The MRI Image analysis service (MRI-CIA)

Volker Bäcker

06.04.2023

Montpellier Ressources Imagerie
Center for Image Analysis

The MRI Center for Image Analysis (MRI-CIA)

MRI-CIA has been created to answer the bioimage analysis needs of the users of MRI. We offer comprehensive support for bioimage analysis, from the start of a research project to publication. The support we provide is tailored to each individual case and can include one-on-one software training or the creation of custom analysis tools. We handle various aspects of image analysis, such as for example (list non-comprehensive):

- image data handling
- image restoration and registration
- quantitative image analysis and visualization
- instance segmentation and tracking
- morphological and intensity quantification
- colocalization analysis and spatial statistics

MRI-CIA closely collaborates with the other engineers of the MRI core facility in order to ensure optimal image acquisition modalities for downstream quantitative analysis.

Contact: mri-cia@mri.cnrs.fr

Scope of Services

The services provided by MRI-CIA include training and consulting in bio-image analysis and finding and implementing solutions for bio-image analysis problems. In the second case the preferred way is to develop tools and train the biologists to use them to perform their own analyses. In some cases, especially when new methods and technologies are involved, it can be preferable that MRI-CIA executes the analysis for the user. In that case the costs for the computation time will be added to the fees.

In science, image analysis problems are often new and unique to a specific biological experiment. It can therefore happen, that a project can not be finished successfully with the available means and that this fact only becomes evident after work has been invested into the project. Regardless of the success of a project, MRI-CIA will provide a detailed report of all actions undertaken and their results.

Users should take the costs for image analysis into account when applying for grants (ANR, Inca, MITI, …). MRI-CIA provides a free quote on request. MRI-CIA can also be a partner in a collaborative project, if the project is interdisciplinary or the image analysis part is important, original or innovative.

Access Conditions and Fees

The service is open to the public and private sector without any institutional or geographic conditions. MRI-CIA accepts image analysis projects within the field of life-science without any further thematic restrictions. The images to be analyzed, might be acquired on the MRI imaging core facility, but this is not a precondition for accessing the image analysis service.

There will be an open desk every fortnight. Users can access the open desk freely without prior registration. The engineers of the image analysis service and engineers of the different MRI sites are present during the open desk sessions. The users can ask for help or expose their image analysis projects. All activities during the open desk sessions are free of charge. According to the difficulty and extend of a question or project, it can either be solved directly during the open desk session or a decision is made if it will be handled by the MRI image analysis service or another MRI engineer. The service of the other MRI engineers is free of charge, but restricted in scope. All activities of the MRI image analysis service beyond the open desk sessions are charged.

The tariff is 21.02€/h for academic partners and 552.27€/h for other users.

The tariff for the usage of the analysis machines of the imaging facility is 07.29€/h for academic partners and 35.77€/h for other users.

All project related activities are charged. The service provides a detailed report about its activities related to a project, whether they contributed to a solution or not.

The Project Process

The user and the group leader will fill in and sign the MRI-CIA project form, available at: https://dev.mri.cnrs.fr/attachments/download/2943/MRI-CIA-Project-Form.pdf.

After the initial contact at the open-desk, meetings in person or via visio-conference between the user and MRI-CIA can be agreed upon whenever necessary.

The project parties can fix a schedule, that lists at what dates data is expected to be available and when milestones and final results should be delivered.

The user can ask for a detailed, written project report, which contains all actions undertaken by MRI-CIA in the context of the project, at any stage of the project.

A project is finished when the user accepts the results (usually software tools) or when he decides to end the project. Modifications and additions to a project are possible, but might result in a new planning, also taking into consideration other ongoing projects. A user can end a project at any time, in which case he will receive the project report and will be charged the hours of work MRI-CIA has already spent on the project.

On demand of the user, MRI-CIA will write the part of the material and method section in a publication, that describes the method and tools provided by MRI-CIA.

If an engineer of MRI-CIA is coauthor of a publication, the user gives the coauthor the occasion to read and comment on the text, before it is submitted for publication.

An administrative contact identified for the user's group will receive an invoice for the hours MRI-CIA has spent on the project at regular intervals. He/she then has 30 days to send his/her purchase order to mri-gestion@mri.cnrs.fr.

Examples of projects and services offered

Projects can be small, medium sized or long running. Small projects have a duration from hours to a small number of days. Medium sized projects are finished in a number of weeks and long running projects can take multiple months. Here are some examples of tools we developed in the past.

Examples of small projects

Small projects usually include advice and individual training, the implementation or adaptation of standard image analysis workflows, the automation of existing workflows, the adaptation of existing tools or the conversion of results into the form needed by an existing tool.

Example S1 – Convert images to movies and add timestamps

Development of a script to batch-convert images from an acquisition, with multiple positions, into stacks and avi-movies and add a timestamp in the format day:hour:min to each frame.

Duration: 3 hours   Fee: 63.06€

Example S2 – Drift Correction based on witness in different channel

The objects of interest are so variable and are moving so much that they can't be used for drift correction. Development of a script to correct the constant drift, by using a reference object in a different channel at two timepoints

Duration: 4h   Fee: 84.08€

Example S3 – Interactive workflow tool to create kymograms on axons

Development of an interactive tool to create and exploit kymograms on axons in 2D time-series images.

Duration: 12h   Fee: 252,24€

Example S4 – Detection and counting of dense nuclei in 2D images with machine learning

Creation of a 3-class random-forest classifier that separates nuclei from the background and from each other. Automated application of the classifier, post processing, counting of nuclei and report generation.

Duration: 16h   Fee: 336,32€

Examples of medium sized projects

Medium sized projects often include the creation and usage of multiple tools in a workflow. A number of known methods is often available and the appropriate method has to be determined. Medium sized objects usually include a training of the users on the developed tools.

Example M1 – Segmentation, tracking and intensity over time of nuclei

Test of standard (for example seeded watershed) and deep learning algorithms (cellpose, stardist) on the 3D data and on 2D projections. Creation of a 3-class random-forest classifier that separates

nuclei from the background and from each other on 2D projections. Post processing and tracking with trackmate. Measurement and reporting of the normalized intensity over time in a different channel. Creation of user documentation and technical documentation.

Duration: 106h --13 days development + 3 meetings of 40 min. each   Fee: 2228,12€

Example M2 – Cochlea analysis tool

Export the images from the opera database to tif-files. Find empty wells and exclude them from the analysis.

Calculate the stitching, correct the background illumination and create the mosaics. Overlay the fluorescent channels and the transmission channel. Register the time-series images.

Measure the number of dead cells in the cochlea in the beginning. Measure the length of the cochlea, and the surface of the positive cells in the red and green channel over time. Measure the colocalization between the red and the green channel.

Duration: 261h – 32.5 days   Fee: 5465.20€

Example of a long running projects

Example L1 – Analysis of the swelling of protoplasts

Protoplasts are captured in traps on a microfluidics device. The traps on the device are arranged in a grid. A fluid enters the device and the protoplasts begin to swell. The aim is to measure the speed of the swelling of the protoplasts. 5-10 images/sec are taken using brightfield imaging.

8 main tools and 15 secondary tools have been developed. The main tools are:

- Export of the time-series of individual traps
- Classification of traps into the classes filled and empty
- Detection of the time-point at which the swelling begins
- 3 tools for the manual selection of protoplasts (using 2 or 3 points)
- Measurements and creation of plots of the area over time of protoplasts
- Automatic segmentation of protoplasts using the deep-learning method stardist

Duration: 641h – 80 days   Fee: 13452,80€

Software used by MRI-CIA

The main platforms used by MRI-CIA are the open source software packages FIJI/ImageJ, napari and python3. Further open software packages used are:

- Ilastik
- Cellprofiler and Cellprofiler Analyst
- Icy
- Imjoy

Propitiatory software packages used by MRI-CIA and available, at the core facility, for users are:

- Matlab

- Huygens

- Imaris

  - Filament Tracer

  - Imaris Cell

  - Imaris XT

  - Tracking