List of Semester Theses  
Winter Semester 2004/2005

All the topics given below are real technical contributions to the following research topics:

- Content-based information retrieval
- The development of the data analysis software of the NASA/RHESSI spacecraft
- The development of the data analysis software of the HERSCHEL/HIFI spacecraft
- The EU-project European Grid of Solar Observations.

I have two slots this semester. The first semester thesis presented below (feature recognition) must be allocated. From the two other topics, (Python and VOPlot), only one should be chosen.

RHESSI is at http://hessi.ssl.berkeley.edu and http://rhessidatacenter.ssl.berkeley.edu/  
EGSO is at http://www,egso.org.  
HERSCHEL is at http://sci.esa.int/science-e/www/area/index.cfm?fareaid=16

Custom-made semester theses: if you have interest in our research, and have a concrete proposition for a topic, please contact me.

Contact me for further information at csillag@fh-aargau.ch

Feature recognition in images

In this semester thesis, we develop a system to extract information from a particular type of images, called spectrograms. The information extraction is done by analyzing images using a neuronal-network based pattern recognition engine. This engine is provided by the company semantic system ag that is our industrial partner in this project. The engine mimics the behavior of neuron reactions and builds information maps that can be used to sort out the image content.

In this semester thesis you will have the chance of using an advanced neuronal network to explore how far an automated information extraction on spectrogram data sets can be done with this new technology. You will also explore whether this method can solve classification problems in spectrograms, and find the limitations and advantages compared to other methods. For this, you will develop the existing engine further and tune it for the image and content analysis of spectrograms.
A Python-based Data Analysis Environment (Alternative 1)

Many data analysis systems in Astronomy, medical sciences and environmental sciences are developed using a commercial scripting language called IDL, the Interactive Data Language (nothing to do with interface definition language), see www.rsinc.com. Thus all these software projects are inherently tied with a commercial product on which we have little influence.

A number of publicly funded projects are reluctant about the idea of being dependent on a commercial product. This is the case, for instance for the software of the spacecraft HERSCHEL, a 900M Euro instrument that will be launched in 2007 (see http://sci.esa.int/science-e/www/area/index.cfm?fareaid=16). Thus we are looking for open-source alternative products that would allow us to reuse (part of) the software already written, or minimize the changes.

In this semester thesis you will investigate the use of Python as an alternative to IDL. Many issues must be investigated. At first, is Python a valuable alternative to IDL? If not, what are the other scripting languages that could be used? Furthermore, the basic set of IDL/Python routines must be compared and issues (i.e. lacks) on the Python side must be identified. Lat but not least, because this will be the core of the semester thesis, you will create a (small) data analysis package in Python that can read and understand IDL programs and let them perform the same function in Python.

VOPlot and PTPlot (Alternative 2)

Data access over the Web is one thing. The presentation is another. We can easily display data from databases, i.e. tabular data, but the situation is getting more tricky with images and in general graphics. This problem has been addressed by several organizations that have created software to work with graphics over the Web in general, and over Grids in particular. The Electrical Engineering & Computer Science department at the University of California, Berkeley developed PTPlot, it has been extended to VOPlot for the display of astronomical images. In this semester work, we will use PTPlot and VOPlot to work with graphics over the web.