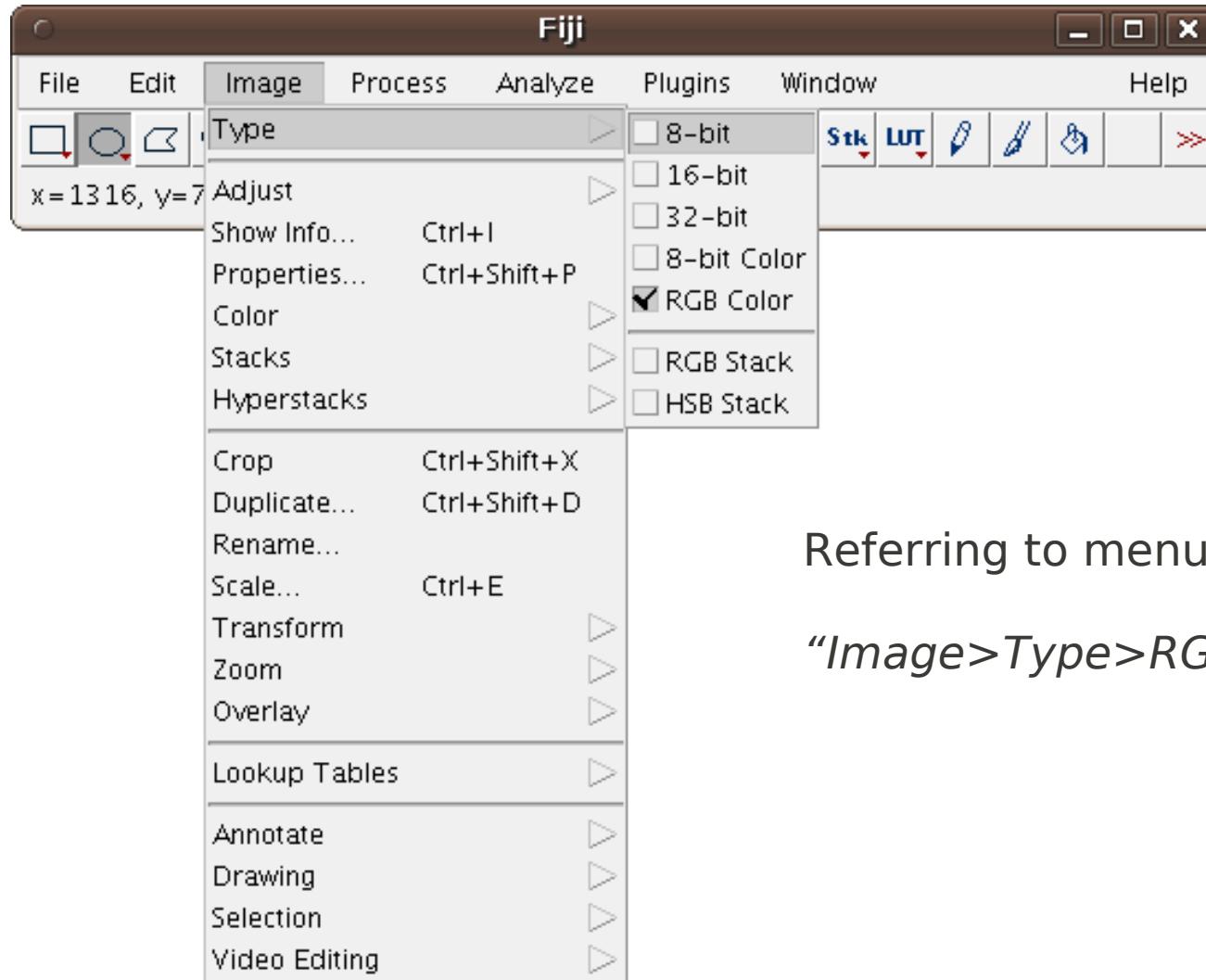
## Image windows



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started:

## Image types

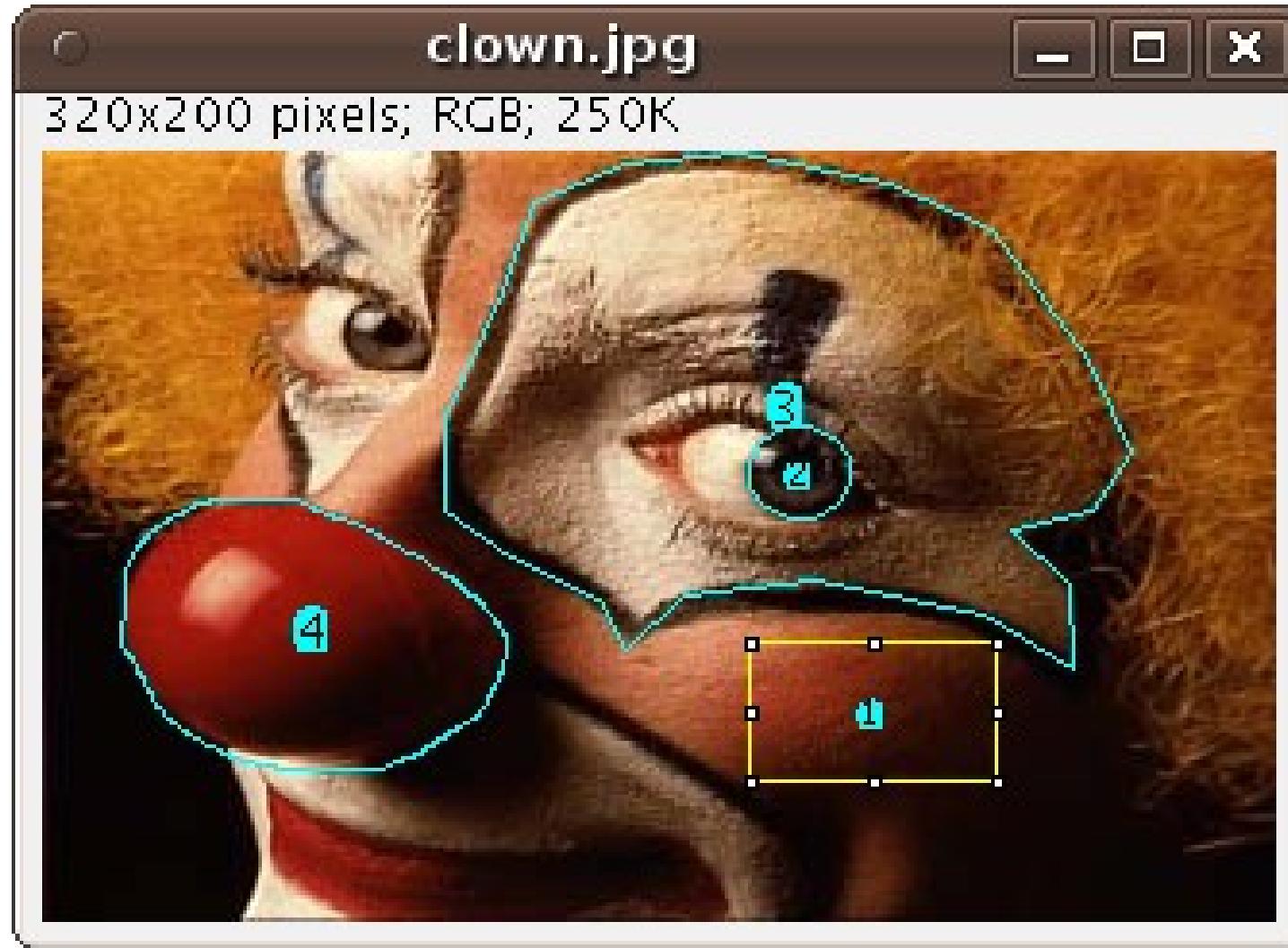


Referring to menu entries:  
“*Image>Type>RGB Color*”

See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started:

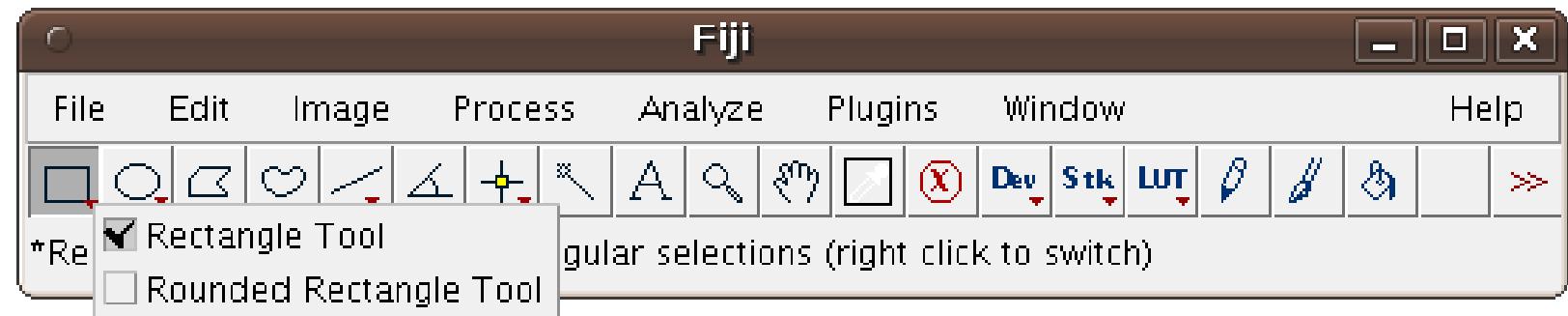
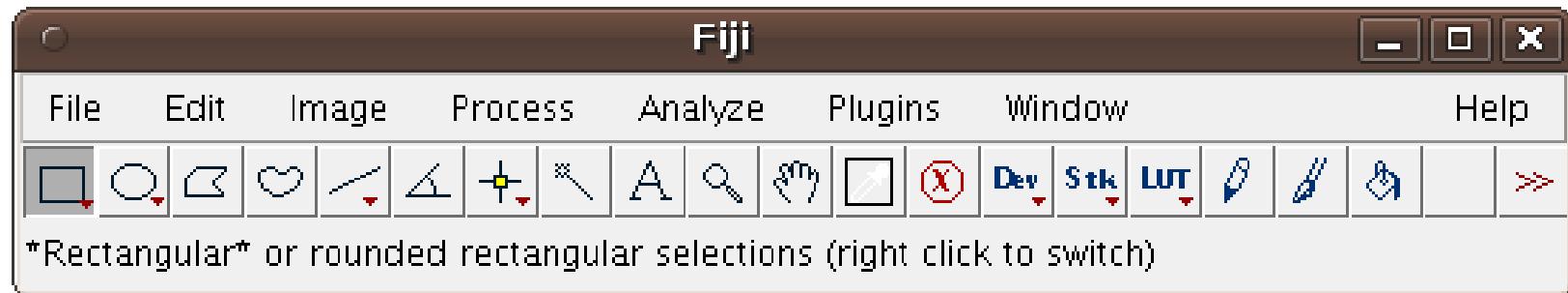
ROIs (*Region of Interest*, or *Selection*)



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started:

## Selecting an area



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started:

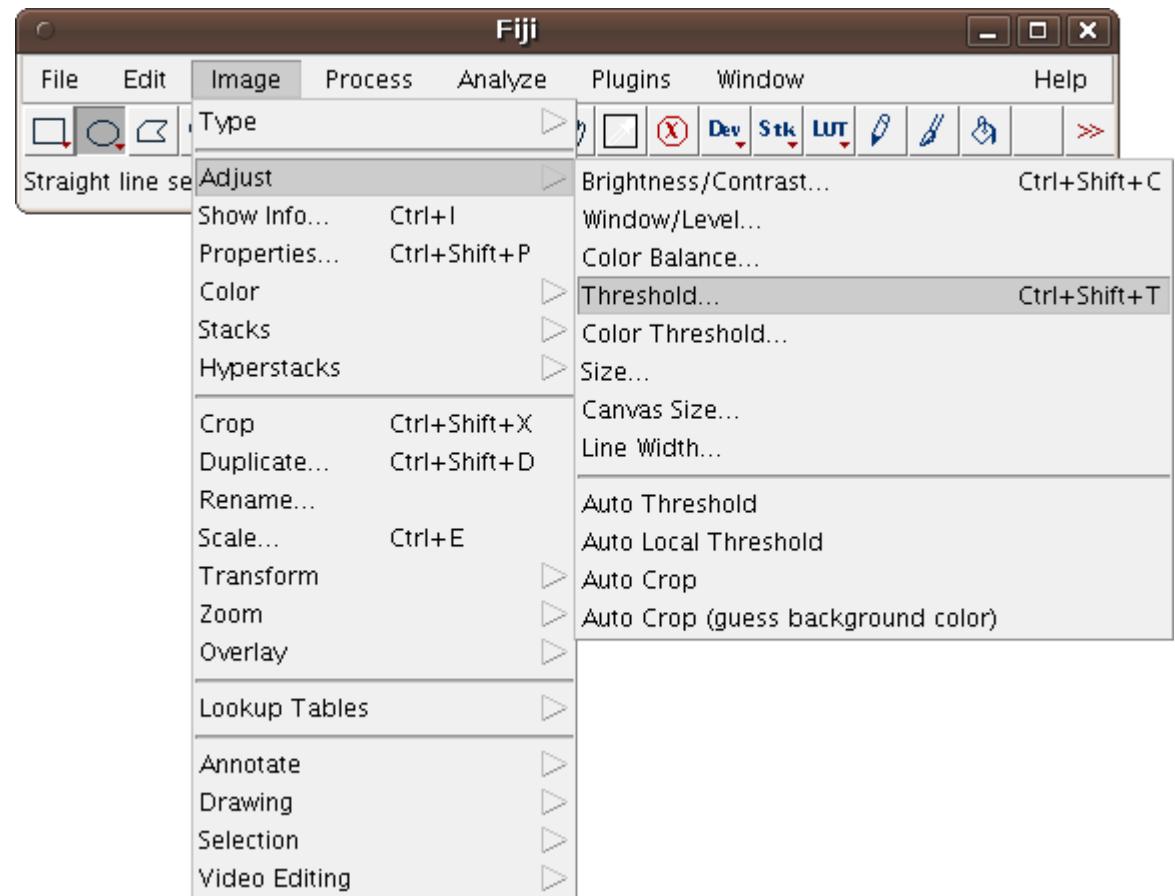
## Selecting an area by threshold



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started:

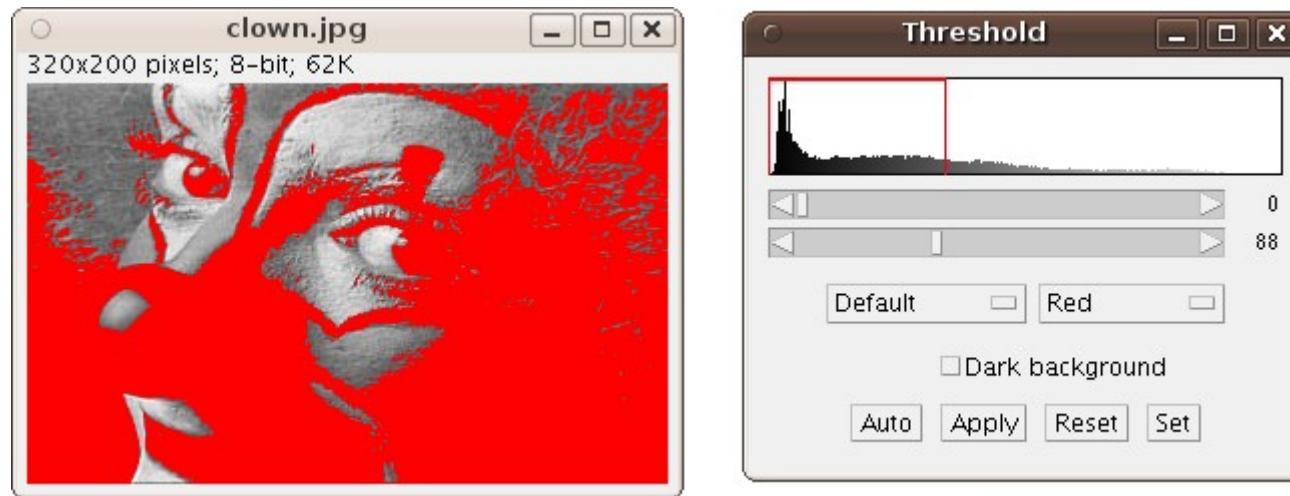
## Selecting an area by threshold



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started:

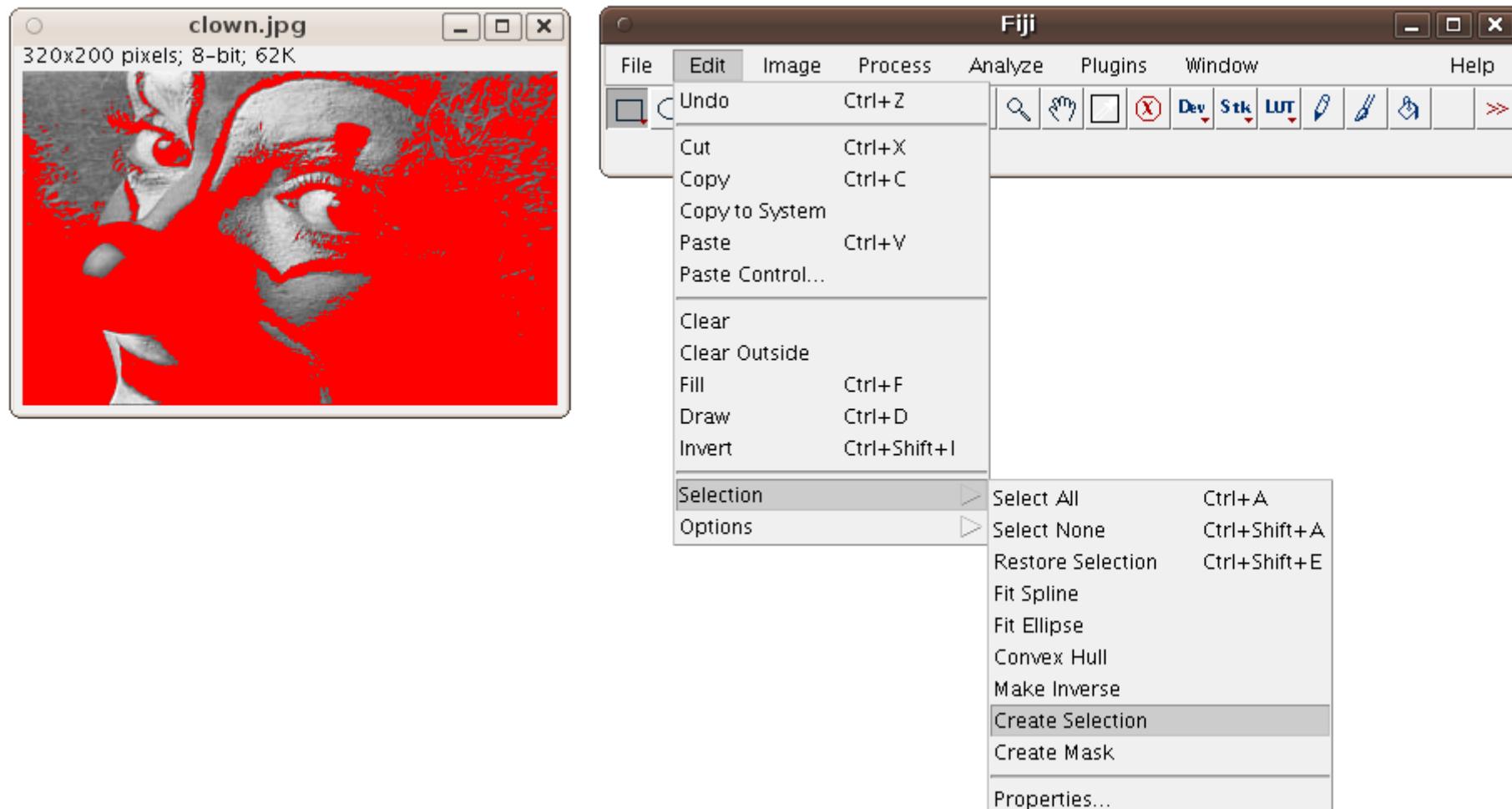
## Selecting an area by threshold



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started:

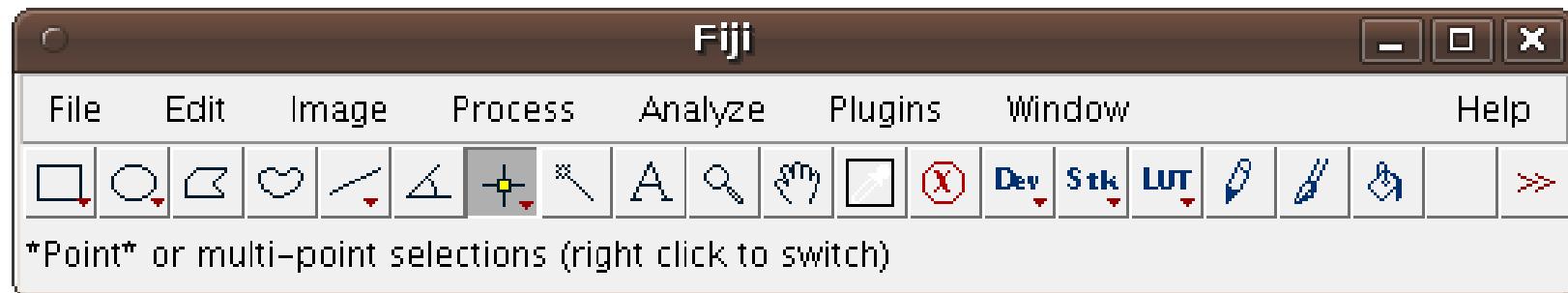
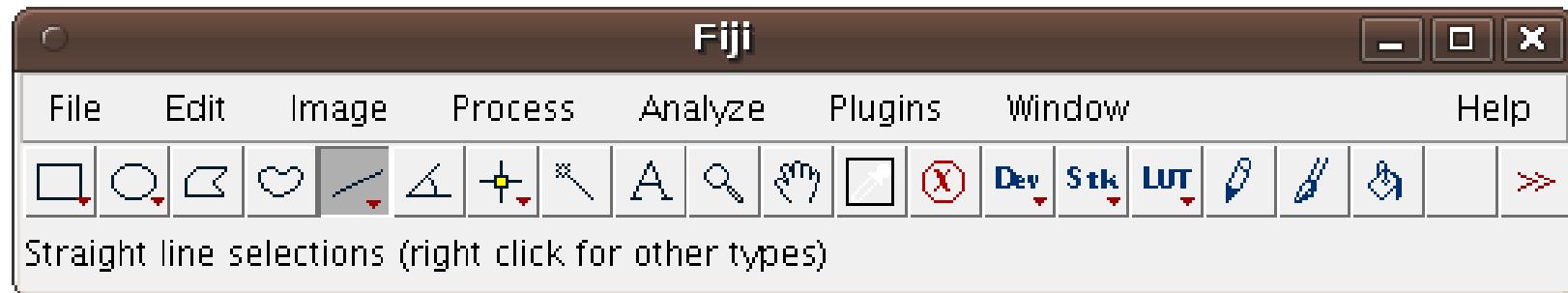
## Selecting an area by threshold



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

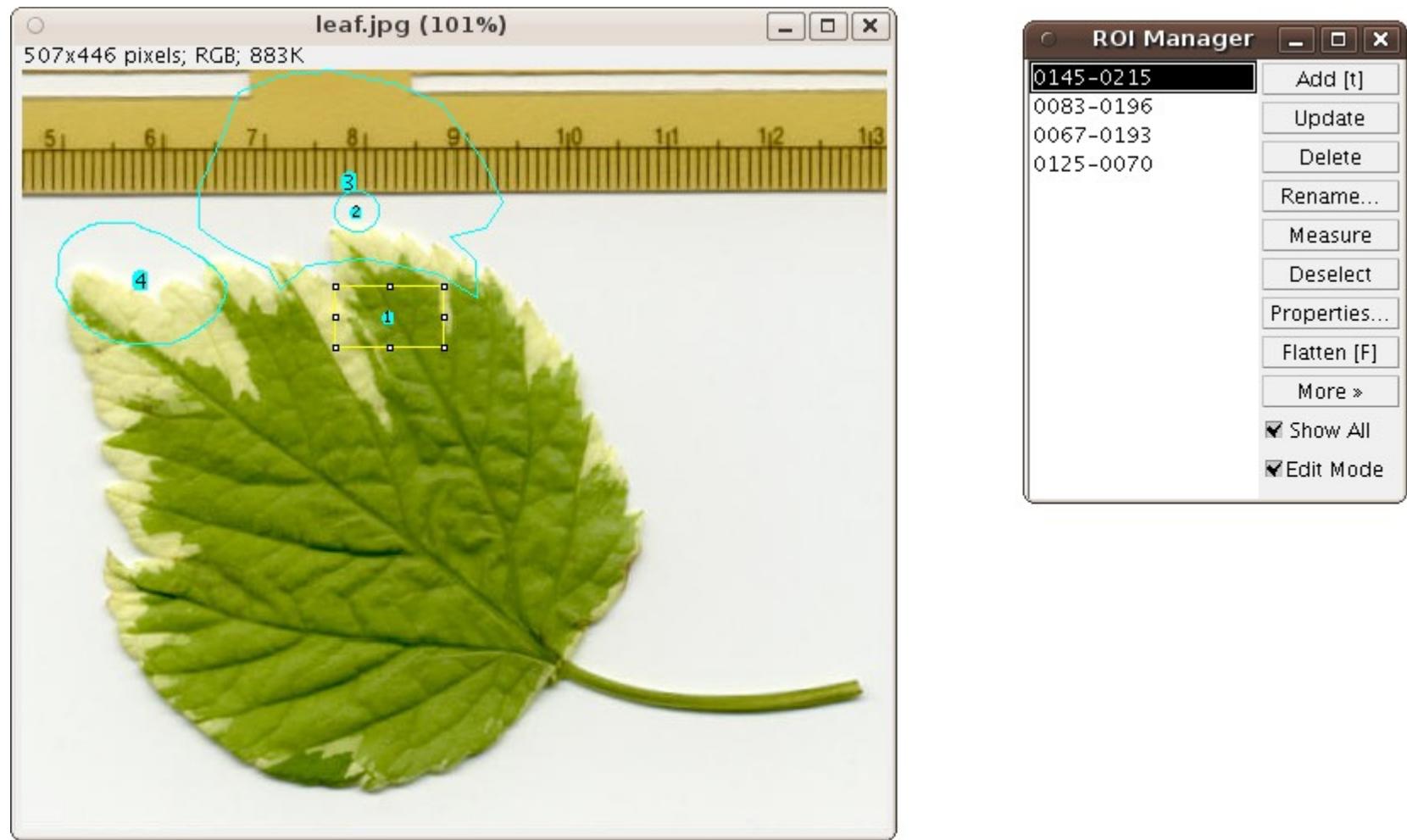
# Getting started:

## Selecting lines, points



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started: ROI Manager



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Getting started:

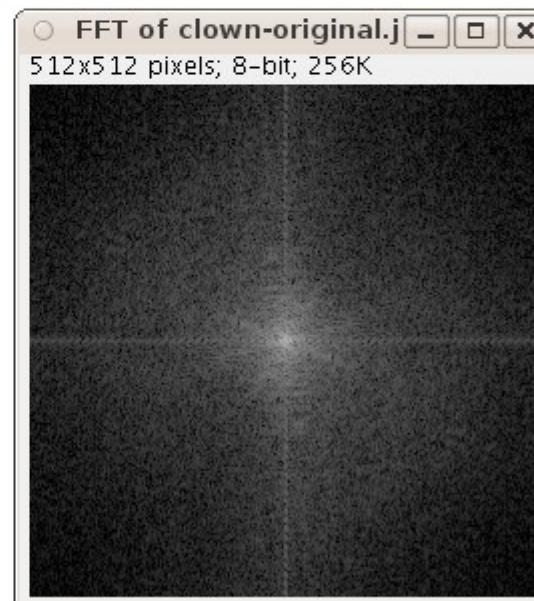
## Common filters

- Median filter: *Process>Filters>Median...*
- Gaussian Blur: *Process>Filters>Gaussian Blur...*
- Fourier Transform: *Process>FFT>FFT*
- Morphological Operators: *Process>Binary>Erode*
- Arithmetic Operators: *Process>Math>Add...*
- Arithmetics on two images: *Process>Image Calculator...*
- etc

**See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)**

# Getting started:

## Common filters: examples



# Getting started:

## Command Launcher



See also [http://fiji.sc/Getting\\_started](http://fiji.sc/Getting_started)

# Macros:

## Purpose

- Automation
- Reusable scripts
- Adding tools to the toolbar
- Adding keyboard shortcuts

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macros:

## Basic concept: Variables

- A variable is a placeholder for a changing entity
- Each variable has a name
- Each variable has a value
- Values can be numeric
- Values can be text, so-called *strings*
- Variables can be assigned new values

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macro variables:

## Setting variables

```
value = 2;
```

```
intensity = 255;
```

```
title = "Hello, World!";
```

```
text = "title";
```

```
text = title;
```

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macro variables:

## Using variables

```
x = y;
```

```
text = "The title reads " + title;
```

```
x = y * y - 2 * y + 3;
```

```
intensity = intensity * 2;
```

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macro variables:

String concatenation: what is it?  
And why do I need it?

```
number = 1;
```

```
text = "The number is " + number;
```

```
run("My plugin", "does_not_work=number");
```

```
run("My plugin", "this_works=" + number);
```

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macros:

## Comments

```
// This is a comment trying to help you to remember  
// what you meant to do here:  
a = exp(x * sin(y)) + atan(x * y - a);
```

// Code can be disabled by *commenting it out*  
// x = y \* 2;

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macros:

## Built-in macro functions

```
print("The title reads " + title);  
  
rename(title); // change the image title  
  
// This creates a new 640x480 color image  
newImage("My new image", "RGB", 640, 480, 1);
```

The documentation of available built-in macro functions can be accessed via *Help>Macro Functions...*

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macros:

## Example: Hello, World!

```
// This creates a new 640x480 color image
newImage("World image", "RGB black", 640, 480, 1);

// make a selection in the image
makeText("Hello, World!", 50, 300);

// draw it
run("Draw");

// write text into the Log window
print("Hello, World!");
```

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macros:

Basic concept: User-defined functions

```
// Define a function for a recurring task
function newBlackImage(title, width, height) {
    // The function body is usually indented for clarity
    newImage(title, "RGB black", width, height, 1);
}

newBlackImage("Tiny", 10, 10);
newBlackImage("Huge", 8000, 8000);
```

See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)

# Macros:

Basic concept: Conditional code blocks

```
// If the image is not binary, abort
if (!is("binary")) {
    exit("You need a binary image for this macro!");
}
```

```
// If the code block consists of only one statement, the
// curly braces can be dropped:
if (!is("binary"))
    exit("This image is not binary!");
```

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macros:

## Basic concept: Loops

```
// Write "Hello, World!" ten times
for (i = 0; i < 10; i++)
    print("Hello, World!");
```

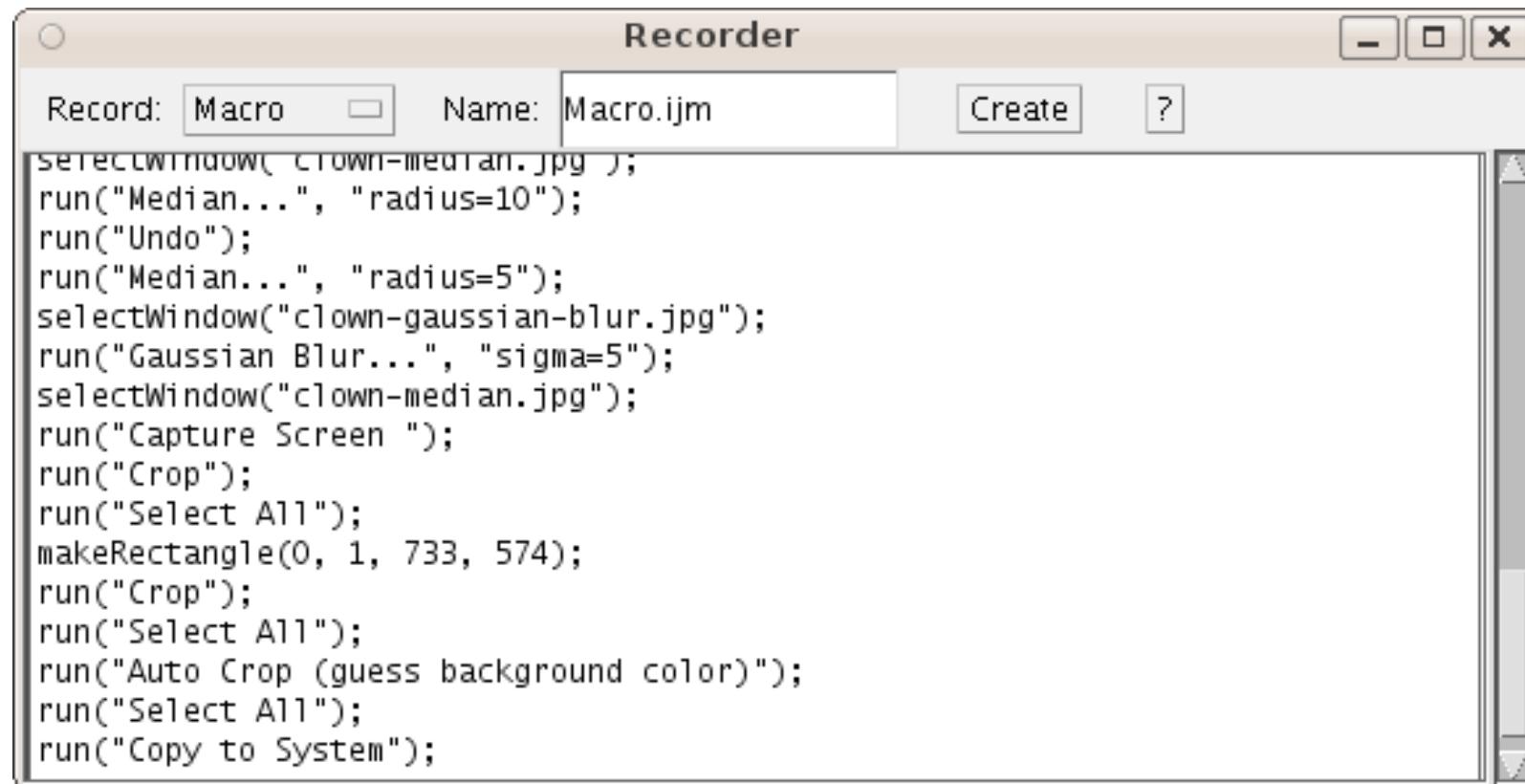
```
// As before, if the code block (or "loop body") consists
// of more than one statement, curly braces need to
// be added
for (i = 0; i < 10; i++) {
    showProgress(i, 10); // show the progress bar
    run("Gaussian Blur...", "radius=" + i);
}
```

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macros:

## The Macro Recorder

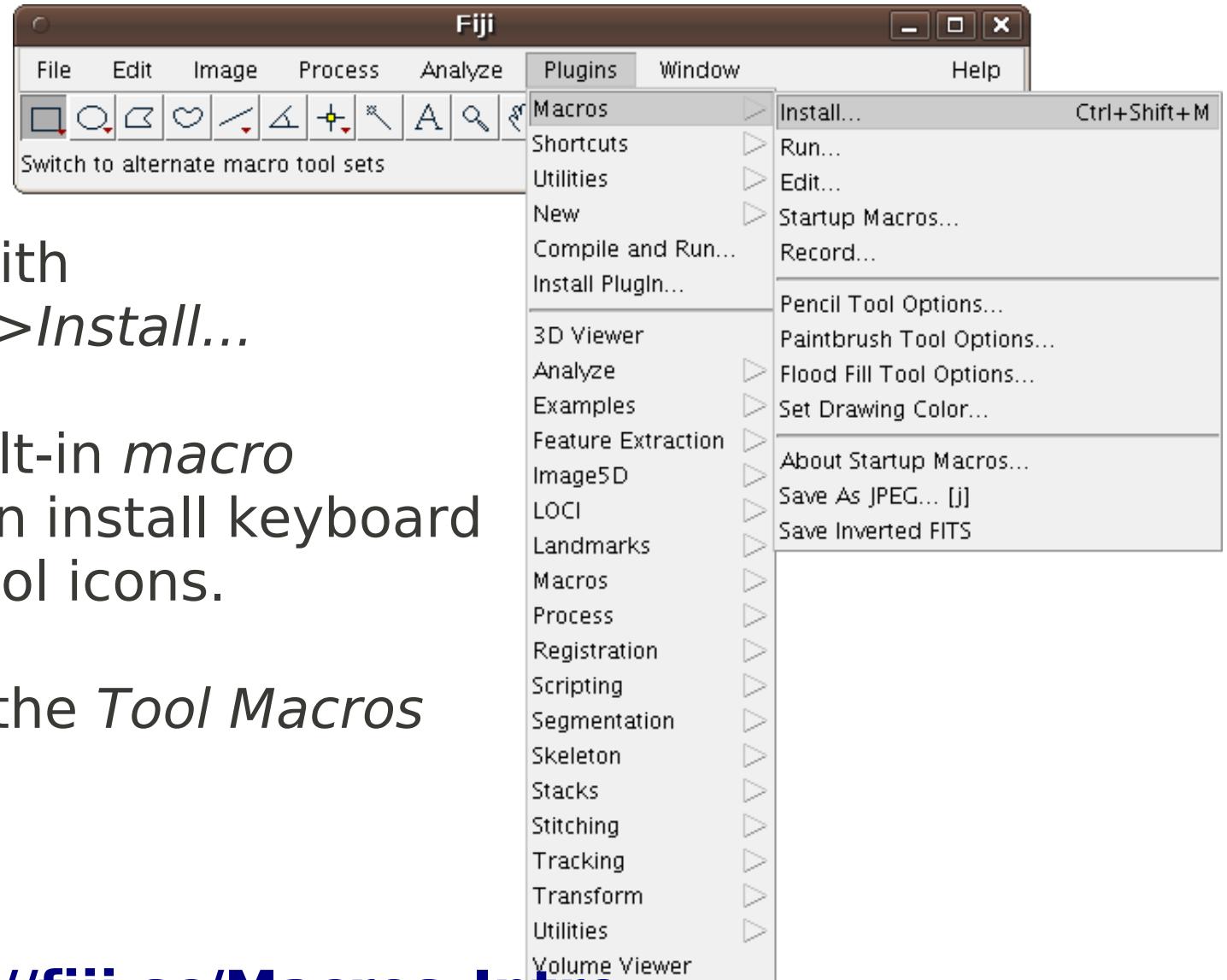
Start it with *Plugins>Macros>Record...*



See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)

# Macros:

## Installing Macros



Install macros with  
*Plugins>Macros>Install...*

By using the built-in *macro* function, you can install keyboard shortcuts and tool icons.

For details, see the *Tool Macros* section in

**Help>Macros...**

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macros:

Real-world example: keyboard shortcut

```
// install a keyboard shortcut: when pressing Ctrl+J,  
// the user is asked for JPEG quality and for a location  
// to save the current image as .jpg file  
  
macro "Save As JPEG... [j]" {  
    quality = call("ij.plugin.JpegWriter.getQuality");  
    quality = getNumber("JPEG quality (0-100):", quality);  
    run("Input/Output...", "jpeg="+quality);  
    saveAs("Jpeg");  
}
```

**See also [http://fiji.sc/Macros\\_Intro](http://fiji.sc/Macros_Intro)**

# Macros:

Real-world example: action tool

```
// A click on the empty rectangle will have the same  
// effect as File>Save As>Jpeg...
```

```
macro "Save As JPEG Action Tool - C000R11ee" {  
    saveAs("Jpeg");  
}
```

```
// A right-click on the tool icon lets the user change  
// the JPEG Quality
```

```
macro "Save As JPEG Action Tool Options" {  
    quality = call("ij.plugin.JpegWriter.getQuality");  
    quality = getNumber("JPEG quality (0-100):", quality);  
    run("Input/Output...", "jpeg="+quality);  
}
```

# Macros:

## Examples on the Fiji Wiki

**[http://fiji.sc/Macros\\_Intro#Example\\_macros](http://fiji.sc/Macros_Intro#Example_macros)**

Note: double-clicking the code snippets automatically selects them for easy copying into the Clipboard.

# Macros:

## Further examples & documentation

<http://rsb.info.nih.gov/ij/developer/index.html>

[home](#) | [news](#) | [docs](#) | [download](#) | [plugins](#) | [macros/dev](#) | [list](#) | [links](#)

### Developer Resources

- [Macro Language](#) (download PDF)
- [Built-in Macro Functions](#) (2010/02/23)
- [Macros on Website](#)  
  - [Examples](#)
  - [Macro Tools](#)
  - [Toolsets](#)
- [Scripting](#)
  - [Examples](#)
- [API Documentation](#) (v1.43i)
- [Browsable Source](#) (v1.43i)
  - [Daily Build Source](#)
  - [Source Code Archive](#)
- [Git Version Control Repository](#) New
- [Writing ImageJ Plugins - A Tutorial](#)
- [Programmer's Reference \(Burger and Burge\)](#) New
- [Programming Tutorials \(Albert Cardona\)](#) New
- [Imaging Book \(Burger and Burge\)](#)
- [UML Class Diagram \(320KB Jpeg\)](#)
- [Configuration File \(IJ\\_Props.txt\)](#)

# Plugins:

When macros are not enough...

Macros are quick and easy to record or write, but

- Slow
- Waste memory for more complicated tasks
- Cannot use the full functionality of ImageJ, only what the built-in functions offer
- Run always in foreground, blocking the computer

# Plugins:

## What does a plugin consist of?

Plugins are *.jar* files (really *.zip* files with a certain structure), containing:

- One or more Java class(es) implementing the functionality, and
- a *plugins.config* file defining which menu entries offer the functionality.
- Optionally additional resources required by the plugin, such as images or icons.

If the plugin is implemented in one Java class, and it offers only one menu entry in the *Plugins* menu, it can be offered as bare *.java* or *.class* file, too.

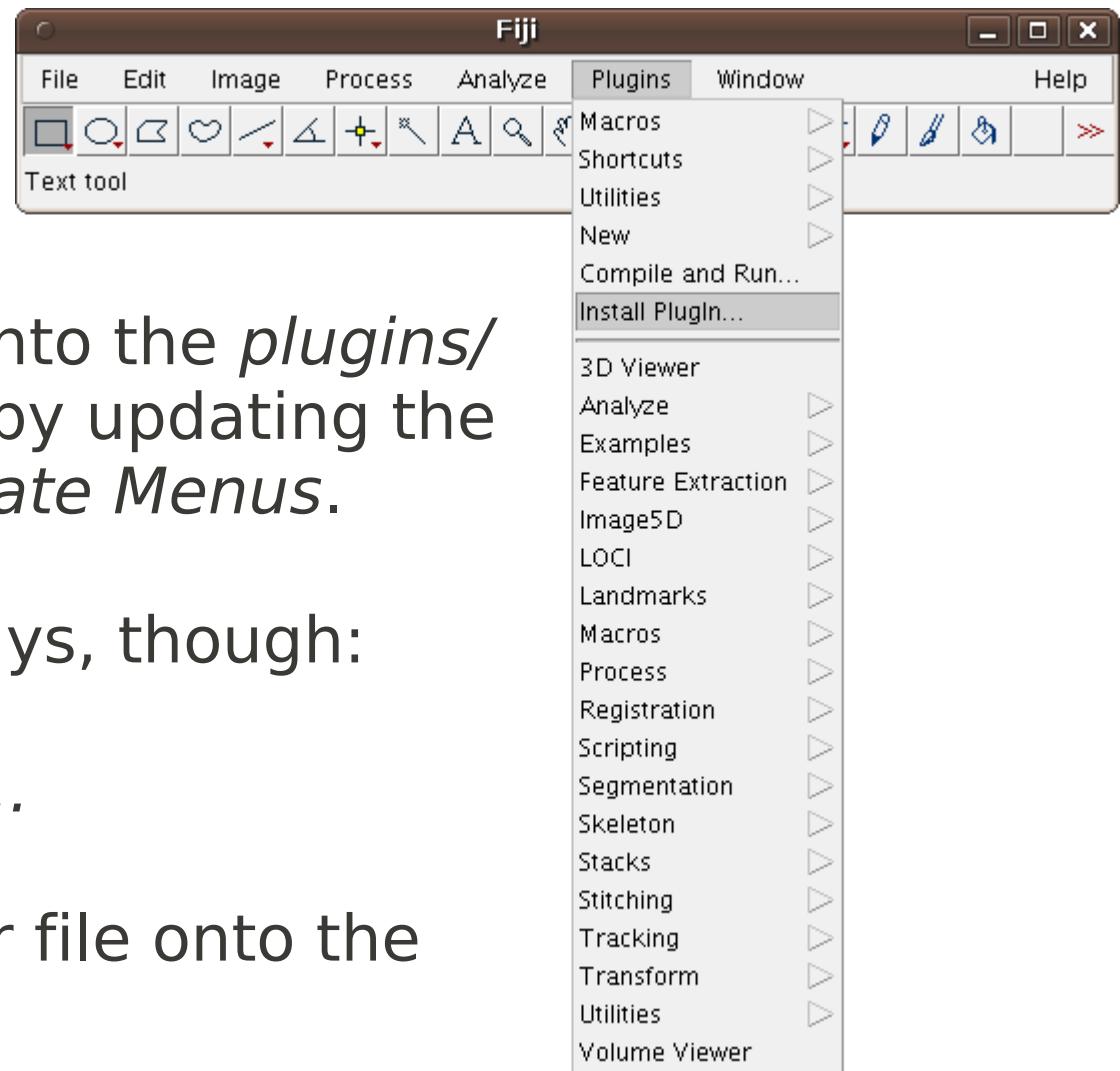
# Plugins:

## Installing plugins

Plugins can be installed manually by copying the *.jar* file into the *plugins/* subdirectory of Fiji and by updating the menus using *Help>Update Menus*.

There are two easier ways, though:

- *Plugins>Install Plugin...*
- Or drag 'n drop the *.jar* file onto the Fiji main window.



# Plugins:

## Where do I find new plugins?

<http://rsb.info.nih.gov/ij/plugins/index.html>

[home](#) | [news](#) | [docs](#) | [download](#) | [plugins](#) | [macros/dev](#) | [list](#) | [links](#)

## Plugins

### Contents

- [Acquisition](#)
- [Analysis](#)
- [Collections](#)
- [Color](#)
- [Filters](#)
- [Segmentation](#)
- [Graphics](#)
- [Input/Output](#)
- [Programming Examples](#)
- [Stacks](#)
- [Utilities](#)
- [Links to External Sites](#)

### Acquisition [top]

- [Hamamatsu Orca 12-bit Camera](#)
- [Shading Corrector](#)
- [QuickTime Capture](#) (Capture images using QuickTime) Updated
- [TWAIN](#)
- [JTwain](#)
- [Twain Scan](#) New
- [SensiCam Long Exposure Camera](#)
- [Video Capture Macro Tool](#) (Video for Windows via VirtualDub) New

# Plugins:

## Where do I find new plugins?

<http://imagejdocu.tudor.lu/doku.php?id=plugin:start>

The screenshot shows a wiki page titled "Plugins". The page header includes links for "Show pagesource", "Old revisions", and "Export PDF". The breadcrumb navigation indicates the user is at "Welcome to the ImageJ Information and Documentation Portal > Plugins". The main content area is titled "Plugins" and contains a brief description: "Descriptions and downloads for ImageJ plugins stored here. There are many more plugins in the ImageJ website." Below this, there are two sections: "Aligning" and "Analysis", each listing several plugin names. A "Table of Contents" sidebar on the right lists categories such as Plugins, Aligning, Analysis, Color, Filters, Input / Output, Morphology, Derived images/ Parametric maps, Segmentation, Stacks, 3D Modelling, and Utilities.

**navigation**

- FAQ
- GUI Commands
- Keyboard Shortcuts
- Plugins
- How Tos
- Tutorials
- Known Problems
- Links
- Macros
- Diverse
- Wishlist
- Video Tutorials
- Create New Content
- Events

**search**

**toolbox**

**Show pagesource** **Old revisions** **Export PDF**

You are here: Welcome to the ImageJ Information and Documentation Portal > Plugins

## Plugins

Descriptions and downloads for ImageJ plugins stored here. There are many more plugins in the ImageJ website.

### Aligning

- Align\_4
- Align\_RGB\_planes
- Align\_Slice
- bUnwarpJ: consistent and elastic registration
- Image Stabilizer

### Analysis

- Fourier Shape Analysis
- Analyze Skeleton (2D/3D)
- JACoP (Just Another Co-localization Plugin)
- 3D Object Counter
- ShapeLogic categorizer: Machine learning or rule based
- Frapp\_Norm (FRAP measurement and normalization)
- ClonalTools (analysis of mosaic images)
- FRAP Analysis (analysis of FRAP experiments)

**Table of Contents**

- Plugins
  - Aligning
  - Analysis
  - Color
  - Filters
  - Input / Output
  - Morphology
  - Derived images/ Parametric maps
  - Segmentation
  - Stacks
  - 3D Modelling
  - Utilities

# Fiji community:

Mailing lists:

Fiji User list <[fiji-user@googlegroups.com](mailto:fiji-user@googlegroups.com)>

ImageJ mailing list <[imagej@list.nih.gov](mailto:imagej@list.nih.gov)>

Fiji developer list <[fiji-devel@googlegroups.com](mailto:fiji-devel@googlegroups.com)>

IRC (internet chat):

#fiji-devel on [irc.freenode.net](irc://irc.freenode.net)

See also <http://fiji.sc/IRC>

Documentation, information, tutorials:

<http://fiji.sc/>

# Thanks!

Max Planck Institute CBG, Dresden

<http://www.mpi-cbg.de/>

Janelia Farm, Ashburn VA <http://janelia.hhmi.org>

INI, Zürich <http://www.ini.uzh.ch/>

**Wayne Rasband** (ImageJ)

The Fiji Team:

<http://fiji.sc/Contributors>

