

Self Organizing Maps in the VO-Cloud (Historical reminder)

P. Škoda^{1,2}, L. Lopatovský, J. Koza

¹Faculty of Information Technology, Czech Technical University in Prague

²Astronomical Institute of the Czech Academy of Sciences, Ondřejov



Astronomical Institute
of the Czech Academy of Sciences



**RESEARCH
CENTER FOR
INFORMATICS**

rci.cvut.cz



EUROPEAN UNION
European Structural and Investment Funds
Operational Programme Research,
Development and Education



MINISTRY OF EDUCATION,
YOUTH AND SPORTS

Science Analysis in VO Environment A Case Study

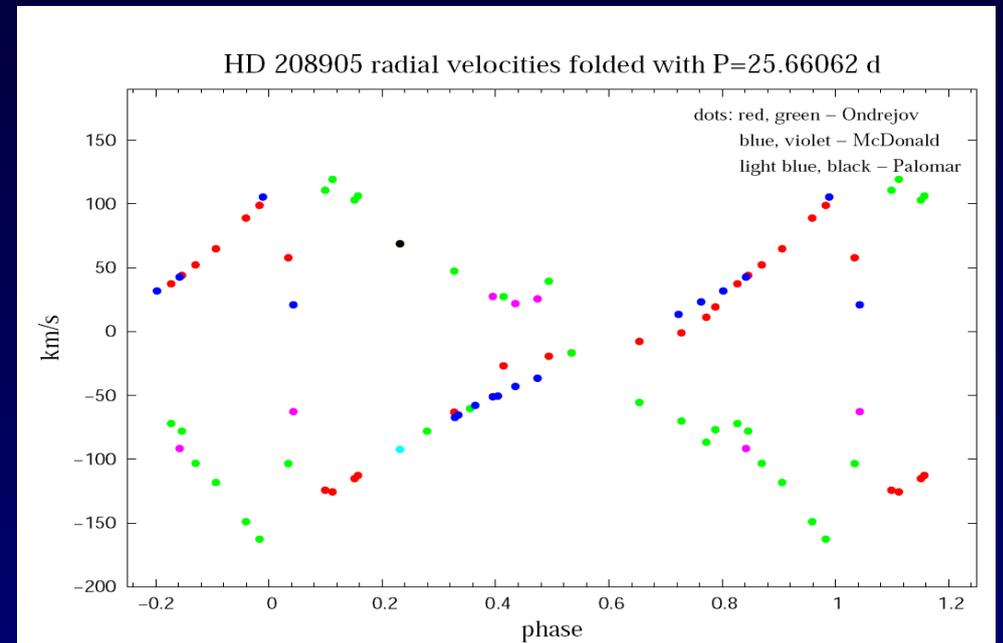
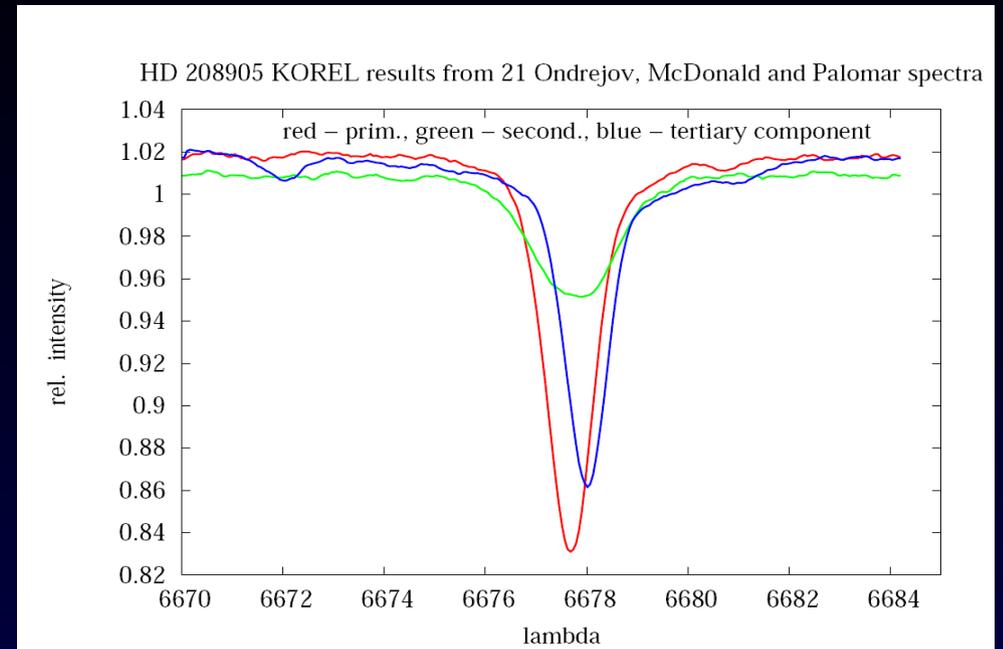
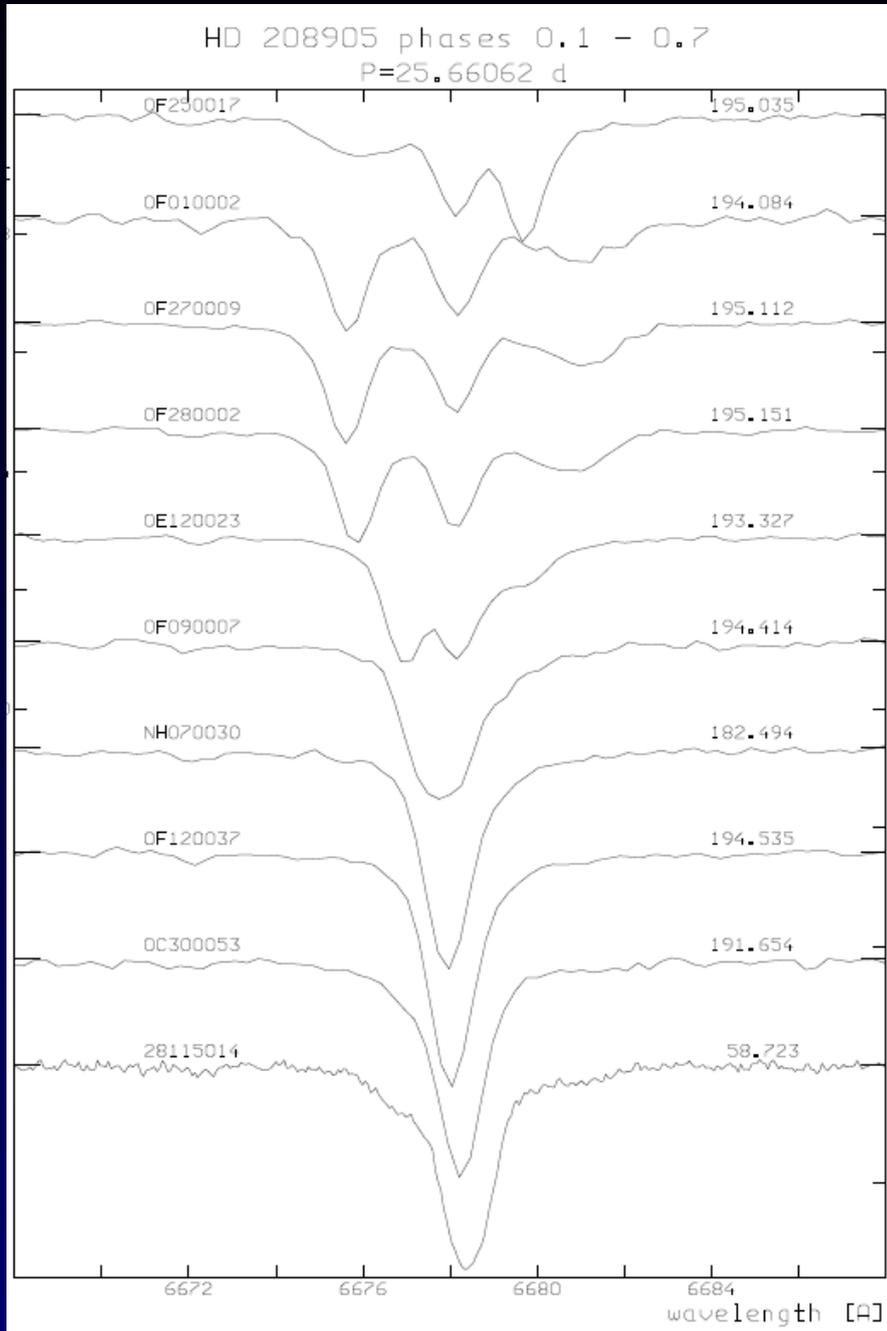
(Integrating DAL and WGS for Spectra Disentangling)

Petr Škoda

Astronomical Institute Academy of Sciences
Ondřejov
Czech Republic

IVOA Interoperability meeting Joined Apps and GWS Session,
CDS Strasbourg 26th May 2009

Spectra Disentangling in Fourier Space - KOREL



Spectra Disentangling in Fourier Space - KOREL

Astronomy & Astrophysics manuscript no. 38020corr
April 28, 2020

©ESO 2020

LETTER TO THE EDITOR

A naked-eye triple system with a nonaccreting black hole in the inner binary ★ ★★

Th. Rivinius¹, D. Baade², P. Hadrava³, M. Heida², and R. Klement⁴

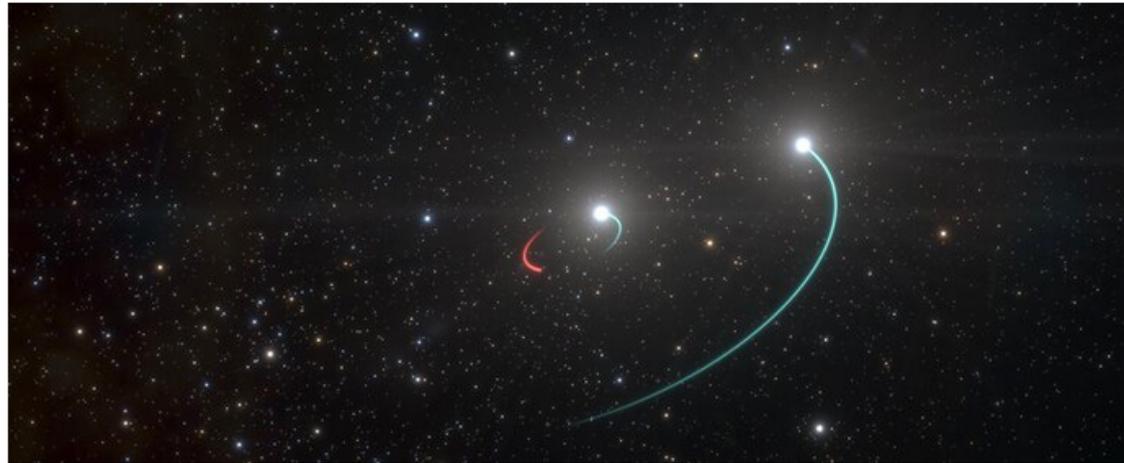
eso2007 — Science Release

ESO Instrument Finds Closest Black Hole to Earth



Invisible object has two companion stars visible to the naked eye

6 May 2020



A team of astronomers from the European Southern Observatory (ESO) and other institutes has discovered a black hole lying just 1000 light-years from Earth. The black hole is closer to our Solar System than any other found to date and forms part of a triple system that can be seen with the naked eye. The team found evidence for the invisible object by tracking its two companion stars using the MPG/ESO 2.2-metre telescope at ESO's La Silla Observatory in Chile. They say this system could just be the tip of the iceberg, as many more similar black holes could be found in the future.

Upload of param and data file

Upload of files - Iceweasel

Soubor Úpravy Zobrazit Historie Záložky Nástroje Nápořádá

http://localhost:1234/

Nejnavštěvovan... Getting Started Latest Headlines ELIAV, a.s. - Firmy.cz

Disable Cookies CSS Forms Images Information Miscellaneous

InterOpMay2009Applications - IV... Upload of files

Chcete, aby si Správce hesel zapamatoval toto přihlášení? Zapamatovat Nikdy pro tento server

KOREL Job preparing Form

Please upload the required files from your local disk using the browser directory tree. The file content must be in UNIX format (only CR, no CTRL-Z at the end). Be sure you did not use PREKOR output for DOS!

Spectra list: (korel.dat): Procházet...

Parameters: (korel.par): Procházet...

Hotovo

Upload of files - Iceweasel

Soubor Úpravy Zobrazit Historie Záložky Nástroje Nápořádá

http://localhost:1234/#

Nejnavštěvovan... Getting Started Latest Headlines ELIAV, a.s. - Firmy.cz

Disable Cookies CSS Forms Images Information Miscellaneous Outline

InterOpMay2009Applications - IV... Upload of files

Chcete, aby si Správce hesel zapamatoval toto přihlášení? Zapamatovat Nikdy pro tento server Nyní ne

KOREL Job preparing Form

Please upload the required files from your local disk using the browser directory tree. The file content must be in UNIX format (only CR, no CTRL-Z at the end). Be sure you did not use PREKOR output for DOS!

Spectra list: (korel.dat): Procházet...

Parameters: (korel.par): Procházet...

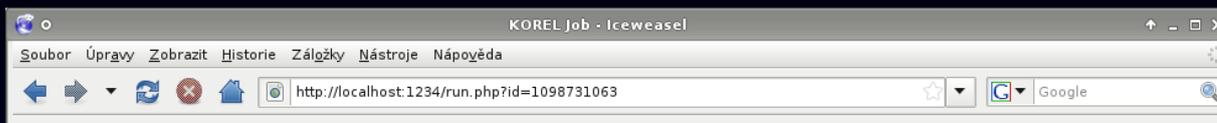
- Sucessfully uploaded

Job 1265004943 is created

[Run job](#)

Hotovo

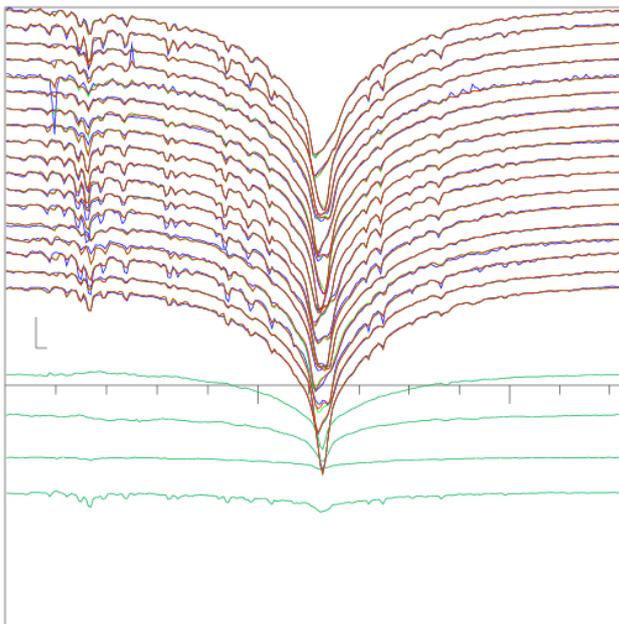
Results and resubmitting



- Starting KOREL job 1098731063 ...
- Job complete

Results:

The disentangled spectra :

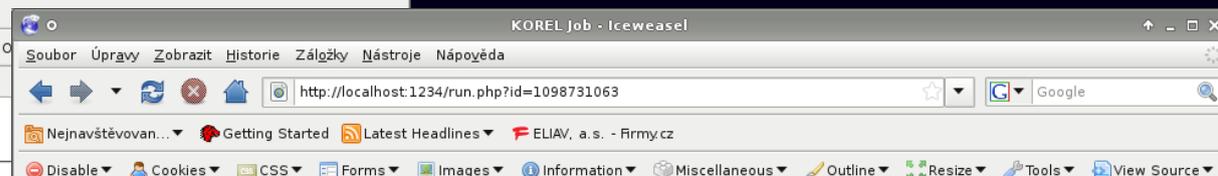


The result file [korel.res](#)

The whole job directory may be downloaded [here](#)

The parametric file, can be edited [here](#).

Hotovo



The result file [korel.res](#)

The whole job directory may be downloaded [here](#)

The parametric file, can be edited [here](#).

```
1 1 0 1 1 0 2 2 | key(1,...,5), k= Nr. of spectra>0, filter, plot
0 0 1 0 1 0      2.553798000 .0001 | 55 UMa sum= 8.504271844767466
0 2 0 1 1      49735.178839985 .002 |
0 0 3 0 1 1      .319733351 .01 | .357
0 0 4 0 1 1      122.951438877 1.1 |
0 0 5 0 1 1      76.095988350 .2 | 87...
0 0 6 0 1 1      .983388967 .01 |
0 2 1 0 1 0      1891.900000000 10.
0 2 2 0 1 1      52715.641149148 5.
0 2 3 0 1 1      .323942615 .03
0 2 4 0 1 1      243.685345134 5.
0 2 5 0 1 1      11.440382020 1.
0 2 6 0 1 1      .518137882 .1
0 3 1 0 1 1      365.256360000 .1      365.242200000 .1
0 3 2 0 1 1      51547.520600000 10.      49722.000000000 10
0 3 3 0 1 1      .016710220 0.001      .016730100 0.001
0 3 4 0 1 1      219.405411671 10.      220.909574736 2.
0 3 5 0 1 1      .001000000 .0001      .001578379 .001
0 3 6 0 1 1      .000039078 .000001      .000073525 .000001
0 3 7 0 1 1      .000009111 .00000001
s 1 01 0 1 0 -.19610 .1
s 1 02 0 1 0 -.07307 .1
s 1 03 0 1 0 -.10926 .1
s 1 04 0 1 0 -.11544 .1
s 1 05 0 1 0 .01207 .1
s 1 06 0 1 0 -.13162 .1
s 1 07 0 1 0 .07563 .1
s 1 08 0 1 0 .07801 .1
s 1 09 0 1 0 -.08540 .1
s 1 10 0 1 0 .00624 .1
s 1 11 0 1 0 -.03080 .1
```

save

[Run new job](#)

Hotovo

UWS – jobs control (REST)

Iceweasel

Soubor Úpravy Zobrazit Historie Záložky Nástroje nápověda

http://korel.localhost:1234/service/jobs/?hlight=124321188030

Nejnavštěvovan... Getting Started Latest Headlines ELIAV, a.s. - Firmy.cz

Disable Cookies CSS Forms Images Information Miscellaneous Outline Resize Tools View Sou

InterOpMay2009Applications - IV... http://korel.lo...ht=124321188030

Korel web service ^{BETA}

About Service Login Register FeedBack

Create a new job Jobs preview Current running job Additional tools Statistics and quotes

| ID Hash | Note Uploaded |
|-----------------|---|
| 39 123793792630 | 2009-03-25 00:38:46 RUN DEL |
| 40 124164858030 | 2009-05-07 00:23:00 RUN DEL |
| 41 124164866730 | 2009-05-07 00:24:27 RUN DEL |
| 42 124177626430 | 2009-05-08 11:51:04 RUN DEL |
| 43 124202725130 | 2009-05-11 09:34:11 RUN DEL |
| 44 124207387535 | 2009-05-11 22:31:15 RUN DEL |
| 45 124207437535 | 2009-05-11 22:39:35 RUN DEL |
| 46 124207462035 | 2009-05-11 22:43:40 RUN DEL |
| 47 124207472535 | 2009-05-11 22:45:25 RUN DEL |
| 48 124207821636 | 2009-05-11 23:43:36 RUN DEL |
| 49 124222792930 | 2009-05-13 17:18:49 RUN DEL |
| 50 124229317630 | 2009-05-14 11:26:16 RUN DEL |
| 51 124259686330 | 2009-05-17 23:47:43 RUN DEL |
| 52 124259810530 | 2009-05-18 00:08:25 RUN DEL |
| 53 124259815530 | 2009-05-18 00:09:15 RUN DEL |
| 54 124260164230 | 2009-05-18 01:07:22 RUN DEL |
| 55 124263523830 | 2009-05-18 10:27:18 RUN DEL |
| 56 124321188030 | 2009-05-25 02:38:00 RUN DEL |

Copyright (C) 2008 SKooDA | (http://www.skooda.org)

Hotovo

Concept of scientific „CLOUD“

ITERATIVE REPEATING of SAME computation (workflow)

Machine Learning (of emission line profiles of LAMOST)

LARGE **stable** INPUT data + small **changing** PARAMS

Many runs on SAME data (tuning required)

Graphics **visualization** from postprocessed output (text) files

Using WWW **browser** - supercomputing in PDA/mobil

Bachelor's Theses

Faculty of Informatics CTU Prague

Unsupervised – SOM
All data - Outliers

Supervised – Classes by eye
Training+testing set

CZECH TECHNICAL UNIVERSITY IN PRAGUE
FACULTY OF INFORMATION TECHNOLOGY
DEPARTMENT OF THEORETICAL COMPUTER SCIENCE



Bachelor's thesis

Application of Self-Organizing Maps in
Astroinformatics

Lopatovský Lukáš

Supervisor: RNDr. Petr Škoda, Csc.

14th May 2014

CZECH TECHNICAL UNIVERSITY IN PRAGUE
FACULTY OF INFORMATION TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE



Bachelor's thesis

Application of Random Decision Forests in
Astroinformatics

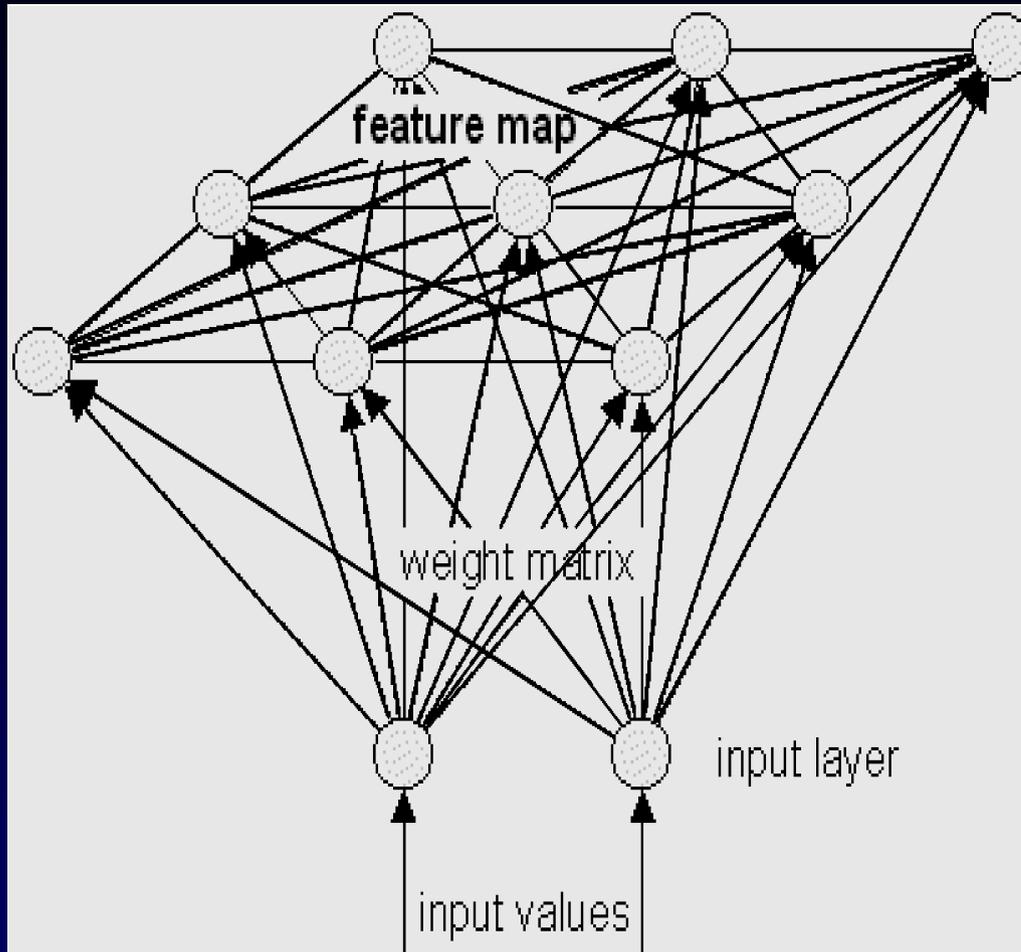
Andrej Palička

Supervisor: RNDr. Petr Škoda, CSc.

12th May 2014

Principles of SOM

Self-Organizing = Kohonen map



Association (activation) map

How many vectors activate every neuron

Unified Distance Matrix (U-matrix)

Every neuron = sum of distances to neighbours

The higher = more unique (outlier)

create job

vo-cloud Create new SOM job - Iceweasel

vo-cloud Create new SO... x

vocloud-dev.asu.cas.cz/vocloud/jobs/index.xhtml

Google

Most Visited Getting Started Connecting...

VO-CLOUD CREATE NEW SOM JOB

Home Jobs Create Settings Admin Help Logout (skoda)

Project label:

Description:

Email me results

Edit config.json

```
{
  "Name": "Stellar_spectra",
  "Algorithm": {
    "Bmu": "normal",
    "Threads": 1
  },
  "Data": {
    "Path": ["spectra.1863.4"],
    "File_type": "csv",
  }
}
```

Upload parameters

Please attach data with config.json file.

(c) mrq 2014 - [feedback](#)

Job is running

vo-cloud Jobs - Iceweasel

vo-cloud Jobs

vocloud-dev.asu.cas.cz/vocloud/jobs/index.xhtml

Most Visited Getting Started Connecting...

VO-CLOUD JOBS

Home Jobs Create Settings Admin Help Logout (skoda)

| Type | Id | Name | Created | Duration | Phase | Action | Delete | Details |
|-------|------|-----------------------------------|---------|----------|-----------|--------|--------|---------|
| SOM | 8603 | spectra4 | 10/8/14 | 17 sec | EXECUTING | abort | x | 📄 |
| SOM | 8555 | spectra4 (copy) | 10/8/14 | 14 sec | COMPLETED | | x | 📄 |
| SOM | 8550 | spectra5 | 10/7/14 | 119 sec | COMPLETED | | x | 📄 |
| SOM | 8549 | spectra4 | 10/7/14 | 62 sec | COMPLETED | | x | 📄 |
| SOM | 8548 | iris | 10/7/14 | 0 sec | COMPLETED | | x | 📄 |
| SOM | 8547 | ecoli | 10/7/14 | 3 sec | COMPLETED | | x | 📄 |
| SOM | 8537 | spectra4_unspec | 10/2/14 | 89 sec | COMPLETED | | x | 📄 |
| SOM | 8536 | spectra4 | 10/2/14 | 108 sec | COMPLETED | | x | 📄 |
| SOM | 8534 | new test of spectra (copy) (copy) | 9/26/14 | 10 sec | COMPLETED | | x | 📄 |
| SOM | 8533 | new test of spectra (copy) | 9/26/14 | 0 sec | PENDING | start | x | 📄 |
| Korel | 8530 | testkorel (copy) (copy) | 9/26/14 | 0 sec | COMPLETED | | x | 📄 |
| SOM | 8520 | new test of spectra | 9/26/14 | 12 sec | COMPLETED | | x | 📄 |
| Korel | 7602 | big job with map (copy) | 4/14/13 | 37 sec | COMPLETED | | x | 📄 |

39% full (Using 396.4 MB / 1.0 GB)

(c) mrq 2014 - [feedback](#)

Output part1 (map)

vo-cloud Details of job 8603 - Iceweasel

vo-cloud Details of job 8... x

vocloud-dev.asu.cas.cz/vocloud/jobs/index.xhtml

Most Visited Getting Started Connecting...

VO-CLOUD DETAILS OF JOB 8603

Home Jobs Create Settings Admin Help Logout (skoda)

spectra4

SOM on spectra labeled in 4 classes

| Type | Id | Phase | Worker | Created | Started | Finished | Executing time |
|------|------|-----------|-----------|--------------------|--------------------|--------------------|----------------|
| SOM | 8603 | COMPLETED | som local | 10/8/14 2:31:27 PM | 10/8/14 2:31:31 PM | 10/8/14 2:32:45 PM | 73 sec |

run again delete

Preview

index.html - fullscreen

Stellar_spectra

30 25 20 15 10 5 0

0 5 10 15 20 25 30

4 3.5 3 2.5 2 1.5 1 0.5 0

Output Part 2 - U-matrix

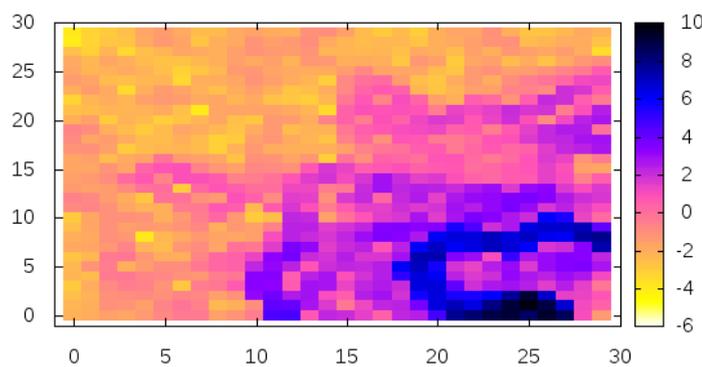
vo-cloud Details of job 8603 - Iceweasel

vo-cloud Details of job 8... x

vocloud-dev.asu.cas.cz/vocloud/jobs/index.xhtml

Google

Most Visited Getting Started Connecting...

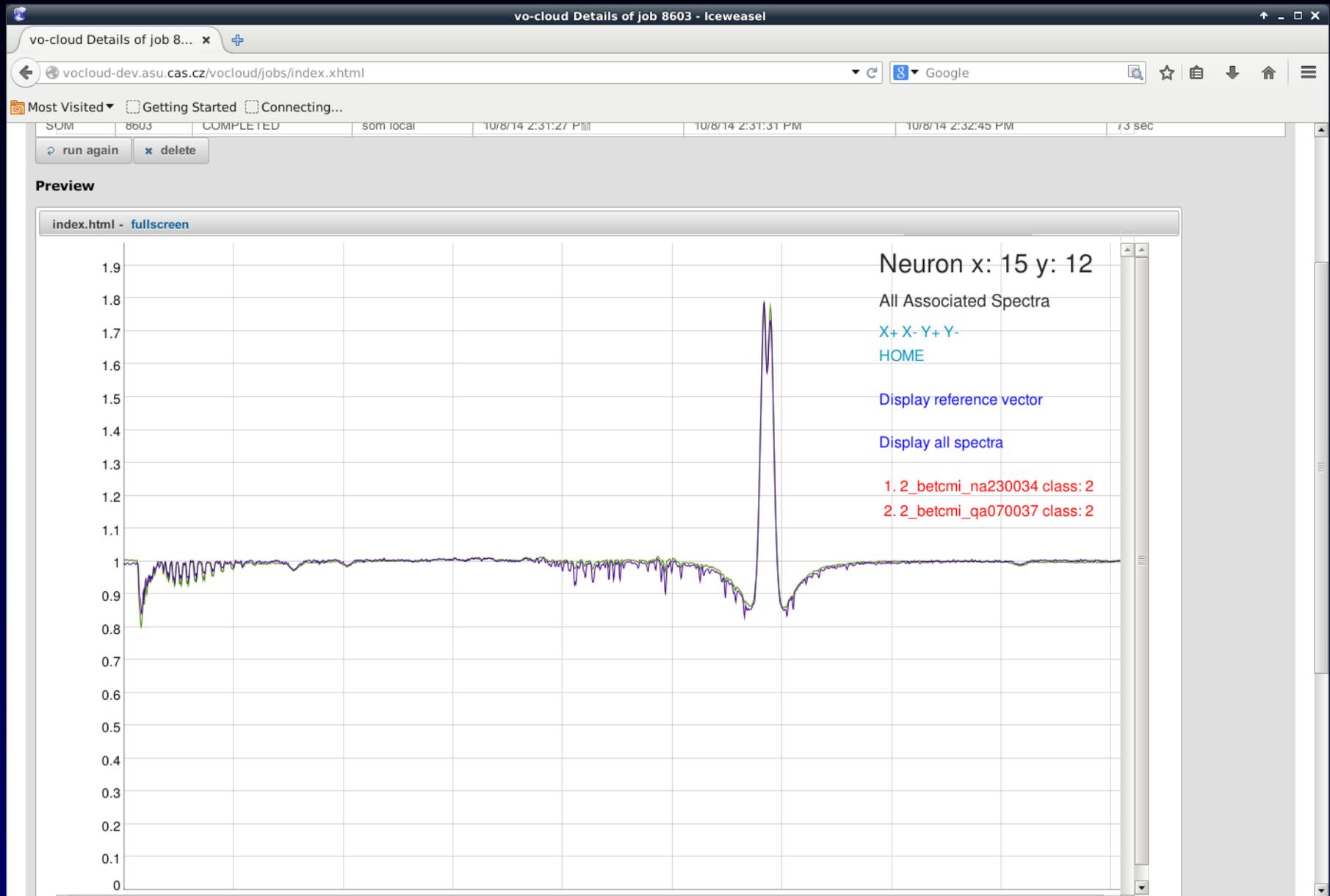


Files

| Name | Size | Download | View |
|----------------------|----------|---|---|
| config.json | 691 |  |  |
| spectra4_classes.zip | 9033994 |  |  |
| uws-job.xml | 1046 |  |  |
| results.zip | 15817894 |  |  |
| errors.txt | 158 |  |  |
| run.out | 2362 |  |  |

(c) mrq 2014 - [feedback](#) - [github](#)

Reference vector for a neuron



Upgraded view - current

VO-CLOUD DETAILS OF JOB

Home Manage filesystem Jobs Download history Create job Jupyter Settings Admin Help Logout (admin)

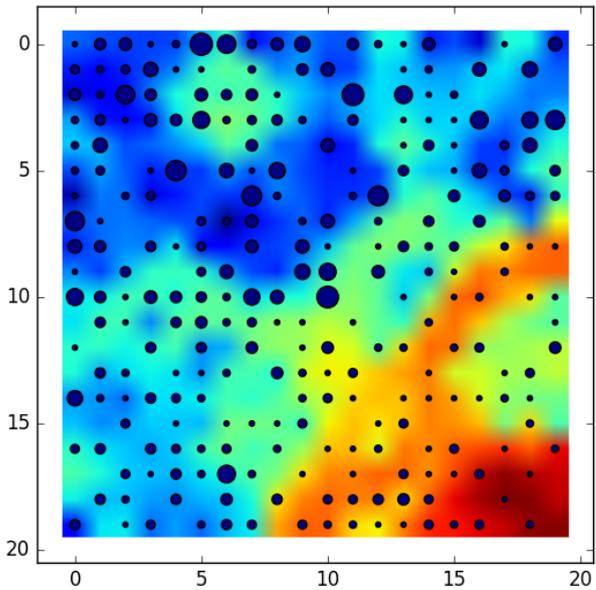
AllSpecOndSOM

| Type | Id | Phase | Worker | Created | Started | Finished | Executing time |
|------|------|-----------|--------------|---------------------|---------------------|---------------------|----------------|
| SOM | 1-92 | COMPLETED | local worker | 2/14/17 11:32:47 PM | 2/14/17 11:32:47 PM | 2/14/17 11:32:59 PM | 11 sec |

Run again Delete

Preview

index.html - Fullscreen



Files

VO-CLOUD DETAILS OF JOB

Home Manage filesystem Jobs Download history Create job Jupyter Settings Admin Help Logout (admin)

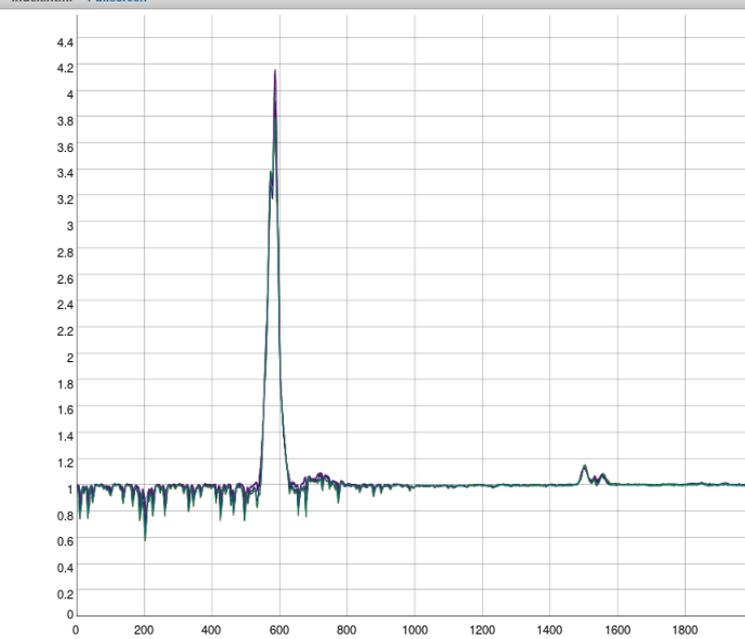
AllSpecOndSOM

| Type | Id | Phase | Worker | Created | Started | Finished | Executing time |
|------|------|-----------|--------------|---------------------|---------------------|---------------------|----------------|
| SOM | 1-92 | COMPLETED | local worker | 2/14/17 11:32:47 PM | 2/14/17 11:32:47 PM | 2/14/17 11:32:59 PM | 11 sec |

Run again Delete

Preview

index.html - Fullscreen



Neuron x: 18 y: 1

All Associated Spectra

- Y+
- X- HOME X+
- Y-
- Display reference vector
- Display all spectra

1. no name class: x
2. no name class: x
3. no name class: x
4. no name class: x
5. no name class: x
6. no name class: x
7. no name class: x
8. no name class: x
9. no name class: x

Files

DEMO

Service at <https://vocloud-dev.asu.cas.cz>

Source on GitHub

<https://github.com/vodev/vocloud-som>