

iAstro MC Meeting & Workshop

VIRTUAL OBSERVATORIES

Plate Content Digitization

Archive Mining

Image Sequence Processing

27-30 April 2005, Sofia, Bulgaria

PROGRAMME & ABSTRACTS

Heron Press  Sofia

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PROGRAMME

Wednesday, 27 April

- 08:30–09:00 Registration
- 09:30–09:45 Official Opening. Introductory Remarks
from University of Sofia
- 09:45–10:00 Introductory Remarks and General Background
from Bulgarian Academy of Sciences
- 10:10–10:20 Introductory Remarks and General Background
from Bulgarian GRID Consortium

PLENARY SESSION

Chairman: V. Golev

- 10:20–11:00 *Fionn Murtagh*: The iAstro COST Action: From Physics to
the Science and Engineering of Information
- 11:00–11:45 *Milcho Tsvetkov*: Wide-Field Plate Database: 10 Years of
Development
- 11:45–13:45 **LUNCH BREAK** “YAITSETO” (*Egg’s Hall*)

PLATE DIGITIZATION SESSION 1

Chairman: M. Tsvetkov

- 14:00–14:45 *Douglas Mink*: Harvard Plate Scanning Project
- 14:45–15:15 *Cesare Barbieri*: The Italian Experience
to Digitize the Astronomical Photographic Archives
- 15:15–16:45 *Peter Kroll*: Scanning Activities at Sonneberg Observatory

PLATE DIGITIZATION SESSION 2

Chairman: C. Barbieri

- 17:00–17:30 *Areg Mickaelian*: The Digitized First Byurakan Survey and
the Armenian Virtual Observatory
- 17:30–17:50 *Istvan Jankovics*: Gothard Historical Astrophotographic
Plate Archive
- 17:50–18:20 *Rene Hudec*: Astronomical Plate Archives: Past,
Present, Future
- 18:20–18:30 **POSTER SESSION** (*Conclusions and Closure Day 1*)

Thursday, 28 April

IMAGE SEQUENCE PROCESSING SESSION 2

Chairman: R. Molina

- 15:45–16:10 *Aggelos Katsaggelos*: Efficient Video Communication over Lossy Channels
- 16:10–16:35 *Dacil Barreto*: Motion Estimation Techniques in Super-Resolution Image Reconstruction. A Performance Evaluation
- 16:35–16:55 *Petre Popescu*: ICRF CCD Images Data-Base — Methods of Image Processing
- 16:55–17:15 *Georgi Petrov*: Cluster Analysis of Faint Galaxies in Hercules Void (1600+18)
- 17:15–17:35 *Mohsen Farid*: Characterization of Visual Interaction within Eye Movement Data
- 17:35–18:00 *POSTER SESSION*
- 17:30–19:00 *MC-iAstro MEETING (Conference Hall of Hotel 'RAI')*
- 19:30–22:00 **Social Dinner: Restaurant of the Hotel of the Academy**

Friday, 29 April

Visit the UNESCO's World Heritage the Rila Monastery and the town of Melnik

Saturday, 30 April

GRID-VIRTUAL OBSERVATORY SESSION 1

Chairman: O. Dluzhnevskaya

- 09:00–09:30 *Emanouil Atanassov*: Bulgarian Involvement in the European Grid Operations
- 09:30–10:00 *Oleg Malkov*: The Russian Virtual Observatory: Recent Developments
- 10:00–10:20 *John Seiradakis*: Converting European-Pulsar-Network Data to XML
- 10:20–10:40 *COFFEE BREAK*

Saturday, 30 April

GRID-VIRTUAL OBSERVATORY SESSION 2

Chairman: J. Seiradakis

- 10:40–11:00 *Albert Bijaoui: Analysis of a Set of Multiband Images in the Framework of a Virtual Observatory*
- 11:00–11:20 *William Thuillot: Virtual Observatory and Ephemerides of the Solar Objects*
- 11:20–11:40 *Andras Holl: Interlinking between IBVS and WFPDB*
- 11:40–12:00 *Philippe Prugniel: MIGALE – an Virtual Instrument*
- 12:00–12:20 **POSTER SESSION**
- 12:20–12:40 *Round Table Discussion, Closure*

PLENARY SESSION

The iAstro COST Action: From Physics to the Science and Engineering of Information

Fionn Murtagh

Dept. Computer Science, Royal Holloway, University of London, Egham TW20 0EX, England

Wide-Field Plate Database: 10 Years of Development

Milcho Tsvetkov¹, Katya Tsvetkova¹, Konstantin Stavrev¹,
Ana Borisova¹, Galin Borisov¹, Damyan Kalaglarsky²,
Rumen Bogdanovski², Hristo Lukarski², Svetlin Fotev²,
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The development for last 10 years of the Wide-Field Plate Database (WFPDB, <http://www.skyarchive.org>) as an initiative of the IAU Working Group on Sky Surveys, hosted by Commission 9, is presented. The new version of the Catalogue of the Wide-Field Plate Archives contains descriptive information, for practically, all existing professional wide-field photographic observations stored in 414 archives around the world. They contains more than 2,200,000 plates obtained with professional telescopes of 125 observatories world-wide. The WFPDB is now the basic source of information for the archived observations. Currently the WFPDB provides access to the information for more than 30% of the estimated archive total number. Following the requirements of the Centre de Données Astronomiques de Strasbourg (CDS) and International Virtual Observatory Alliance (IVOA) the WFPDB contains the digitized plate preview images, as well as digitized plate row data using the new generation of the flatbed scanners. The WFPDB team continues to enlarge the database with submitted or retrieved information from the photographic plates which enable the astronomical community to complement their investigations going more than 100 years back in time.

PLATE DIGITIZATION

The Harvard Plate Scanning Project

Douglas J. Mink, Alison Doane, Robert Simcoe, Jonathan Grindlay
Harvard-Smithsonian Center for Astrophysics

There are over 500,000 glass photographic plates in the Harvard Plate Stacks, exposed in both the northern and southern hemispheres between 1885 and 1993. This 100 year coverage is a unique resource for studying temporal variations in the universe. We realized that it would be even more useful if the images were all available in digital form over the Internet. We will report on progress in the design and construction of a high resolution, large field scanner, which we are building after discovering that no commercial model could adequately deal with our largest, most useful plates. In addition to plate scanning, we will report on our progress toward digitizing the catalog of plates, constructing an automatic pipeline to make the scanned images useful, and the scanning of the handwritten observing logs which provides the most complete information about the conditions under which the plates were taken.

The Italian Experience to Digitize the Astronomical Photographic Archives

Cesare Barbieri

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A great amount of highly valuable information is stored in the photographic archives of many Italian Observatories and in the Specola Vaticana, amounting to more than 70,000 plates, some of which dating back to the end of the 19 Century.

This paper presents the results of a large-scale project started in 2002 to digitize these archives. Identical systems, composed by a commercial flat-bed retro-illuminated scanner plus a dedicated personal computer and acquisition software, have been installed in all participating Institutes, namely Padova-Asiago, Rome University, Rome Monte Porzio, Torino, Catania. In addition to the process of digitization, the overall project has led to a precise inventory of the still useable material and its storage in appropriate conditioned rooms, to the digitization of all the logbooks, to the provision of high quality BVRI CCD sequences in selected fields with the Campo Imperatore telescopes, and finally to the distribution of the digitized information to all interested researchers via the international Web. Instead of aiming to a sequential completion of the digitization, priorities have been set up according to the scientific interests of the involved researchers, e.g. QSO variability, peculiar objects such as HKD15 and the McNeil nebula, the automatic classification of spectra (stars, Markarian galaxies) on objective prism plates. In Asiago, more than 2500 Schmidt plates have been already digitized and used for published scientific papers, and more than 800 at the Vatican Observatory.

The project has greatly benefited from a collaboration with the DLR in Germany and with the Sofia Sky Archive Data Center.

Scanning Activities at Sonneberg Observatory

Peter Kroll, Thomas Berthold, Peter Hiltner, Norbert Polko,
Joerg Saenger

Sonneberg Observatory, Sternwartestr. 32, D-96515 Sonneberg, Germany

The Sonneberg Plate Archive with its nearly 300,000 plates is going to be digitized in an inexpensive and fast way. With the help of four commercial flat-bed scanners that are used in parallel more than the half of the plates will be scanned by mid of 2005. The lecture gives an overview about the technical approach, related problems, data management and man power. It also sketches some very recent results in stellar astronomy on the basis of this data.

The Digitized First Byurakan Survey and the Armenian Virtual Observatory

Areg M. Mickaelian

Byurakan Astrophysical Observatory (BAO), Byurakan 378433, Armenia

The Digitized First Byurakan Survey (DFBS) has been created as a result of digitization of the First Byurakan Survey (FBS) plates, the largest-area spectroscopic survey of the sky, covering 17, 000 sq. deg. FBS is known as the Markarian survey, as by using these low-dispersion spectra, he discovered 1500 UV-excess (UVX) galaxies. Markarian galaxies led to dramatic new knowledge in the field of AGN and starburst galaxies. The FBS plates have also been used to search for UVX stellar objects, late-type stars, and identifications of IRAS sources. New projects are possible with efficient use of the DFBS. At present, 2000 FBS plates have been scanned and stored on 85 DVDs. Astrometric solution for all plates, extraction of spectra, calibration of the data to wavelengths and fluxes, a numerical classification scheme and creation of the DFBS catalog and database are in process. The Armenian Virtual Observatory (ArVO) based on the DFBS is being created offering to users data on any of 20,000,000 objects present in the survey. The ArVO will be complemented with the Second Byurakan Survey (SBS), other Byurakan archive data and observations from the 2.6m telescope and will allow Armenian astronomy to contribute and be integrated into the international AVOs.

Gothard Historical Astrophotographic Plate Archive

Ildiko Vincze, Istvan Jankovics

Gothard Astrophysical Observatory of Lorand Eotvoes University

Eugen von Gothard (1857-1909) established his astronomical observatory on his estate in Hereny, near Szombathely, in 1881. The first observation at the new observatory happened on October 20, 1881. The main instrument used to be the 254 mm Newton telescope manufactured by the Browning Company (London, 1874). The most relevant part of Gothard's activity is the photography of various kind of objects: planets, comets, nebulae and galaxies and the spectroscopy of comets, stars and nebulae. He was the first in the world in the autumn of 1886, who was able to take a plate of the Ring Nebula (M57), which clearly shows the central star. From 1883, in the course of his spectroscopic observations he pointed out the periodical appearance and disappearance of hydrogen and helium emission lines in the beta Lyrae. During the investigation of the spectrum of Novae Aurigae Gothard found a principal relationship regarding the connection between novas and planetary nebulae in 1892. The scientific inheritance of Gothard is maintained by Gothard Astrophysical Observatory of Lorand Eotvoes University. A valuable part of this material is the astronomical plate collection of 455 pieces taken between 1882 and 1900.

Astronomical Plate Archives: Past, Present, Future

Rene Hudec

Astronomical Institute Ondrejov

There are more than 3 million astronomical archival plates around the globe. I will give an overview of the worlds most important astronomical plate archives as well as related projects and science. I will also show that novel algorithms and software programs together with wide plate digitization and use of powerful computers allow the full and effective extraction of the scientific data recorded in the plates for the first time. Examples of scientific projects based on digitized astronomical plates will be given and discussed.

Astrophysics with Astronomical Archival Plates

Rene Hudec

Astronomical Institute Ondrejov

I present and discuss some examples of astrophysical projects based on the use of astronomical archival plates. Even the recent astrophysical satellite projects such as the ESA INTEGRAL can benefit from the analyses on the plates which can add valuable data for physical understanding of objects observed by INTEGRAL (such as blazars and cataclysmic variables). These studies can also help to follow and/or predict the active states of the targets and hence help to trigger the observations by the satellite. Related aspects such as the importance of digitised plates for the Virtual Observatory will be also addressed.

Astronomical Heritage Databases. A Case Study

Magda Stavinschi¹, Mihai Caramihai², and Vasile Mioc¹

¹*Astronomical Institute of the Romanian Academy*

²*University POLITEHNICA Bucharest*

During the last Conference of the European Society for Astronomy in Culture a new working group was set up. It intends to support the efforts of UNESCO World Heritage Centre in order to contribute to the implementation of the Thematic Initiative Astronomy and World Heritage” elaborated during the first international meeting held in UNESCO Bureau for Science in Europe (ROSTE) in March 2004. The first and most important task of the WG should be a first identification of archaeo-astronomical sites and development of a database containing all relevant data needed for further research work. Focus on these aspects, we intend to design and develop an object-oriented database model in order to store and easy access information regarding archaeo-astronomical sites.

Moscow Astronomical Plate Archive: Contents, Digitization, Current and Possible Applications

Nikolai N. Samus, L. A. Sat, and A. V. Zharova

Institute of Astronomy and Sternberg Astronomical Institute, Moscow

The plate stacks of the Sternberg Astronomical Institute contain some 50000 plates taken with several telescopes in Moscow, Moscow Region, Crimea, and other sites after 1895. The most important part of the archive are plates taken with the 40-cm astrograph in Crimea, the same instrument that was used prior to World War II in Sonneberg. The archive is maintained in an excellent shape, the percentage of high-quality plates is very high. We are now starting a project of this archive's complete digitization using high-resolution scanners. We will describe the archive and the current state of its digitization and discuss its applications for studies of variable stars, astrometry, and other purposes.

MAO NAS of Ukraine Plate Archive: Towards to WFPDB Integration

Tatyana Sergeeva¹, V. Golovnya¹, L. Kizuyn¹, L. Yizhakevych¹, S. Shatokhina¹, Milcho Tsvetkov², Katya Tsvetkova²

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The Plate Archive of the Main Astronomical Observatory (Golosyiv, Kyiv) will be described. It includes about 85 thousands plates which have been taken for various astronomical projects during 1950-2003. Among them there are more than 60 thousands plates containing stellar, planetary and active solar formations spectra and more than 20 thousands of direct northern sky area plates (mostly of wide field). The catalogues of those wide field plates have been prepared in computer-readable form. Now they are adapted to WFPDB format and will be integrated in it in the near future.

Activities at Belgrade Astronomical Observatory on Collecting of Data and Their Organization in a Database

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For a number of problems in astronomy and physics a large number of different data is needed, so that the organization of such data in databases is obviously of interest. Problems where such databases are particularly important, are for example modelings of stellar atmospheres as well as of different laboratory and technological plasmas, spectra synthesis and radiative transfer calculations. In order to complete as much as possible Stark broadening data needed for astrophysical and laboratory plasma research and stellar opacities calculations, we are making a continuous effort to provide Stark broadening data for a large set of atoms and ions. Since the organization of obtained data in a database is useful to scientific community, we are also making a continuous effort to develop in Astronomical Observatory a database "BELDATA", which will contain Stark broadening data, but also in the future stellar catalogues published in Astronomical observatory and publications of Astronomical observatory. Moreover, on Belgrade Astronomical Observatory and other old observatories, a large amount of photographic plates with observational data are stored. An international effort is to digitalize such plates and include them in Sofia and Belgrade databases. In Belgrade, work on databases with various data of interest for physicists but also for astronomers is also in course in the Institute of Physics. Laboratory for Gaseous Electronics has been trying for several years to set up a database for swarm data and the cross sections normalized to swarms. Also, plans are to include numerous measurements of various collision cross-sections between electrons and various molecules performed in Belgrade. In this contribution we will discuss the organization of various data of interest for astronomers and physicists in databases. Also, activities at Belgrade astronomical observatory on collecting data and their organization in the database BELDATA with the discussion of some similar activities in the Institute of physics, will be presented.

A Tool for Identifying Astronomical Plates

Thierry Pauwels

Koninklijke Sterrenwacht van België

In this paper we present a tool to identify astronomical plates or CCD frames of which the right ascension, declination and scale are unknown. CCD pixels need not to be square. At input a list of (x, y)-coordinates of stars should be supplied to the programme together with a ‘magnitude’ of the star. This magnitude needs not to be accurate, but is only used to determine which star is brighter than which other star. The programme then finds configurations of stars and tries to identify them in a data base of stellar configurations. Usually, most of these configurations will not be found, because e.g. a star in the catalogue may be listed as brighter than another one, while on the plate or frame, using another photometric system, it may be fainter. Other configurations may get a wrong identification, because somewhere else in the sky there is a similar configuration. However, 3 or 4 correct identifications, which then cluster in a small region in the sky, are enough to identify some stars and find the exact right ascension and declination of the centre of the plate. As a minimum the plate should cover about 10×10 square arcminutes and contain a few tens of GSC stars for the programme to work.

Catalogue of Wide-Field Plate Archives: Version 5.0

Katya Tsvetkova, Milcho Tsvetkov

Institute of Astronomy, Bulgarian Academy of Sciences

The updated version 5.0 of the Catalogue of Wide-Field Plate Archives (<http://www.skyarchive.org>) since March 1st, 2005 is presented. This version includes additionally the original name of the telescopes used for observations, which enables the plate search in the observatories. The Catalogue includes information for 414 archives made in the astronomical observatories world-wide since 1879 up to 2002. The distributions of 2 204 725 wide-field plates by different parameters as used telescopes (type, aperture, focal length, scale), period of observations, number of direct or spectral observations, archive type (table or computer-readable form), as well as inclusion in the WFPDB and location of the archives, are given.

The VO in Sunlight

Andre Csillaghy

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The European Grid of Solar Observations (EGSO) is a grid testbed funded by the European Commission's Fifth Framework Program under its Information Society Technologies (IST) thematic priority. This 3-year project was designed to provide enhanced access to solar and related data around the world. The services provided by EGSO can be accessed through different interfaces. The main access is a Web-based Graphical User Interface (GUI) that allows the user to access the services offered by the grid in a common and integrated way. Also, an Application Programming Interface (API) is available in the SolarSoft tree, that allows access to the services from IDL applications. Furthermore, various dedicated web interfaces allow to access individual catalogs built in the framework of this project, such as the Solar Event Catalog (SEC), the Solar Feature Catalog (SFC), and the Unified Observing Catalog (UOC). In this paper we present the final version of the Grid, featuring the latest GUI, the new IDL API, as well as the access to the different catalogs and registries that help resolving complex queries and route them through the appropriate nodes of the Grid. The featured version of the GUI also provides users with a new function that helps them to search for instruments based only on some observational characteristics. In this final version, all major and recent solar data sets are now accessible from EGSO. EGSO is also closely coupled to the Collaborative Sun-Earth Connector (CoSEC), another virtual observatory-related project, from which it uses processing services. More information about EGSO can be found under <http://www.egso.org/>

IMAGE SEQUENCE PROCESSING

Super Resolution Reconstruction of Multispectral Images

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Super resolution reconstruction of images aims at obtaining a high resolution image from a set of low resolution observations [1]. The last few years have also seen an enormous interest in the application of such techniques to compressed or uncompressed video sequences [2]. Very recently, the existing super resolution approaches have started to be applied to multispectral and hyperspectral images. In this work we study the application of Bayesian Super Resolution techniques to multispectral images. Images of different spatial resolution taken in different bands are combined to improve their resolution [3,4]. Experimental results are presented on Landsat 7 Enhanced Thematic Mapper data.

References

1. Moon Gi Kang; Chaudhuri, S. (eds); Super-resolution image reconstruction. IEEE Signal Processing Magazine, Volume: 20, Issue: 3, May 2003.
2. L.D. Alvarez, R. Molina, and A.K. Katsaggelos, High Resolution Images from a Sequence of Low Resolution Observations, in Digital Image Sequence Processing, Compression and Analysis., T. R. Reed (ed.), ch. 9, pp: 233-259, CRC Press, 2004.
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Spatial Segmentation of Image Sequences Based on their Time Activity

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There are many applications in medical imaging where one is interested in finding the areas of the image that exhibit the same time activity. Such applications occur in positron and single photon emission imaging as well as in perfusion studies with magnetic resonance imaging (MRI). In this talk we will present Bayesian methodology based on clustering to solve this problem. At first the dimensionality of the pixel observations is reduced using a probabilistic principle component model along the spatial dimension of the data. Then, a multidimensional Gaussian mixture model with spatial constraints is used for clustering. Examples from MRI perfusion studies of the heart and the brain will be shown.

ICRF CCD Images Data-Base — Methods of Image Processing

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The astrometric division of Astronomical Institute of the Romanian Academy began the observations for connecting optical and radio reference systems. We obtained till now, a significant amount of astronomical data which will become our new CCD Images Data-Base regarding ICRF extra-galactic radio-sources. The drawback of narrow-field astrometric observations was overcome by using overlapping FITS frames, in order to include in the final image enough reference stars to compute an accurate plate solution. The paper shows the methods of stacking and overlapping images with application to open clusters used as astrometric calibration regions.

Characterization of Visual Interaction within Eye Movement Data

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²*School of Electronics and Electrical Engineering,*

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To create a visual modality of interaction, one needs to understand the spatial distribution of eye gaze data as the eye fixates on objects of interest within a scene, specifically the dispersion of the (x,y) points of gaze from the point where the subject perceives himself to be looking at. Additionally there is the issue of performance in deciding whether the computed point of gaze is the proper point of gaze, which also requires proper pre-processing (filtering) of the data. In this regard the question arises as to how much data to collect in order to be enough to make such decisions.

To address the above needs, we analyze data collected during eye gaze sessions (1) to investigate of the interrelations between the movement along the x- and y-axes, and (2) to produce a dynamic model of the eye movement during fixation. We consider two fixation patterns: one dot of diameter 2 mm in the geometrical center of the computer screen; and a mesh of nine points spanning the whole screen. The latter is normally used as part of the equipment calibration. Data are collected at a sampling rate of 60 Hz, which is enough to provide a good account of the system dynamics.

The analysis presented here is conducted in a dynamic fashion and involves multivariate statistical tools, such as static and dynamic principal component analysis (PCA) and subspace identification. Such techniques are data-driven and projection based to enable the extraction of significant variation and to clip off insignificant and redundant information (Russel *et al.*, 2000; Qin, 2003). The techniques used do not suffer from the same inherent problems as conventional system identification tools, as often reported in the research literature (MacGregor *et al.*, 1991; Wise and Gallagher, 1996).

To enhance the data analysis, a filtering technique is introduced here with the aim of removing erroneous data points. Analyzing eye gaze trace data reveals that a total of four state variables are found, which account for accurate dynamic description of the equation of motion. This is consistent with the physiological description of eye movement for objects moving in a plane perpendicular to the visual axis.

References

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Compression of Astronomical Images by means of Polyspline Wavelets

Ognyan Kounchev¹, Damyan Kalaglarsky²

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We present a new approach to compression of images which is based on a new multivariate spline paradigm, see O. Kounchev "Multivariate Polysplines. Applications to Numerical and Wavelet Analysis", Academic Press, 2001. An essential property of the polyspline wavelets is that their support is elongated - this is important for the sparseness of the representation of two-dimensional images. Not less important is that they enjoy many beautiful algebraic properties embedding them in the framework of the Multiresolution Analysis. One should compare our alternative approach to data compression with other paradigms, as the curvelets of E. Candes, D. Donoho, New tight frames of curvelets and optimal representation of objects with C^2 singularities, *Comm. Pure Appl. Mathematics*, 2004, and with another recent paradigm in a similar direction, see E. Le Pennec, S. Mallat, Sparse geometric image representations with bandelets, preprint, submitted, 2003. Let us note some recent applications of curvelets to astronomical data representation with which we will make a numerical comparison, see J.L. Starck, D.L. Donoho and E.J. Candes, Astronomical Image Representation by the Curvelet Transform, http://www-stat.stanford.edu/beamlab/aa_cur02.pdf

Efficient Video Communication over Lossy Channels

Aggelos K. Katsaggelos

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Supporting video communication over lossy channels such as wireless networks and the Internet is a challenging task due to the stringent quality of service (QoS) required by video applications and the many channel impairments. Two important QoS characteristics for video are the degree of signal distortion and the transmission delay. Another important consideration is the cost associated with transmission, for example, the energy consumption in the wireless channel case and the cost for differentiated services in the Internet (with DiffServ) case.

Emphasis will be primarily given on video compression for transmission over wireless channels, but similar results can be obtained for transmission over networks with differentiated services. We consider the joint adaptation of the source coding parameters, such as the quantization step-size and prediction mode, along with the physical layer resources, such as the transmission rate and power. Our goal is to provide acceptable QoS while taking into account system constraints such as the energy utilization. We propose a general framework that allows a number of “resource/distortion” optimal formulations for balancing the requirements of different applications.

Cluster Analysis of Faint Galaxies in Hercules Void (1600+18)

Georgi Petrov¹, Josef Fried², Aleksei Kniazev³

¹*Institute of Astronomy, Bulgarian Academy of Sciences*

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³*European South Observatory, Garching, Germany*

Over 1800 faint galaxies, detected in 1 sq. degree field, centered at 16h00m + 18deg00m (1950) — Hercules void were analysed using cluster analysis technique. The data base contains coordinates, large diameters, axis ratios, position angles, magnitudes, effective radii and surface brightness at 50 to 25 mag/sqr.sec isophote. Different methods of separation and grouping were discussed. Preliminary classification of the objects, based on concentration index is presented. Groups of primeval and low surface brightness galaxies were defined.

Motion Estimation Techniques in Super-Resolution Image Reconstruction. A Performance Evaluation

Dacil Barreto, Luis D. Alvarez, and Javier Abad

University Institute of Applied Microelectronics, University of Las Palmas de Gran Canaria, Gran Canaria, Spain

For a number of problems involving image sequences, a good motion estimation is a crucial task. In particular, when obtaining a high resolution image or video sequence from a set of low resolution images [1], the quality of the estimated motion plays a critical role in the performance of the high resolution algorithm. In this paper, we evaluate two different non-parametric motion estimation techniques, one based on a block matching method [2] and the other based on the optical flow equation [3], to obtain sub-pixel displacements between frames. We will also consider the local quality of the displacement map to improve the high resolution estimations [4].

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GRID-VIRTUAL OBSERVATORY

Bulgarian Involvement in the European Grid Operations

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This work describes the Bulgarian participation in the European Grid Operations that currently are implemented under the EGEE (Enabling Grids for E-sciencE) FP6 project. The project aim is to build on recent advance in grid technology and develop a service grid infrastructure in Europe which is available to scientists 24 hours-a-day. One of the main activities in this project is the activity SA1 - European Grid Support, Operation and Management. This activity create, operate, support and manage a production quality European grid infrastructure which provide computing, storage, instrumentation and informational resources at many resource centers (RCs) across Europe accessible to User communities and virtual organizations in a consistent way according to agreed access management policies and service level agreements.

This paper presents overview of our contribution in the following directions: Middleware deployment and resource induction, VO and user support, accounting, monitoring, and Grid management. Bulgarian Grid users can find the answer of the question how their applications could be run on this grid infrastructure.

The Russian Virtual Observatory: Recent Developments

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The Russian Virtual Observatory (RVO) has been officially recognized as one of the key projects of the Scientific Council on Astronomy of the Russian Academy of Sciences since December 2001.

The ultimate goal of the RVO initiative is to integrate resources of astronomical data accumulated in Russian observatories and institutions, and to provide Russian data to the rest of the world. RVO will be merged naturally into the International Astronomical Observatory. Another goal of the project is to provide Russian researchers with on-line access to the rich volumes of data and metadata that have been and will continue to be produced by astronomical survey projects.

The recent activity in these directions is rather manifold:

- collection of information about all available Russian and some former Soviet Union astronomical data resources, their classification and registration in the registries of other VO projects;
- digitization of plates and construction of an electronic library, containing scans of the plates, obtained in Russian observatories;
- mirroring of principal world databases;
- construction of a special collection of links to useful resources, called Internet Resources in Astronomy (IRinA), that will be based on a multi-level classification scheme and will include comprehensive list of national resources.

RVO architecture, main tasks and roadmap are discussed in the presentation as well.

Interlinking between IBVS and WFPDB

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We describe a pilot project for creating links between databases (Wide-Field Plate Database, WFPDB) and electronic journals (Information Bulletin on Variable Stars, IBVS). The project aims closer connections between scientific papers and the data they are based upon. The merits of a paper can be evaluated better (both before and after publication) if the data used is accessible, which gives a possibility of its re-use - one of the goals of the Virtual Observatory.

The observational data archiving in astronomy is well established for large (mainly space-born) projects. Archives can be easily built for Big Science (*e.g.*, MAST at STScI, with literature links described by Padovani (2002). Accomazzi *et al.* (2004) describe possible standards to refer to data stored in archives. Another possibility for data archiving is given by the journals in which the research paper, based on the given data-set, is published. Data tables associated to the A A papers are being archived at CDS. IBVS archives data tables along with papers (Holl, 2004).

In IBVS there are published papers based on photographic plate material. As the WFPDB (Tsvetkov *et al.*, 1994) is a database storing meta-data on existing all over the world photographic observations (more than 2,200,000 plates in 414 archives), as well as digitized plate images (in the WFPDB version installed in Sofia), we started a pilot project to explore possibilities of interlinking the electronic IBVS with the WFPDB. This project was facilitated by the fact that we scanned with the UMAX flatbed scanner selected plates from the Konkoly Observatory plate collection with 600 dpi resolution as preview plate images and with 1600 dpi as real plate scans. On IBVS side, auxiliary files (tables) were created for some papers with links to the WFPDB entries of the plate material identified in the database. On WFPDB side a possibility of adding publication information (if available) to the database is investigated.

Links:

<http://www.konkoly.hu/IBVS/IBVS.html>

<http://www.konkoly.hu/cgi-bin/IBVSetable?1456-t3.tex>

<http://www.skyarchive.org/>

<http://www.ecs.soton.ac.uk/harnad/Temp/data-archiving.htm>

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Virtual Observatory and Ephemerides of the Solar Objects

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Research in dynamics and astrometry of objects of the Solar system drives us to provide various data useful for the preparation of astrophysical observations from the Earth and from the space, or for the analysis of these observations. At the present time, our web server (www.imcce.fr) allows many users to get, on a large time interval, accurate positions of the objects of the Solar system, the planets but also the natural satellites, asteroids and comets. The advent of the Virtual Observatory will offer new facilities in order to cross information from various sources, thanks to the use of international standards. Thus we intend to develop new web services concerning the Solar system objects in this specific context of interoperability: data base of their physical and orbital characteristics, physical ephemerides (i.e. aspects), ephemerides of their positions, astrometric tools for image processing and orbital reconstruction.

Analysis of a Set of Multiband Images in the Framework of a Virtual Observatory

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In the framework of a Virtual Observatory a same sky region may be observed with a high number of spectral bands. Even for few bands, it is not easy to match the objects identified in each image and to get consistent measurements. An approach based on a fusion image is proposed. Different algorithms were tested for building such an image. The best results are obtained from the one which takes into account a deconvolution with a wavelet approach.

Multiscale algorithms allow us to increase the detection rate compared to classical ones based on a pixel thresholding. The measurements of all the objects are then done from the radial profiles. This allows us to get consistent measurements from images obtained with different filters.

The main difficulty lies in the photometrical classification. The number of significant classes increases very rapidly with the number of bands. Principal component analysis, based on photometrical correlations, does not allow us to reduce the number of classes by an important factor. Instead to search to identify all the photometrical classes, it is possible to describe the spectral distribution as a superimposition of different pure element ones. This mixing can be due either to a true object superimposition or to the description of an intermediate class as the interpolation between different pure elements. The proposed method starts from a classification built from photometrical ratios. The source separation is then done by a CLEAN-like algorithm.

Converting European-Pulsar-Network Data to XML

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XML is becoming the standard VO format, in particular for the VO-Table. During the last few years I worked, with a student of mine (who is at Lindau, MPI fuer Aeronomie, at the moment) to convert data from the standard EPN-format to XML-format. At some stage, I had opened an E-mail conversation with several people working on the VO standards and they had shown strong interest, but due to strong diversions from other activities, I did not manage to pay a visit in the States, etc. The converter is finished and I could give a first description of it. Two years ago, a preliminary presentation was given at a pulsar conference in Crete. The idea behind this project was to use some standard tools that have been developed for either the R-language project or Matlab, for which XML-parsers exist to open new mathematical tools for pulsar research.

POSTERS

Using Data of VO to detect X-ray Astrophysical Sources and Their Application to the Theoretical Investigations

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In this paper we discuss how Virtual Observatories can help us in our investigations pointed to X-ray astrophysical objects in particular close binaries with accretion flows. It is known that emission from accretion discs irradiates by X-rays, which spectrum gives properties of the studying object. Due to analysis of the VO data we may compare the observational results with our theoretical research. We explain here, the necessity of expanding a further VO toward X-ray observational data.

Digitizing Plates of Natural Planetary Satellites: Observations of High Accuracy of the Past

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Many plates were taken from 1967 to 1998 of the systems of natural satellites of Mars, Jupiter and Saturn at the U.S. Naval Observatory in Washington DC. Most of these plates have been reduced at a time where star catalogues were not enough accurate and dense to ensure a good astrometric reduction. The arrival of new accurate catalogues such as the UCAC2 and, in the future, the GAIA catalogue, make valuable the scanning of selected plates from which the positions of the satellites will be used for the improvement of the dynamical models of motions

StarGazer - towards to the WFPDB Integration

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We describe a new development of the StarGazer (SG) — star field visualization system and its integration to the Wide-Field Plate Database (WFPDB; www.skyachive.org). The SG astronomical software system is designed for star field visualization based on stellar and deep-sky objects catalogues (YBS, SAO, Tycho, GSC-ACT, USNO A2) within a database over 60 million objects. Written in Perl, the web-based client-server architecture is used, powered by PostgreSQL as a search engine (www.skyarcvhive.org/stargazer). We are reporting the support of variable star catalogues like GCVS in StarGazer and the new attempts of automatic identification of the stars on the digital images and digitized photographic plates.

Wide Field Plate Archive of the Crimean Astrophysical Observatory: Status and Perspective

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Nauchny Crimean Astrophysical Observatory

The patrol photographic observations in the Crimean Astrophysical Observatory were initiated by Shajn. The plate archive of observatory contains about 11,000 plates from three collections obtained in 1935-1998. Photo-visual and photographic magnitudes of direct plates are limited of 12.5m - 16.5m and 14m - 18m. The main characteristics of about 12% plates are described in the computer-readable form and in a list in the tabular form and submitted to Global WFPA catalogue. At present the created data base is added by information for other plates and in future to integrate in WF-PDB the scanning of plates will be made. Some results of using of plate archive to astrophysical tasks are briefly presented.

Photometric Study of the FU Orionis Object BBW 76 from the Bamberg Observatory Southern Sky Survey

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The Bamberg Observatory Southern Sky Survey provided 95 photographic plates with the FU Orionis object BBW 76, clearly detectable in the time interval 1963-1976. We perform aperture photometry of BBW 76 from the scanned with the Epson Expression 1640 XL flatbed scanner 2x2 degrees area near target star. For each plate a transformation of plate magnitude to the GSC 2.2 magnitudes in B photographic band was found out for selected reference stars, and used for deriving B magnitudes of BBW 76. The analysis of the photometric behaviour of BBW 76 is presented.

Processing of the Eruptive Prominence Images

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The films of eruptive prominences (EPs) registered at the Astronomical Institute of the Wroclaw, Poland University (1979 and 1980 years) were digitized with the automatic microdensitometer at the National Astronomical Observatory Rozhen, Bulgaria.

The basic algorithms for processing of the digitized prominence images, determination of the kinematic parameters (velocity and acceleration) of the EP, as well as the dynamics and the evolution of the EP internal structure, are considered.

GridBased Detection of Galaxy Clusters Using Virtual Observatory Methods

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A new method for a simultaneous search for clusters of galaxies in X-ray photon maps and optical galaxy maps is described. The merging of X-ray and optical data improves the source identification so that a large amount of telescope time for spectroscopic followup can be saved. The method appears thus ideally suited for the analysis of the recently proposed wideangle X-ray missions like DUO and ROSITA. As a first application, clusters are extracted from the 3rd version of the ROSAT AllSky Survey and the Early Data Release of the Sloan Digital Sky Survey (SDSS). The time consuming computations are performed within the German Astrophysical Virtual Observatory (GAVO). On a test area of 140 square degrees, 75 X-ray clusters are detected down to an Xray flux limit of $3 \times 10^{-13} \text{ erg s}^{-1} \text{ cm}^{-2}$ in the ROSAT energy band 0.1-2.4 keV. The clusters have redshifts $z \leq 0.5$. The survey thus fills the gap between traditional largearea Xray surveys and serendipitous Xray cluster searches based on pointed observations, and has the potential to yield about 4,000 X-ray clusters after completion of SDSS (P. Schuecker *et al.* in "Astronomy & Astrophysics", A&A 420, 6174, 2004).

Observation in the Past with MAO NAS of Ukraine Plate Archive

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The Plate Archive of the Main Astronomical Observatory (MAO) of the National Academy of Science of Ukraine includes 20 thousands of direct sky area plates, which have been taken for various astronomical projects for period of about 50 years. These plates contain more than hundred thousand images of minor planets with magnitude up to 16.7m. About 10% of minor planets, which can be found on our archive plates were firstly discovered after time when plates have been taken. So we can rediscover them by so called “observation in the past” and obtain their positions for the improvement of the dynamical models of its motions. Other Solar System bodies for which we try to get those “observation in the past” are external planets satellites. The objects choose criteria, methods of search, identification and determination of position are discussed. First results of asteroids and external planets satellites search in MAO plate archive are presented.

Gamma Ray Bursts Analyses on EN Network Plates

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Astronomical Institute Ondrejov

The Optical Monitors, both photographic and CCD, despite of lower detection limits, are still valuable for detection of prompt real-time and (hypothetical) pre-burst optical emission of gamma-ray bursts. We refer on the ongoing project at the Astronomical Institute in Ondrejov based on digitized data from the photographic EN network.

TCA Kyiv Wide-Field Plate Catalogues Presented in the WFPDB

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The Main Astronomical Observatory of the National Academy of Sciences of Ukraine in Golosiiv (Kyiv, Ukraine) possesses 14 wide-field plate archives. The first archives are recently included into the WFPDB. Here we present the basic information for these archives obtained with the 10cm, 11cm and 15cm Three Cameras Astrographs (TCA) in the period 1955 - 1961. The total number of plates in these archives is 967 plates. Astrometry was the main observational programme. The plate catalogues are available on-line at <http://www.skyarchive.org>.

The Novel Method for Identifying Fast Optical Transients on Digitized Astronomical Archival Plates

Rene Hudec, Lukas Hudec

Astronomical Institute Ondrejov

We report on the novel method how to identify brief optical transients (OTs) on digitized astronomical archival photographic plates. This method does not require identification of all objects and their comparison with the catalogue, but rely solely on the information included in the particular plate itself. Examples of analyses on multiple exposed 40 cm ESO GPO telescope plates from the ROB archive will be presented and discussed.

Image Presentation in the Wide-Field Plate Database

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The image presentation has recently been a huge challenge to the on-line database access systems. The Wide-Field Plate Database (WFPDB) mostly contains very large images (images that do not fit in the memory of a PC). The images are retrieved by digitization of wide-field photographic plates. We discuss how the image data is stored in a database and how it can be accessed via an on-line web-based system. The Discrete wavelet transform along with appropriate coding are applied to make possible efficient data presentation and provide convenient access to the images, facing many specific requirements, e.g. network bandwidth limits, fast image retrieval, limited storage space, etc

Inclusion of the DSA Kyiv Wide-Field Plate Catalogues into the WFPDB

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The archives made with the 12 cm Double Short focus Astrograph (DSA) of the Main Astronomical Observatory of the National Academy of Sciences of Ukraine in Golosiiv (Kyiv, Ukraine) in the period 1949 - 1990 are included recently into the WFPDB. The total number of plates in these archives is 2041 (tube A) and 2142 (tube B).

Nonextensive (Tsallis) and Generalized (Renyi) Entropies and Their Application to Signal and Noise Modelling in Wavelet Transform Space

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We discuss the application of Tsallis or nonextensive entropy, as well as Shannon (Boltzmann-Gibbs-Shannon) entropy, to image retrieval. We also look at Renyi or generalized entropy in the context of signal modelling using Gaussian mixture models. In all cases we employ the wavelet transform.

The MAO NASU Plate Archive Database: Current Status and Perspectives

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The online database of the MAO NASU plate archive is constructed on the basis of the relational database management system MySQL and permits an easy supplement of database with new collections of astronegatives, provides a high flexibility in constructing SQL-queries for data search optimization, PHP Basic Authorization protected access to administrative interface and wide range of search parameters. The current status of the database will be reported and the brief description of the search engine and means of the database integrity support will be given. Methods and means of the data verification and tasks for the further development will be discussed.

Historical Jan Fric's Plates at the Ondrejov Observatory

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There are 45 historical plates taken by small aperture cameras in the years 1895/96 by Jan Fric (brother of the founder of the Ondrejov Observatory) in Prague and located in the archive of the Ondrejov Observatory. We will present details on these plates. Most of the plates were taken with the goal to improve the photographic process used at that time for astronomical imaging. The limiting magnitude is mag 13 in the best cases. These efforts were interrupted in January 1897 by the death of Jan Fric at an age of only 34 years.

Adaptive Filter Applications in Surface Photometry of Galaxies

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We expose the need for filtering in surface photometry and the variety of filters used. We present the essence of adaptive filtering and its advantage over the alternatives. Illustrations of the 2-dim adaptive filter applications for smoothing and intervening objects cleaning in galaxy images are produced.

The Optimal Information System Contained in the Digitized Photographic Plates and CCD

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The images obtained from digitization of photographic plates or directly from CCD camera is put in a standard graphic format, compressed or uncompressed. After the image processing, the result is stocked in a standard graphic format (the most common formats are FITS and TIFF). Each time when is necessary to obtain new information, the image must be reanalyzed. When a comparison with other images (of the same area) is made, the whole set of images must be reanalyzed. Besides, in the processing moment, some information with a certain level of uncertainty may be existing. Because of those aspects, it is necessary to exist a representing system of the information for any area which contains, for each image, at least the following elements: the position of the celestial object, the shape (after the reducing operation in comparison with the other objects from same image), the variation of the light intensity, the uncertainly level of each information that has been inferred. Beside that, the final image will contain not only results obtained from “mixing” of all images from that area, but also the information from catalogues. Practically, these representing systems, judged from the point of view of obtained data, will be formed by two subsystems: a static subsystem – that contains data for each image and a dynamic subsystem – resulted by the inquiries of the static subsystem that will contain the “mixing” result of all images and catalogue data. From the functional point of view, the system will contain the data part and the dynamic inquiries part, made in such way that the update of all databases to be made automatically. So, the user is seeing the whole system as a relational database, that can be accessed directly by him, or by other software applications and so the image files are no more used.

Implementing Ephemerides Facilities in the Vizier and Aladin Tools of the CDS in Strasbourg

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The Institut de mecanique celeste et de calcul des ephemerides (IMCCE, Paris Observatory) is willing to provide information on Solar System objects to the Astronomical Virtual Observatory. The first step is the interconnection of IMCCE ephemerides servers with the Vizier and Aladin tools of the Centre de donnees astronomiques de Strasbourg (CDS). The services have been made interoperable, using the International Virtual Observatory standard VOTable. A request related to the position of asteroids made by users of Aladin or Vizier is transmitted to the ephemerides servers of IMCCE and the answer is quickly and automatically returned. Equipped with this new facility, Aladin allows in particular users to explore photographic archives stored at CDS, observatory archives accessible through Aladin, or to process their own images, in order to identify asteroids. The ephemerides are obtained from a numerical integration using as initial conditions the orbital data extracted from the Lowell database of asteroids. This work is still in development but, at this stage, the method is well established and we intend to give access to this tool in a few months.

Archiving the Solar System Objects of the Next GAIA Space Mission

William Thuillot, Magda Stavinschi

IMCCE-Paris Observatory

The future space astrometric mission GAIA will map the Galaxy in the 2011-2015 period. Global astrometry of billions of astrophysical objects will be performed during this survey. Among them many new Solar System objects, in particular fast moving objects, will be discovered. We thus expect to discover several hundred of thousands of small moving objects. But several problems appear : the need to get a fast identification and to be able to discriminate between the well-known objects and the new ones, the need to quickly compute accurate orbital parameters for these ones in order to be able to identify them in the following observations by GAIA and to avoid their loss. For these goals we propose to carry out actions before the mission, mainly the development of accurate ephemerides of all objects of the solar system, and the set-up of a dedicated network of observers and automatic/robotic stations for observations on alert in the framework of a follow-up program. Archives, data mining and VO facilities will play a fundamental role for these actions.

Bamberg Northern Sky Survey: Catalogue and Incorporation in the WFPDB

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The Bamberg Northern Sky Survey is a part of the observational programme of the Dr. Remeis Observatory in Bamberg, started in 1928 by E. Zinner. The aim was investigation of variable stars in the Northern hemisphere together with the observatory in Babelsberg (Potsdam, Germany). The sky divided into zones (-4, 10, 24, 40, 53, 70 and 90 degrees) actually was completely covered by 6400 Bamberg plates obtained in the period 1928–1962 with the Ernststar telescope (aperture 13.5 cm, focal length 24 cm, scale 859"/mm). Here we present the computer-readable catalogue of these observations, recently included into the WFPDB and accessible online.

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