VO2012

Virtual Observations 2012

WERKCOLLEGE 7: VIRTUAL OBSERVATORY

Document identifier:	**VO2012-W7-01**
Date:	**October 14, 2012**
Activity:	
Document status:	
Document link:	

Abstract: On the two use-cases of Euro-VO tutorial this werkcollege will show functionality of Aladin and topcat tools.

1. PREINSTALLATION OF NECESSARY SOFTWARE

Dowload topcat and Aladin:

```
http://www.star.bris.ac.uk/~mbt/topcat/topcat-full.jar
```

```
http://aladin.u-strasbg.fr/java/nph-aladin.pl?frame=get&id=Aladin.jar
```

Both applications can be run locally

```
>java -jar topcat-full.jar
```

Tasks in this werkcollege are based on a standard Virtiual Observatory tasks developed by Euro-VO community.

2. CONFIRMATION OF A SUPERNOVA CANDIDATE

(based on the EuroVO-AIDA WP5 case, developed by G. Iafrate and M. Ramella, expanded by E. Hatziminaoglou)

```
http://www.euro-vo.org/pub/fc/workflows/SN_light.html
```

Confirming a supernova candidate on an image taken by the Col Druscie Remote Observatory Supernovae Search (CROSS) programme; looking for other Supernovae in the field.

* launch Aladin and topcat make sure they communicate with each other via SAMP (the Aladin little antenna should be emitting, and the Aladin logo should appear in the topcat main window)

* load in Aladin the image of NGC6946 (open URL)

```
http://www.euro-vo.org/pub/fc/workflows/ngc6946.fit
```

* to make the image clearer, modify the pixel distribution ("pixel" button, 3rd from the bottom in the vertical tool bar, right next to the image window or Image-> Pixel contrast & map (Cntrl+M)), you can change the colour map;

* the image has no astrometric calibration; this becomes obvious by placing the cursor anywhere on the image: the "Location" field at the top of the main window will state the lack of astrometric calibration. The calibration can be done from within Aladin

  - open the Server Selector by clicking on the File -> Open button

  - set the "Target" name (NGC6946) and "Submit" - the response will appear in the form of a table in the Server selector window

  - click on the image of your choice (tip: do not select large images!) and "Submit" - the selected image should now appear in the main Aladin window

  - we now need to overplot a catalogue on the newly loaded image in order to accurately pick up the coordinates of the stars we will use to perform the astrometric calibration open the Server Selector by clicking on File->Open (in case you have closed it) and click on "Surveys" under "Catalogue Servers" chose a catalogue (2MASS point source catalogue (PSC), USNO or GSC2 are good choices) and "Submit"; the catalogue should now appear on top of the calibrated image but not on top of the local (uncalibrated) image if the symbols are too small (dots), highlight the catalogue plane and edit its properties ("prop"); select e.g. circle, rhomb or square and "Apply"

  - place both images (calibrated and non-calibrated) side by side by splitting the display window in two panels (click on the corresponding option at the bottom left of the display window - multiview)

  - highlight the non-calibrated image plane and select the properties button "prop", 2nd from the bottom(or right-click on the image and select "Astrometric calibration...")

  - in the Astrometric Reduction section select New and select by matching stars

  - activate the cells under "x y" position (by clicking on them) and click on a few (5-6) stars on the uncalibrated image and their corresponding counterpart in the calibrated image, altenating between the two images; the position of the stars on the calibrated image should appear as coordinates under hh mm ss +dd mm ss ; after selecting a sufficient number of stars (5-6) click Create
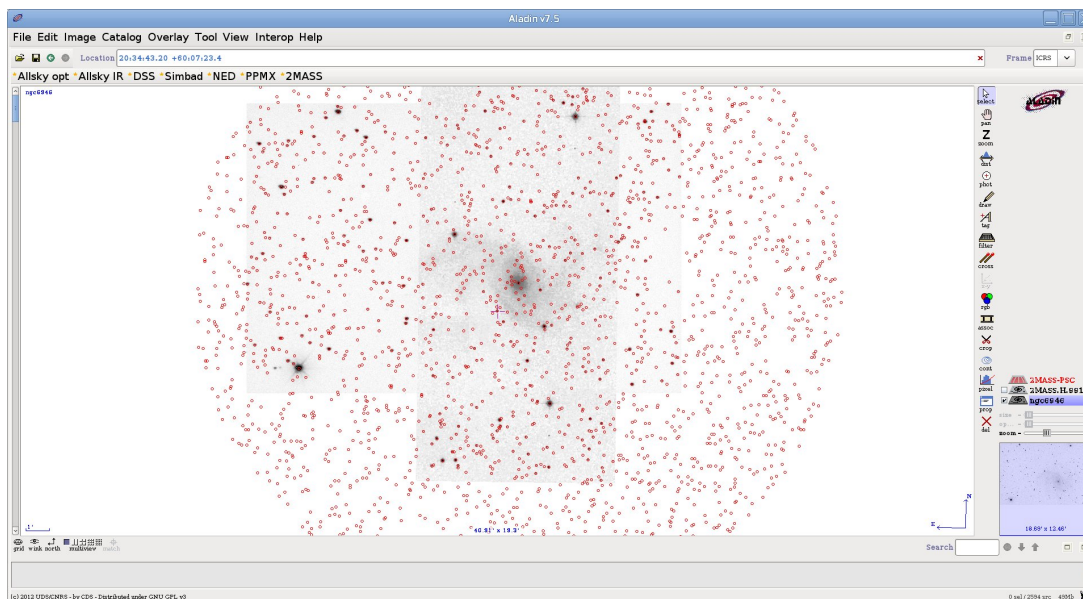
Figure 1: Example of aligned images

- if everything went according to plan, the catalogue you loaded before (2MASS, USNO etc) should now appear on top of the previously uncalibrated image
- return to single view mode (showing one single image in the main Aladin window) you should be viewing something like Fig. 1

* in order to identify the supernova, unselect the catalogue you used for the calibration and superpose the two images: change the transparency of the POSSII or 2MASS image by sliding bar appearing on the image logo to the right

* "tag" the supernova

* measure the distance from the centre of the galaxy, by clicking on the "dist" icon, 4th from the top of the vertical tool bar: then click on the centre of the galaxy and without releasing the mouse button, drag the pointer all the way to the supernova; the distance is displayed on the main window

* now look for known supernovae in the same field

- load Simbad from the Server Selector, apply no filter
- clicking on either of the object, the available information will appear in tabular form at the bottom of the Aladin window, linking directly to the Simbad query results on your browser - try it
- to see immediately the SNe, highlight the Simbad plane and click on the column named OTYPE
- the corresponding histogram (objects grouped per type) will appear in the little graphic window below the stacks (right low corner); move the mouse over each bar to see the corresponding objects highlighted in the main Aladin window
- send the Simbad plane to TOPCAT
- view the Simbad table selecting View -> Table Data
- view the column metadata selecting View -> Column Info
- place the cursor on any Simbad identification on the main Aladin window and see how the relevant column is highlighted in the TOPCAT Table Data

- create the SN sub-sample as follows:

  + click on Display row subset –> Define new subset using algebraic expression as equals(OTYPE,"SN")
  + OR (if you don't know the syntax for the algebraic expression) display the column meta-data; highlight the OTYPE column; rank the table based on the selected column by clicking on one of the yellow arrows at the top of the column metadata window; display the table; select the rows with OTYPE=SN; define a new sub-set including the selected rows only by clicking on the upper left button of the display table window

* select other images taken in other wavebands and different epochs

* try to create an RGB image ("rgb") from three images of your choice

* draw contours ("cont") on any of the image

3. DISCOVERY OF BROWN DWARFS MINING THE 2MASS AND SDSS DATABASES

Original task is a part of Euro-VO tutorial

`http://www.euro-vo.org/pub/fc/workflows/BDs.html`

Brown dwarfs are objects occupying the gap between the least massive stars and the most massive planets. They are intrinsically faint objects so their detection is not straighforward and, in fact, was almost impossible until the advent of global surveys at deep optical and near-infrared bands like SDSS, 2MASS or DENIS among others. Here we propose to mine the SDSS and 2MASS databases to identify T-type brown dwarfs through an appropriate combination of colours in the optical and the infra-red.

With this use case, we explore different ways to do the same tasks (cross-match, sources selection,...) with different VO tools. Given the capabilities of each VO tool, there can be indeed several ways to execute the same workflow (series of steps in the data processing)

3.1. FIRST WORKFLOW: ALADIN

* Launch Aladin

* Search 2MASS and SDSS sources around RA:08h 30m DEC:01d 30m (default radius: 14 arcminutes)

    2MASS: 686 sources

    SDSS: 9855 sources

* Find common sources in 2MASS and SDSS catalogues (use the Aladin catalogue cross match tool with default threshold (4 arcsec) and bestmatch option): 680 sources (677 point sources)

* Select points sources using the SDSS flag (cl=6) creating a filter plane (you need to edit a filter in advanced mode to perform this selection - see the Filter manual for detailed help): 642 sources (639 point sources)

* Create a new plane with the filtered sources

* Select sources with no detection in the u,g SDSS filters ($u > 22.0$ & $g > 22.2$) using a new filter plane: 6 sources

* Select sources following the criteria provided by Burgasser et al. (2000, Apj, 531, L57) $(J-H) < 0.3$ && $(H-K) < 0.3$: 1 object `-->` RA:127.703265deg; DEC:1.475320deg To do so, you can either use arithmetic operations between columns directly in the filter syntax, or you can create new columns in the x-match catalog that are an arithmetic combination of 2 columns (e.g. Jmag & Hmag)

* Confirmation of the brown dwarf nature of this object by searching through VO services using the Load from the "allVO" option

3.2. SECOND WORKFLOW: TOPCAT

* Launch Aladin and TOPCAT

* search 2MASS and SDSS for sources with a cone search from topcat around RA:08h 30m DEC:01d 30m

- Go to the File menu and "Load Table"

- Go to the DataSources menu and select "Cone Search"

- Give "2MASS" as a Keyword to query available services and select the 2MASS point sources catalog

- Give the coordinates and a radius of 14'

- Repeat for the SDSS search (select the DR6 SDSS calatog for example)

- Alternatively, you could load the 2MASS and SDSS catalogs in Aladin and broadcast the planes to TOPCAT using SAMP

* Create a new table by matching raws in the two tables with 4"maximum error and the best match option. 680 pairs are found

* Visualise the cross-matched raws and define a raw subset for which the SDSS class is equal to 6

* Select sources with no detection in the u,g SDSS filters ($u > 22.0$ & $g > 22.2$) by defining a new raw subset (6 remaining sources)

* Update the selection criteria to add the criteria: $(J - H) < 0.3$ && $(H - K) < 0.3$: 1 object --> RA:127.703265deg; DEC:1.475320deg As in the previous flow, you can either give selection criteria that are an arithmetic combination of columns, or you can create new columns in the catalog. For this, go to the main TOPCAT window -> Display column meta data -> Columns menu -> New synthetic column

* To visualise the information on the brown dwarf candidate, you can select the name of your subset in the "Row Subset" menu in the main TOPCAT window and broadcast it to Aladin (if Aladin is opened) or any other VO application compatible with the SAMP interoperability standard

3.3. THIRD WORKFLOW: VIZIER, TOPCAT OR ALADIN

Do the query and selection with Vizier, cross-match with TOPCAT or Aladin

* Vizier enables you to query catalogs with selection criteria. Go to the Vizier webpage:

  `http://vizier.u-strasbg.fr/viz-bin/VizieR`

* Type "SDSS" in the description, give the RA:08h 30m and DEC:01d 30m coordinates as well as target radius of 14 arcminutes, and press "Find Catalogues"

* Select the SDSS Photometric Catalogue

* Give constraints on the class of objects ($= 6$), the u magnitude (> 22.0) and g magnitude (> 22.2) columns

* Change the number of entries per table to a large number (in order to see the 5829 sources) and the output to VOTable (doing so, the table will be readable by all VO tools)

* Read the VO table file with Aladin or Topcat and proceed as described above (first flow for Aladin, second flow for TOPCAT)

3.4. SCRIPTING WITH ALADIN

Aladin has a script mode, where you can build a list of commands to be processed (Tool -> Macro Controller). The workflow can be executed automatically for a list of targets.

 * Open the Tool -> Macro Controller in Aladin

 * Load the script[1]

 * Load the parameters[2] (note that the coordinates columns need be separate by TABS)

 * Execute the script for one or all the parameters

 * Modify the script to save some results for example (Help -> Help on script commands)

---

[1] http://cds.u-strasbg.fr/twikiAIDA/pub/EuroVOAIDA/VOSchool09/Gal2/Aladin_workflow_script.ajs
[2] http://cds.u-strasbg.fr/twikiAIDA/pub/EuroVOAIDA/VOSchool09/Gal2/Aladin_workflow_params.txt