

Variable Star Working Group

Laurent Eyser (Observatoire de Genève)
Cambridge, April 15 2004

Goals of GAIA VSWG

- To **assess** the relevance of GAIA for diverse variable types
- To **identify** possible problems, needs related to variable sources (astrometry, photometry, alerts)
- To **develop** the software to cope with variability, and extract astrophysical information from the time series (photometry, radial velocities)

Members of the WG

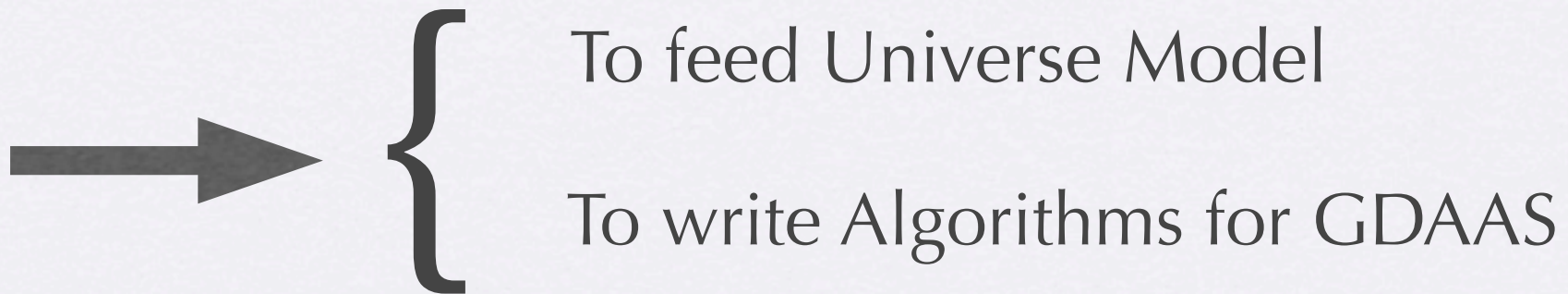
- Core members: 15
- Associate members: 22
- 9 C + 11 A did work related to VSWG
- 3 C + 6 A never answered

Goals are related to

- **Design:**
 - astrometry (problem + asteroseismology),
 - photometry (precision + filter system),
 - Radial velocities (eclipsing binaries)
 - Scanning law
- **Data treatment:** provide algorithms for GDAAS2
- **“Bibliographical” work:** Forecasts variable objects, other surveys (current, future)

List of tasks (after Nice Meeting)

- Web-site, Organisation (meetings, grants, observing proposals, texts)
- Study astrophysical objects, other surveys, forecasts
- Signal processing: Statistics (defining parameters, hypothesis testing, bayesian methods), Scanning law, classification



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LIST OF ACTIONS April 8 2004
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GENERAL

Table with 3 columns: WHAT, WHO, WHEN. Rows include: Statistical criteria. Selection of criteria to detect variability; Sampling law. Complete simulations; Universe Model. Add some types of variability to Universe Model; Classification.

Deadline GDAAS2: September 1 2004

See: http://obswww.unige.ch/~eyer/VSWG/tasks/taskscurrent.txt

 DETAILED ACTIONS

WHAT -----	WHO -----	DDL ---	STARTED -----	DONE -----
Write email to WG about Nice and actions to be taken (Web, email)	Laurent, Dafydd	Jan	13.12.03	10.01.04
Answer M.Perryman "GAIA in 2003" Write text (Web, email)	Laurent, Dafydd	ASAP	08.01.04	15.01.04
F.Mignard's visit to Geneva (Organisation)	Laurent, Francois	Mar	14.01.04	10.03.04
Travel Torun, Classif algorithm on OGLE. Collaboration with Darek Graczyk and Antoine Naud Hipp-OGLE classif (Organisation)	Laurent	Jan	16.01.04	20.01.04
Next meeting Fixing date with ICAP meeting in 6 month-time (May?), (Organisation) --> April 15, 16 2004	Laurent, Wyn, Coryn, Dafydd	Feb	10.01.04	21.01.04

Working group documents

- List of Data Mining methods (Antoine Naud)
- Variable Star Characteristics ("All")
- Forecasts about variables (Eyer & Cuypers; Bono-awaited)
- Compilation of surveys (past Eyer & Cuypers, future)

Some data mining methods (Antoine Naud)

1) CLAS - Main families of classification methods:

- ANN - Artificial Neural Networks: (techniques inspired from biology with adaptive inner parameters).
- MLP Multi-Layer Perceptron
- RBF Radial Basis Function
- SVM - Support Vector Machine
- Tree based methods
- KNN - k-nearest neighbors classifiers
- LDA - Linear Discriminant Analysis
- Boosting -> improve the performance of classifiers,

2) DRED - Dimensionality reduction makes high-dimensional data problems more tractable.

a) feature extraction:

- Generative Topographic Mapping
- SOM, Neuroscale, the elastic net, Curvilinear Components Analysis
- Principal curves and principal surfaces.
- PCA - Principal Components Analysis originates in multivariate statistical analysis, it has now many versions: linear, nonlinear (autoassociators), neural, kernel based, ..
- MDS - Multidimensional Scaling (also known as "Sammon mapping")
- PP - projection pursuit
- Local approaches to dimensionality reduction

b) feature selection:

- information theory based feature selection

3) CLUS - Clustering, partitioning:

- SOM Self-Organizing Maps
- LVQ - Learning Vector Quantization
- k-means, C-means, fuzzy C-means
- k-medoids
- hierarchical methods (dendrograms)
- for large datasets: birch, clique, proclus

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Please see <http://obswww.unige.ch/~eyer/VSWG/varchar.html>

Working group documents

- List of Data Mining methods (Antoine Naud)
- Variable Star Characteristics ("All")
- Forecasts about variables (Eyer & Cuypers; Bono-awaited) 2-3:7 million Ecl. Bin., EC:Z
- Compilation of surveys (past Eyer & Cuypers, future)

Tools for variability analysis

- Make a list of tools
- Provide programmes (Fortran, SuperMongo)

Please see: <http://obswww.unige.ch/~eyer/tools.html>

Three subjects

- Proposition of some algorithms (later in workshop)
- Classification (later in workshop)
- Comparison of period search algorithms

Future

- Continue mentioned studies
- Eyer visit USA April-June, inquiry of other future surveys (PAN-STARR)
- Treatment of eclipsing binaries (Zwitter)
- F. Pont: Detection of Planets (some studies have been done by N. Robichon)
- Comparison period search (there are 2 novel methods! by Mignard and by Bartholdi & Eyer)

Other subjects

- Grants: Wilson, Eyer-Grenon, Naud-Graczyk
- Observing proposal: Jorissen-De Laverny
- Eclipsing binaries:
 - Zwitter, Munari
 - Wilson (extending his code: extreme mass ratios)

Conclusion

- Diverse aspects are treated in VSWG:
- We try to get those aspects concentrated on the VSWG webpages