BIGSKYEARTH

Big Data Era in Sky and Earth Observation
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COST
EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

Research Matchmaking: Building Bridges Between Disciplines

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Book of abstracts

INTRODUCTORY TALKS:

Overview of funding opportunities

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Brief review of several lines of possible funding for projects initiated within scope of Big-Sky-Earth COST actions will be given. I will touch on H2020 MSC, LEIT-ICT, LEIT-SPACE schemes as well as FET. Mainly I will focus on calls which close toward the end of the year and during 2017. Also, I would like to point that consultations for new calls during 2018-2020 are in progress and, if you want to have your input considered, you should get in touch with your national representatives in different field as soon as possible.

Experience with H2020 proposals

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Gottfried Schwarz is a graduate of the Technical University of Munich and since many years he has been involved in a number of national and international space projects with the German Aerospace Center (DLR) at Oberpfaffenhofen near Munich (Germany). In particular, he has been engaged in the design of deep space instruments from initial engineering studies to detailed design work, modelling of instrument performance, instrument assembly and testing, real-time experiment control, instrument check-out and calibration, signal processing, image data compression, feature analysis, classification, data verification and validation as well as data processing and scientific data analysis, in particular of optical and SAR remote sensing data, interpretation of geophysical data with emphasis on retrieval algorithms with inversion techniques, and data mining.

Big Volunteered Geographic Information for context-aware navigation

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The amount of data each organization has to deal with today has been rapidly growing. The huge volumes of data appear as an opportunity to improve various applications, including routing and navigation services. However, the analysis of large datasets, commonly referred to as "Big Data," has been a huge challenge due to the lack of suitable analysis tools and adequate computing resources. In parallel, the rapidly growing number of crowdsourcing platforms also generates huge volumes of volunteered geographic information (VGI), which also requires analysis to reveal their potential. How existing techniques for dealing with Big Data could be useful for the analysis of VGI remains an open question, since VGI differs from traditional data. In this chapter, we focus on examining the latest developments and issues associated with big data from the perspective of the analysis of VGI. This chapter notably explores the current state of Big Data; it highlights the opportunities that are created by the emergence of Big VGI and crowdsourced data on improve routing and navigation services, as well as the challenges that remain to be addressed to make this a reality. As such, it suggests some avenues for future research on the next generation of collaborative routing and navigation services.

I am currently an assistant professor at Department of planning and development, Aalborg University Copenhagen, Denmark. I commenced my PhD in Oct 2008 at the University of Vienna (Univie) focusing on simulation of land use/cover changes dynamics supervised by Prof. Wolfgang Kainz, and finished it in April 2011 with excellence. My dissertation was awarded by Springer for publication as an outstanding PhD thesis. While doing my PhD, I was appointed as a funded research scholar at the University of North Carolina at Charlotte (UNCC) in 2009. After my PhD, I was appointed as a

postdoc research assistant at the Univie for one year. While pursuing my PhD in Vienna, I had the opportunity to become a consultant at the United Nations office in Vienna as a Remote Sensing/Geoinformation expert and share my expertise with experts, end-users and global disaster managers. Thereafter, I was offered a postdoc position from Heidelberg University since April 2012. While doing my duties in Heidelberg University, my research proposal as an early career researcher was granted by the Humboldt foundation, which is a globally-known prestigious fellowship. My research project was on "Crowdsourcing spatial information from citizen science projects" for duration of 2 years within Jan 2013 – Jan 2015. Thereafter, I was appointed as a senior scientist at GIScience research group, Heidelberg University until March 2016. My research interests include, but NOT limited to:

Geographic Information Science, Geocomputation, Spatial Planning
Remote Sensing and spatio-temporal monitoring of Environment
Geosimulation and Agent-Based Modeling for Environmental Phenomena
Volunteered Geographic Information and Crowdsourced Mapping
Disaster management and risk analysis/mapping
Big data, Data Science

Progress of the PERICLES FP-7 data preservation project

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PERICLES (Promoting and Enhancing the Reuse of Information throughout the Content Lifecycle exploiting evolving Semantics) is an FP7 project started on February 2013. It aims at preserving by design large and complex data sets. PERICLES is coordinated by King's College London, UK and its partners are University of Borås (Sweden), CERTH- ITI (Greece), DotSoft (Greece), Georg-August-Universität Göttingen (Germany), University of Liverpool (UK), Space Application Services (Belgium), XEROX France and University of Edinburgh (UK). Two additional partners provide the two case studies: Tate Gallery(UK) brings the digital art and media case study and B.USOC (Belgian Users Support and Operations Centre) brings the space science case study. PERICLES addresses the life-cycle of large and complex data sets in order to cater for the evolution of context of data sets and user communities, including groups unanticipated when the data was created. Semantics of data sets are thus also expected to evolve and the project includes elements which could address the reuse of data sets at periods where the data providers and even their institutions are not available any more. PERICLES uses the Linked Resources Model (LRM) instead of the OAIS standard.

In the space science case associated with PERICLES. B.USOC supports experiments on the International Space Station and is the curator of the collected data and operations history. B.USOC has chosen to analyse the SOLAR payload flying since 2008 on the ESA COLUMBUS module of the ISS as the PERICLES prime space science case. Solar observation data are prime candidates for long term data preservation as variabilities of the solar spectral irradiance have an influence on earth climate. The nature of the data to be preserved for the reuse of the current SOLAR series is much more extended than a simple set of time tagged tables of spectral irradiances, it is an important inventory of more than 50 classes of documents and/or metadata directly relevant to SOLAR, it includes not only the calibration elements and their evolution during SOLAR lifetime but also all tools used as the software's and versions used in interpretation.

In order to foster potential user's present and future needs, there is an ongoing survey involving a community of practice, this community of practice was started at a previous Big-Sky-Earth meeting and had already three electronic meetings.

B.USOC and the other partners are now involved in the definition of a demonstration scenario for the space case, the projects ends in February 2017 and will constitute the seed for a Long Term Data Preservation programme in B.USOC.

Christian Muller is responsible for the science support and knowledge management at B.USOC, the Belgian User Support and Operation Centre which is part of the ESA USOC distributed network for the International Space Station science activities, B.USOC is facility responsible centre for the SOLAR package which monitors solar spectral irradiance for atmospheric chemistry, climate and space weather applications. It will support also the WHAT and ASIM payload on the study of the upper part (sprites and elves) of strong lightning. It supported and maintains the data of the French CNES satellite PICARD on sun characterization by observation of irradiance and diameter. Outside of the earth-space science domains, it supports the Fluid Science Laboratory on the ISS and any payload that ESA or Belgian authorities would assign it. From the data point of view, B.USOC has a mandate to distribute the data requested by the PI's and to maintain a repository of all data acquired. B.USOC participates in two FP-7 projects: ULISSE and PERICLES which aim at data distribution and preservation, the evolution of the ESA data policy will probably extend the present mandate to long term data preservation and even the generation of scientific products.

Application of Signal Processing on networks for Big Data problems

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The idea of the proposed projects is to explore recent advances and to launch new methods in the area of Networks in Signal Processing, in order to treat high-dimensional data.

In particular, the following topics will be of interest:

1. Deep learning and wavelets/filters on networks and their applications to Big Data in Astronomy and Earth observations.

2. Investigation of various constructions of wavelets/filters on networks and their applications to analyzing Big Data arising in Sky and Earth observations.

3. Applications of the above methods to problems in Big Data arising in Sky and Earth observations, from regularly structured Networks, and Networks arising from irregular domains, as multi-sensor, wireless networks, transportation networks, etc.

Ognyan Kounchev's Research interests:

• Mathematical Methods for Image processing of Big data • Potential Theory and Applications to Inverse problems in Geophysics and Geomagnetism; • Approximation Theory, Spline Theory, Moment Problems, Numerical Analysis; • Visualization of Big data - applications of polysplines to design; • Harmonic Analysis and especially Wavelet Analysis; • Mathematical Finance

VLF Data Acquisition and database storing

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The ionosphere, having characteristics of plasma, is very sensitive to electromagnetic disturbances whose intensity mainly vary with solar activity. In the past few years, we study the influence of solar perturbations on the terrestrial ionospheric D-region by analyzing the amplitude and phase time variations of very low frequency (VLF) radio waves emitted by VLF transmitter all over the world and recorded by the AWESOME and ABSPAL receivers in Belgrade in real time. Naturally, there is a need to store these huge amount of collected data. Here, we will try to present a need of central database storing, its current stage and growing need for exchange with peoples from other fields of science.

Statistical Study for Empirical Fragment Distributions and Shape Estimation of Meteoroids

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We consider a meteoroid shape estimation technique based on statistical laws of distribution for fragment masses. The estimation of initial meteoroid shape is very important, since it affects the meteoroid pre-entry mass, terminal meteorite mass, and fireball luminosity. However, its reconstruction is complicated. The meteorite fragments of the same meteoroid do not match each other due to incomplete recovery as well as melting and ablation. Nevertheless, many studies consider the ablation to be weak after the major fragmentation. Therefore, the resulting mass distribution does not experience significant changes. Moreover, the brittle shattering process has fractal properties, namely the self-similarity for scaling mass sequences described by power law.

The idea to reconstruct initial meteoroid shape is derived from the experiments demonstrating that brittle fracturing produces multiple fragments of size lesser than or equal to the least dimension of the body. The number of fragments depends on fragment masses as a power law with exponential cutoff. Since the empirical density distribution of recovered fragment masses is discrete, we convert it to the piecewise complementary cumulative distribution function. Then, we conduct a normalization procedure, equaling fragment masses at the point of lower mass constraint. Next, the least-squares method is applied to fit the sought-for analytical distribution into the empirical one. Once the mass constraints and cutoff value are obtained, we estimate dimensionless shape parameter and size proportions for initial pre-entry meteoroid. Thus the scaling exponent essentially indicates the initial form of the fragmented body. We successfully applied the technique of scaling analysis to the empirical data on the mass distributions for Kosice, Sutters Mill and Bassikounou meteorites.
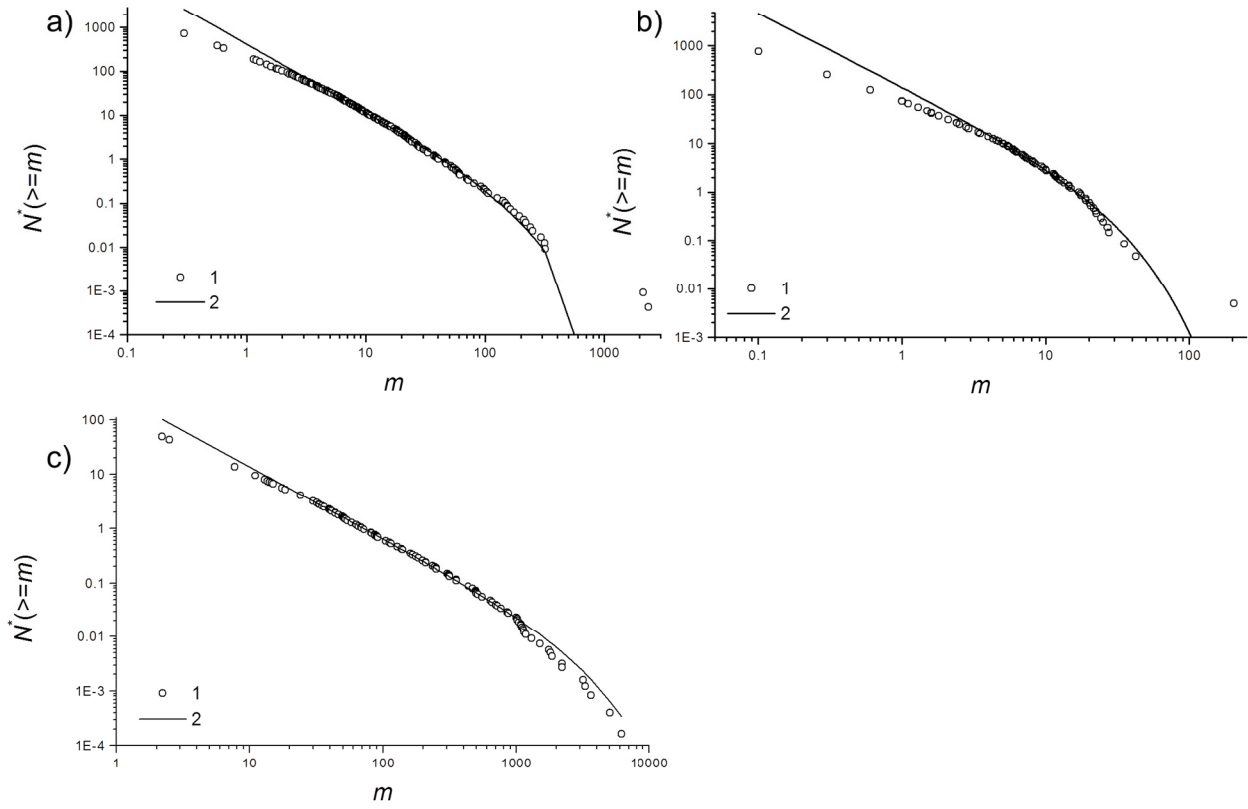
Fig.4. Complementary cumulative number of fragments $N^*(\geq m)$ vs m.
1 – Observed data, 2 – Power law distribution with exponential cutoff.
a) Košice: $\beta_0 = 1.53$, $m_L = 5.64$, $m_U = 155.17$.
b) Sutter's Mill [4]: $\beta_0 = 1.51$, $m_L = 5.0$, $m_U = 21.0$.
c) Bassikounou [5] : $\beta_0 = 1.32$, $m_L = 29.9$, $m_U = 2839.42$.

Information visualization for massive data

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Recently, the amount of data being collected from various devices, sensors, networks, transactional applications, web and social media, sky and earth observations has been constantly increasing. Data in technologies and sciences are usually high-dimensional, where data items are described by some features. It is difficult to understand these data without additional processing. Visualization aims to provide data in some visual form that would assists the human beings to gain insight into the data, to understand and comprehend them, and directly influence a further process of decision making. The advantage of visual analysis is that it is much easier to detect or extract some useful and meaningful information from the graphical representation of data than from raw numbers. A variety of visualization approaches have been developed. Some of them aim to represent each data feature in a visual form (matrix of scatter plots, parallel coordinates, Andrews curves, etc.). The others are based on dimensionality reduction, where data dimensionality is reduced to two or three, and the obtained data are represented on 2D or 3D scatter plots (principal component analysis, multidimensional scaling, self-organizing maps, etc.). It allows to see data similarities and relationship between data items. Selection of visualization approaches depends on data characteristics as well as the aim to be reached. Moreover, problems arise when massive data should be visualized. The astronomy and earth observations are ones of scientific fields that generate huge amount of data. Here it is confronted not only to time- and computer resource-consuming problem, but also to effective ways of graphical representation of such data.

Olga Kurasova received the doctoral degree in computer science (Ph.D.) from Institute of Mathematics and Informatics jointly with Vytautas Magnus University in 2005, Lithuania. She is a senior researcher at Vilnius University (Institute of Mathematics and Informatics) and an associate professor at Lithuanian University of Educational Sciences. Her research interests include data mining methods, optimization theory and applications, artificial neural networks, visualization of multidimensional data, multiple criteria decision support, big data analysis. She is the author of more than 50 scientific publications. She was a supervisor of three Ph.D. students, who successfully defended their doctoral dissertations. Currently, she is a supervisor of four Ph.D. students.

Consequences of meteoroid impacts based on atmospheric trajectory analysis

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One of the important steps in the prediction of an impact threat to Earth raised by potentially hazardous asteroids is the understanding and modeling of the processes accompanying the object's entry into the terrestrial atmosphere. Such knowledge enables characterization, simulation and classification of possible impact consequences. For observed meteor events the reconstructed atmospheric trajectory is the key to deriving the pre-impact meteoroid's orbit in the Solar System on the one hand, while on the other hand, it is also a required for dark flight simulations which enables us to follow any surviving meteorite fragments all the way down to the ground. Using dimensionless expressions, which involve the pre-atmospheric meteoroid parameters, we have built physically based parametrisation to describe the changes in mass, height, velocity and luminosity of the object along its atmospheric path. The developed model is suitable to estimate a number of crucial unknown values including the shape change coefficient, ablation rate, and surviving meteorite mass. It is also applicable in the prediction of the terminal height of the luminous portion of flight and therefore, the duration of the fireball. Besides the model description, we demonstrate its application using the wide range of observational data from meteorite-producing fireballs appearing annually (such as the Annama, Košice and Neuschwanstein fireballs) to larger scale impacts (such as the Chelyabinsk, Sikhote-Alin and Tunguska events). In particular, this approach enabled us to recently recover the Annama meteorite which was observed from 3 stations of the Finnish Fireball Network on 19 April 2014.

Maria Gritsevich's group at Finnish Geospatial Research Institute studies various space geodetic and astronomical observing techniques covering different wavelengths: from very long baseline interferometry (VLBI) and radar, to satellite laser ranging (SLR) and passive optical observations. In addition, the remote sensing techniques are complemented by laboratory measurements. Their research topics range from fundamental electromagnetic scattering processes and different inverse problems for both natural and artificial space objects, to quasar source structure

# Spectropolarimetric measurements and reference data collection using FIGIFIGO

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We present an overview of the Finnish Geodetic Institute's field goniospectrometer, FIGIFIGO, and highlight its capabilities for spectropolarimetric measurements of various targets under actual field conditions. The design concept of this custom made instrument has proven to have a number of advantages, such as a well designed, user friendly interface, a high level of automation, and an excellent adaptability to a wide
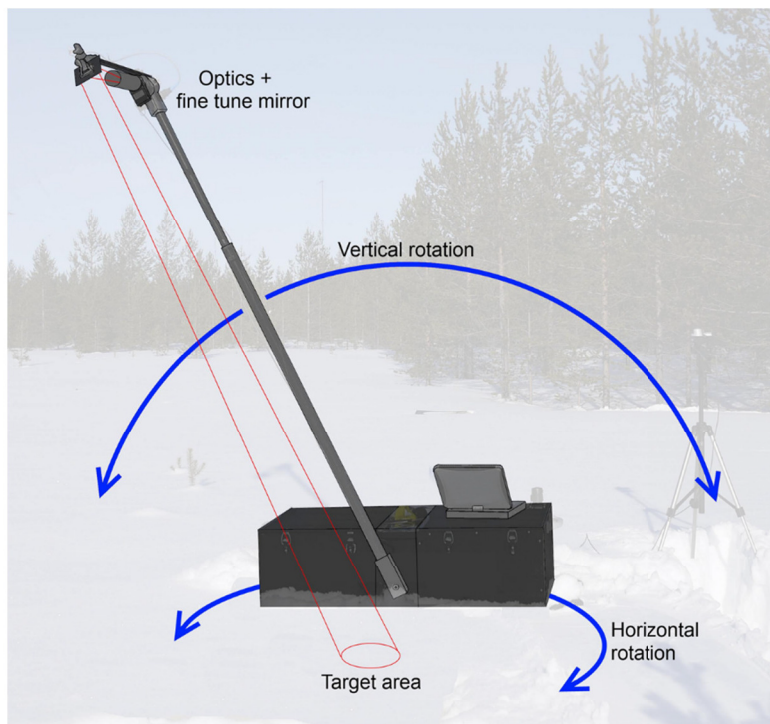
range of weather conditions during field measurements. The instrument communicates via a control computer which has a simple user-friendly interface. This allows users to quickly and easily set up optional parameters prior to the collection of a measurement series. The setup and operation of the instrument is fast and efficient, both in the laboratory and under actual field conditions. It is battery powered and very portable, making it feasible to transport it by plane, car, boat, or sledge. The system includes a sky camera to detect the orientation of the goniometer and a pyranometer to monitor the synchronous illumination conditions. The instrument's mirror can be finely adjusted to apply small spatial corrections to the optical chain. Recent refinements in the calibration of the system has significantly improved the accuracy of the measurements and correspondingly, improved the acquired data's reliability. Experience gained from using the instrument has provided the operators with useful

and practical information on how to operate the instrument in more efficient and accurate manner. FIGIFIGO has been used to measure the reflectance properties of hundreds of different targets, such as snow, various types of vegetation, meteorites, planetary analogues, sand, gravel, as well as many man-made targets. The potential use of the results from these measurements are diverse; including their use as ground truth references for remote sensing studies, testing and validation of theoretical scattering models, estimating climate change over time, measuring other ecological effects caused by changes in land cover, and more generally, to aid in the identification and analysis of both seasonal, and nonseasonal variations of targets of interest.

Maria Gritsevich's group at Finnish Geospatial Research Institute studies various space geodetic and astronomical observing techniques covering different wavelengths: from very long baseline interferometry (VLBI) and radar, to satellite laser ranging (SLR) and passive optical observations. In addition, the remote sensing techniques are complemented by laboratory measurements. Their research topics range from fundamental electromagnetic scattering processes and different inverse problems for both natural and artificial space objects, to quasar source structure

Neural Networks-Based Massive Multidimensional Data Visualization

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Characteristics of today's world, such as globalization, dynamics and often unpredictable changes, huge amounts of data, are being observed on any of its entities. As telescopes, detectors, and computers grow ever more powerful, the volume of data will enter the petabyte domain. It is often desirable to visualize a big or massive dataset with more than three features. The visualization of such multidimensional data is highly important in data mining because of providing a specific means for the knowledge discovery. When data are becoming increasingly large we require more effective ways to process, analyze and interpret these data in more comprehensive form by visualizing the data. Like many other fields, astronomy has become a very data-rich science, driven by the advances in telescope, detector, and computer technology. The most classical visualization methods are unsuitable for massive datasets. In this research, we focus on neural networks-based methods for the visualization of massive multidimensional datasets (such as astronomical datasets).

Some specific unsupervised learning methods, including SAMANN (a feed-forward neural network to learn Sammon's mapping) and SOM (Self-Organizing Map), can be used to cope with data processing time problem. The strategy that can decrease the passes of training data up to the only one when training neural networks is based on the assumption that huge amount of data includes many similar objects. After the training, network can be used for decision support – any number of new objects can be converted to meaningful form, i.e. presented as points on the plain. Further research should be on the discovering new domains (e. g., astronomical data, streaming data analysis) where massive multidimensional data are required to be visualized when reaching proper human decisions.

Physical Interpretation of big optical data from planetary and terrestrial surfaces

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Data of Earth and planets are nowadays not only huge but very varying. Physical analysis needs calibrated measurements that can be fed to models and processed to yield further physical quantities. Often, one data set cannot give enough information for useful interpretation, but when one can combine several different sets, much more can be recovered. One key question is to find from all available sets the ones that best complement each others, and are of sufficient quality for quantitative analysis. The next question is to design new measurements most optimally.

We work especially on bidirectional, polarimetric and spectral reflectance data of Earth and planetary surfaces. We have several field and laboratory measurement facilities, and develop new radiative transfer and electro-magnetic scattering models and numerical techniques for complex particulate media. We look for cooperation at least in the following fields

- radiative transfer modelling,
- electromagnetic scattering techniques,
- laboratory measurements,
- exotic field expeditions,
- spectral databases,
- polarisation,
- UAV remote sensing,
- new satellites,
- planetary rovers,
- analogy simulations,
- multi sensor data,
- calibration,
- new inversion and analysis tools.

We don't have now any specific project or call in mind, but we are ready to participate or coordinate suitable H2020 or ESA projects, if enough scientific challenge.

Machine Learning tools for Photo-Z redshift reconstruction

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The expansion of the universe causes the spacing of galaxies that are gravitationally bound. During this expansion, we get a modified galaxies radiation, their spectra are shifted to the red. Two categories of methods have been developed to measure the photometric redshift. The first category consists of template fitting methods that adjust SED (spectral energy distribution) and require the construction of models for comparison. The second category of methods consists of empirical methods that use spectroscopic redshift to calibrate the learning algorithm and overcome the problems of uncertainty within models built using template fitting method.

Artificial neural networks are one of among the efficient empirical methods used for photo-z redshift reconstruction. They are learning techniques that have been widely used to solve regression and classification problems. Yet anyone looking to use a multilayer artificial neural network in a given application is facing many questions related to the choice of the architecture: What is the number of hidden layers and how to select the number of neuron in each layer? The question that arises just after holding the components of the network is, how to know that this choice is reliable? If it is not, how do we know that? Wrong choices may lead to bad quality of learning and bad performance of the built network. Many questions that researchers have tried to answer, but the task remains difficult.

Our current work deals with such questions, and moreover is taking into account the future explosion of collected datasets, as in SDSS or LSST projects.

Storage and indexing of point cloud data

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Very large true three--dimensional (3D) point datasets, as opposed to the previously common 2.5D data sets, are progressively more common nowadays, such as from Light Detection and Ranging (LiDAR).

Increasingly, attempts are made to exploit these 3D point data sets beyond mere visualization. However, current Spatial Information Systems provide only limited 3D support. Even commercial systems advertising in-built, 3D data types provide only minimal functionality. Particularly, there is no effective means of indexing large 3D point datasets, which is crucial for efficient analysis and engineering usage. One such target system are Mobile Mapping Systems (MMSs) for infrastructural monitoring and mapping, which are becoming more prevalent as the availability and affordability of solutions that generate high accuracy geospatial data has matured.

Spatial indexing for 3D point clouds is in most cases still realized through 2D solutions, such as R-tree and quadtree. During my research we have analyzed the use of octrees instead for effective indexing of point clouds. Going forward, I would like to investigate alternative solutions to effective storage and indexing solutions that support true 3D capabilities of the data set.

The Digitized Markarian Survey and the Armenian Virtual Observatory

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Markarian Survey (or the **First Byurakan Survey**, FBS) accomplished in 1965-1980 was the first systematic low-dispersion spectroscopic survey of the sky and until now is the largest by its sky coverage (17,000 sq. deg. area covered by 2000 photographic plates, each 4x4 deg.) and the number of available spectra (~40,000,000 spectra for ~20,000,000 objects). 1515 UV-excess (Markarian) galaxies are its main product, as well as a number of other projects were carried out with this observing material. In frame of a collaboration between the Byurakan Astrophysical Observatory (BAO, Armenia), La Sapienza Università di Roma (Italy) and Cornell University (Ithaca, N.Y., USA), its plates were digitized in 2002-2005 and the **Digitized First Byurakan Survey (DFBS)** database was created (http://www.aras.am/Dfbs/dfbs.html). Each plate is 176 MB and the full database is 400 GB. Each spectrum is 107 pixels long with an average resolution of 50 A. DFBS portal is active in Rome (http://byurakan.phys.uniroma1.it/) and Trieste (http://ia2.oats.inaf.it/archives/1). A number of research projects based on the DFBS were conducted and accomplished, including search and study of asteroids (with IMCCE, Observatoire de Paris, France), optical identification of IR, X-ray and radio sources (partially with Hamburger Sternwarte, Germany), search for new QSOs, etc. Some other digitization projects were accomplished in BAO, such as part of the Second Byurakan Survey (SBS), FBS Blue Stellar Objects photographic spectra obtained with 2.6m telescope, chain images of Coma region for variability studies of the blazar ON 231, etc. Later on in 2015, a project was conducted for digitization and scientific usage of the whole BAO Plate Archive (http://www.aras.am/PlateArchive/eng/index.php). It is aimed at the creation of a full electronic database and interactive sky map for further studies and scientific usage. The **Armenian Virtual Observatory** (ArVO, http://www.aras.am/Arvo/arvo.htm) was created in 2005 based on the DFBS. ArVO project development includes the storage of the Armenian archives and telescope data, direct images and low-dispersion spectra cross-correlations, creation of a joint low-dispersion spectral database (incorporating other similar data) and a number of other science projects. A number of national projects have been developed in different countries since 2000, and the **International Virtual Observatory Alliance** (IVOA; www.ivoa.net) was created in 2002 to unify these national projects and

coordinate the development of VO ideology and technologies. At present it involves 18 national (including ArVO) and 2 European projects (based on ESO and ESA). To share our data and contribute in planetary data, we also participate in **International Planetary Data Alliance** (IPDA, https://planetarydata.org) activities. To be integrated in world scientific data and exchange data, BAO also has joined in 2013 the **International Council of Scientific Unions (ICSU) World Data System (WDS**, https://www.icsu-wds.org). The idea is to share data coming from various areas of science and technology for future more efficient research in any field. BigSkyEarth collaboration is an excellent example where data obtained in Sky and Earth exploration may be combined, exchanged and contribute to joint research.

Simulations of galaxy formation in the era of Gaia

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At present the Gaia satellite is mapping the Milky Way in 3D. I will present some of our simulations of galaxy formation and some interesting open questions that can be addressed using them as a means to invite ideas for collaboration. I will also mention our visualisation software for such simulations.

I lead the Galaxy Dynamics group at UCLan. We are studying aspects of galaxy formation relevant to the Milky Way and the huge Gaia dataset that will be arriving soon. These simulations are also directly relevant to interpreting LSST data. I am taking a lead role in bulge science data with LSST.

Application of remote sensing data to environmental monitoring, assessment and planning

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The Consortium of companies Oikon Green Infrastructure Ltd. and Gekom-geopyhsical and ecological modeling Ltd. is interested in application of remote sensing data in environmental monitoring, assessment and planning. Our research and commercial portfolio covers climatological, hydrological and hydrodynimical modelling, geostatistics, spatio-temporal modelling and raster GIS, machine learning methods, as well as natural resource management (spatial planning, agriculture, aquaculture, forestry, renewable energies, game management, etc.). Our expertise was applied to following major projects related to application of remote sensing data:

- Land use/land cover for Croatia (CORINE Land Cover Database for Croatia), Implementation of CORINE Land Cover - CLC2006 in the West Balkan Countries
- Mapping the habitats of the Republic of Croatia - terrestrial and benthic habitats (3-year project), including Modelling spatial distribution of the Croatian marine benthic habitats (Landsat ETM+) – 3 published articles in journals cited in Current Contents
- Analysis of vegetation status (MODIS) – using NDVI, GPP (daily gross primary productivity) and NPP (annual net primary productivity). Project: Monitoring of forest ecosystem health in the area of development of Multipurpose channel Dunav-Sava
- Air quality from space (PMx) for pollution mapping: mapping of PM10 concentration for Croatian territory using MODIS Terra and Aqua Aerosol Optical Depth and modelled meteo data (applying neural networks) within EUREKA !5460 WEBAIR-2 project (1 published article in journal cited in Current Contents)

We are interested in:
-meteo/ocean remote sensing data (cloudiness, waves, wind, currents, sea level, temperature, chlorofill, transparency, etc.) for meteo/ocean numerical models

validation (diagnostic and prognostic), mapping, monitoring and spatial analyses of other (related) environmental variables for development of services in field of marine safety, sustainable planning of aquaculture and fisheries, marine structures development, as well as in planning of adaptation measures to climate change (related to coastal erosion due to sea level rise, impacts of climatic variables on marine life, etc.).

-monitoring, modelling and mapping of air quality parameters in cities on a high spatial resolution (less than 1 km) using remote sensing data on atmospheric composition–aerosols, ozone, nitrogen, etc.

-application of remote sensing atmospheric data for renewable energy assessment and forecasting (solar, wind, hydro), as well as application of such data in domains like health and agriculture.

-application of remote sensing data for updating of habitat maps, allowing more reliable trend assessments of habitat areas and ranges

-monitoring of forest ecosystem health and forest carbon sink

Transient events in LSST survey data

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Large Synoptic Survey Telescope will be a large ground-based telescope system which will provide sky survey in unsurpassed details. One of the modules will be time-domain astronomy and detection of transient events.

In order to properly design the system, a simulation framework is required to optimize algorithms to large data volumes and frequent events. In this talk, Alert Simulator will be presented. This will be a software package that will simulate detection of transient events well in advance of first light. Its main goal will be to test the performance of event brokers/CEP engines as well as various failures or exceptional/extreme modes of operation.

An unmanned airship platform for remote sensing and astronomy applications

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HiperSfera (eng. HyperSphere) (www.hipersfera.hr) airship is specifically designed for a slow flight or hovering, for all-weather long-endurance performance and for high-mass & high-power payload – the type of flying platform needed for hi-value broadband mass-markets, next generation remote sensing with a high temporal and spatial resolution, and low-cost stratospheric astronomy and aeronomy. From the start, HiperSfera is designed for persistent, robust, reliable, and efficient fleet operations. It has the ability to perform critical real-time tasks previously deemed technically impossible or economically unfeasible. HiperSfera's scalable design enables airships of various technical specifications (e.g. useful payload, operational altitude, endurance). Extended endurance and industrial grade payload capability make this kind of aerial platform especially suitable for Big Data applications and use cases.

As a remote sensing platform, a fleet of HiperSfera airships can, through continuous imaging, directly connect a physical reality of large portions of the ground with the end-users over the internet. As such, it can be an irreplaceable tool for disaster management, search and rescue operations, border security, early warning against forest fires, poachers, or illegal lodging, high resolution vegetation monitoring, traffic optimization, and any other application in a need of continuous high-resolution remote sensing.

As an astronomy and aeronomy platform, HiperSfera is ideal for lifting instruments and telescopes to the stratospheric altitudes to avoid clouds, aerosols and more than 99.9% of water vapour, which is the key contributor to the atmospheric opaqueness in part of the mid-IR and all of the far-IR regions. An additional benefit of stratospheric airship telescopes is their ability to regularly exchange, upgrade or repair their instruments. This would transform stratospheric astronomy into a low cost research platform. A high altitude is also ideal for detection and investigation of transient atmospheric phenomena, such as meteors or sprites. At such altitudes the viewing angle can be closer to the horizon due to more transparent atmosphere, which provides a much bigger sampling volume of the atmosphere. Airships can also be used as a calibration targets for ground telescopes.

HiperSfera

Innovative Aeronautical Solutions to Global Societal and Market Challenges
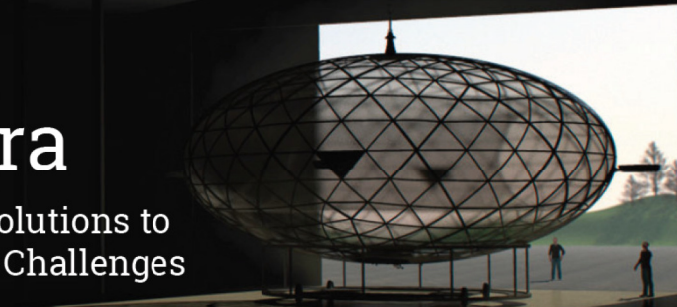
Bojan Pečnik, Chief Executive Officer. Bojan got his PhD in Physics and Astronomy from Ludwig-Maximilians University, Munich, Germany. His extensive experience covers scientific, entrepreneurial and public sectors. He taught undergraduates at the University of Split, founded a first aerospace R&D startup in Croatia. He was a managing director at the tech incubator and he is a Board Member of the Croatia's Naval Institute.

Interactive rich-media data visualization for the masses

Dejan Vinković

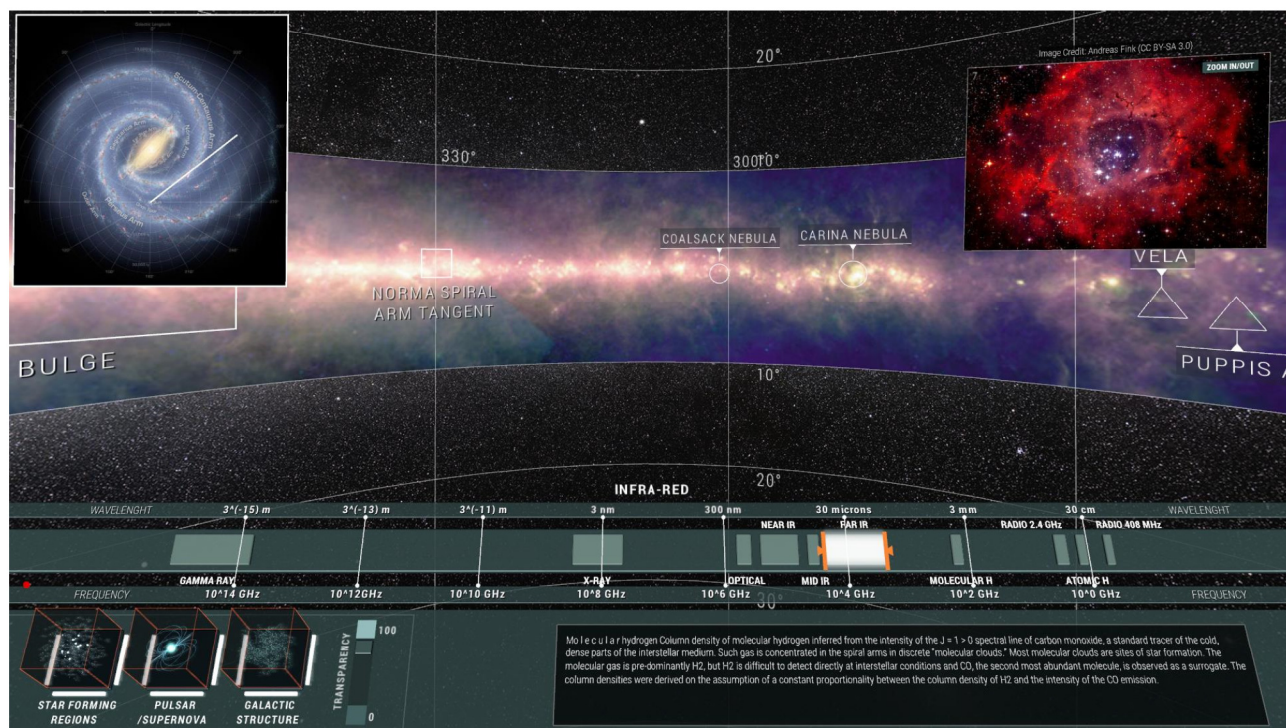*Science and Society Synergy Institute, Croatia*

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Pixelibris (www.pixelibris.com) is envisioned as a web repository of attractive science and mathematics presentations, visualizations and other learning resources using real-time, interactive, "rich media" tools and applications to illuminate various science concepts. Most of our presentations are made in Ventuz (www.ventuz.com). Ventuz is a real-time graphics content creation, authoring and playout control software. We chose Ventuz because of it is ease of use, versatility and scalability. Because we also want to improve and expand upon our projects and make them available across many platforms, our mission is to make Pixelibris a place for collaboration and knowledge sharing.

The project started an experimentation with visualization of Mars remote sensing planetary data. The final result was an interactive visualization of Mars geology, space landing missions and search for water on Mars. It was shown to the public at various events – science picnics in Croatia and Poland, science fairs, and Long Night of Museums. Now the visualizations include a star and planet formation storyline, the multi-wavelength view of the Milky Way, 3D distribution of stars with planets, visualization of spherical harmonics, the math of virtual 3D camera geometry, etc.

We are also considering possibilities for transforming these visualizations into a formats suitable for virtual reality headsets. The current booming market of these devices opens new possibilities for this type of data visualization experience.

Dejan's research interests cover diverse topics like radiative transfer in dusty environments, dust dynamics in protoplanetary disks, circumstellar dust, meteors, planetary cratering, biomechanics, socioeconomy, predictive models of elections and unemployment, and utilization of GPUs for scientific numerical modelling. He is a professor at the Physics Department, University of Split, and the founder and executive director of Science and Society Synergy Institute (www.iszd.hr), a private non-profit institute devoted to scientific research and incubation of independent research projects. He was as a co-organizer of various events and projects, including a scientific expedition to Mongolia in 1998 that detected for the first time in history an extremely rare phenomenon of anomalous meteor sounds. He was PI and co-PI on grants of supercomputing time from NCSA and co-I on HST Observing Program. (www.vinkovic.org)

COST
EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

BIGSKYEARTH
Big Data Era in Sky and Earth Observation
TD COST Action TD 1403

20°

Image Credit: Andreas Fink (CC BY-SA 3.0)

ZOOM IN/OUT

330°   300°10°

COALSACK NEBULA   CARINA NEBULA

VELA

NORMA SPIRAL
ARM TANGENT

10°

BULGE

PUPPIS A

20°

INFRA-RED

WAVELENGHT	3^(-15) m	3^(-13) m	3^(-11) m	3 nm	300 nm	30 microns	3 mm	30 cm	WAVELENGHT

NEAR IR   FAR IR   RADIO 2.4 GHz   RADIO 408 MHz

GAMMA RAY		X-RAY	OPTICAL	MID IR	MOLECULAR H	ATOMIC H	
FREQUENCY	10^14 GHz	10^12GHz	10^10 GHz	10^8 GHz	10^6 GHz	10^4 GHz	10^2 GHz	10^0 GHz	FREQUENCY

30°

STAR FORMING
REGIONS

PULSAR
/SUPERNOVA

GALACTIC
STRUCTURE

TRANSPARENCY
100
0

Mo l e c u l a r hydrogen Column density of molecular hydrogen inferred from the intensity of the J = 1 > 0 spectral line of carbon monoxide, a standard tracer of the cold, dense parts of the interstellar medium. Such gas is concentrated in the spiral arms in discrete "molecular clouds." Most molecular clouds are sites of star formation. The molecular gas is pre-dominantly H2, but H2 is difficult to detect directly at interstellar conditions and CO, the second most abundant molecule, is observed as a surrogate. The column densities were derived on the assumption of a constant proportionality between the column density of H2 and the intensity of the CO emission.

HR EN PL

Geografia
MARSA

Misje na
MARSA

Woda na
MARSIE

mapa
kolorowa

mapa
wysokości

mapa
geologiczna

x10

powiększenie
różnic wysokości

OLYMPUS
MONS

JASKINIE NA
MARSIE

THARSIS

NOCTIS
LABYRINTHUS

KRATER
ZUMBA

KRATER ZUMBA

Położenie:

28.68°S   133.18°W

Bardzo młody, i dlatego dobrze zachowany krater. Średnicy 3,3 km, 620m głębokości, krawędź wznosi się 200 metrów ponad okoliczne równiny utwardzonej lawy. Ciekawy dla naukowców, ponieważ nie jest znacznie erodowany i zasypany. Tylko Zumba i podobne młode kratery zawierają płytkie doły, które mogą pochodzić z interakcji rozżarzonego materiału i wody / lodu w głębi przy uderzeniu.

GALERIA

Search for meteors in astronomical image databases

Dejan Vinković

Science and Society Synergy Institute, Croatia

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Even though meteor science has a long history of meteor observation, we still lack detailed understating of the microphysics of meteor plasma and its interaction with the Earth's ionosphere. The observational problem is that meteors have a large angular size in the sky and they randomly appear in time and direction, which makes them a difficult target to explore by high-resolution high-sensitivity imaging detectors. The emergence of wide-field survey telescopes opened a possibility for exploring meteors with big telescopes utilizing sensitive imaging detectors and high quality photometric fluxes. Such telescopes have a long enough time coverage of a significant fraction of the sky to collect a relevant sample of low-brightness meteors. However, a large quantity of imaging data requires a fast automatic detection of meteors on astronomical images. We have been developing a Linear Feature Detection Software in python, specialized for astronomical images and capable of detecting lines of various brightness levels. The algorithm has been applied on the SDSS database and it can be expanded to other imaging databases.

Dejan's research interests cover diverse topics like radiative transfer in dusty environments, dust dynamics in protoplanetary disks, circumstellar dust, meteors, planetary cratering, biomechanics, socioeconomy, predictive models of elections and unemployment, and utilization of GPUs for scientific numerical modelling. He is a professor at the Physics Department, University of Split, and the founder and executive director of Science and Society Synergy Institute (www.iszd.hr), a private non-profit institute devoted to scientific research and incubation of independent research projects. He was as a co-organizer of various events and projects, including a scientific expedition to Mongolia in 1998 that detected for the first time in history an extremely rare phenomenon of anomalous meteor sounds. He was PI and co-PI on grants of supercomputing time from NCSA and co-I on HST Observing Program. (www.vinkovic.org)

Integrating remote sensing and socioeconomic data

Dejan Vinković

Science and Society Synergy Institute, Croatia

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High spatial resolution of socioeconomic data, intertwined with demographic, political and policy data, can be further expanded in data dimensionality by remote sensing data coming from satellite or airborne sensors. Social, economic and political trends or changes are often triggered, or sometimes heavily driven, by environmental factors that can be detected and monitored over time by remote sensing techniques. These situations are amplified in periods of unstable social and economic preconditions, such as the economic crisis in recent years or the legacy of local wars or natural disasters.

A typical remote sensing data of interest are land cover and land use classification or temporal monitoring of weather extremes (droughts, floods, extreme temperatures, etc.). These data are contextualized through the comparison with temporal changes in social, economic, demographic and political data. Remote sensing is also important for evaluation of policy measures aimed at improving local agricultural land use, creating conditions for positive demographic changes, reducing ecological footprint, or supporting infrastructural projects for mitigation of the impact of weather extremes.

We are currently focused on Croatia, due to our specific local needs. What make these data so interesting are economic and socioeconomic extremes within Croatia. For example, eastern parts of Croatia have one of the highest unemployment rates in EU, especially among youth. But this is also a very fertile land, historically heavily involved in agriculture and food industry. Obviously, there has been some dramatic disintegration of social fabric in recent decades that prevents economic utilization of these natural resources, mainly as a consequence of the war in Croatia in 1990's that not only destroyed local infrastructure, but it also decimated human resources. It is, therefore, very interesting to explore temporal remote sensing data and compare this with various social, economic, demographic, political, and policy data of this region over the last decade, when high hopes have been put into the socioeconomic recovery for this region.

Dejan's research interests cover diverse topics like radiative transfer in dusty environments, dust dynamics in protoplanetary disks, circumstellar dust, meteors, planetary cratering, biomechanics, socioeconomy, predictive models of elections and unemployment, and utilization of GPUs for scientific numerical modelling. He is a professor at the Physics Department, University of Split, and the founder and executive director of Science and Society Synergy Institute (www.iszd.hr), a private non-profit institute devoted to scientific research and incubation of independent research projects. He was as a co-organizer of various events and projects, including a scientific expedition to Mongolia in 1998 that detected for the first time in history an extremely rare phenomenon of anomalous meteor sounds. He was PI and co-PI on grants of supercomputing time from NCSA and co-I on HST Observing Program. (www.vinkovic.org)

Machine Learning, spectra, GPU, Cloud

Petr Škoda

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We present the idea of using advanced machine learning techniques for identifying objects with characteristic spectral line profiles in a multi-million spectra archives. The spectral outliers with reasonable information content found in such surveys may also bring new scientific knowledge, but the interative visual verification is required for the proper judgement. We will, therefore, present a special cloud-based distributed engine VO-CLOUD, tailored to such requirements.

Graduated in Astronomy and Astrophysics at the Faculty of Math and Physics, Charles University, Prague 1987. PhD. in Astrophysics 1996. Working in the Astronomical institute of the Academy of Sciences in Ondrejov since 1987 Main interest is devoted to usage of computers in astronomy. Working in stellar spectroscopy (Be stars, novae). Interested in astronomical technology - telescope control, data acquisition, CCD, data reduction (including echelle) and analysis... Scientific advisor of SPLAT-VO development. Involved in Virtual observatory since 2006 - co-author of 3 IVOA standards. Recent years - propagation of Astroinformatics leading bachelor's, master and PhD. theses of students of informatics at several faculties (data mining of massive sets, GPUs). Working on national project Big data in astronomy.

Detection and classification of transient astronomical objects in real time using complex event processing

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Techniques and concepts of Complex event processing (CEP) are extensively used in industries which require low latency and high data throughput. As it is widely discussed, astronomy enters Big Data era (with big metadata as well), where (near) real time data analysis of astronomical events will become necessary. On top of performance achievements which are fine tuned for event-based applications, CEP engines usually offer an event processing language with high level of abstraction (such as SQL-derived or rule-based languages). Our aim is to build a tool for detection and classification of transient astronomical objects based on an existing CEP framework (e.g. Esper). Furthermore, we plan to construct a domain-specific language (DSL) tailored for specific needs of a domain expert (astronomer/astrophysicist).

Other participants

Image processing and analysis for sky and earth observation

The Image Processing Group (IPG) at Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia (http://www.fer.hr/ipg) conducts research in image processing and computer vision with applications in various areas including biomedicine, visual inspection, automotive applications, and astronomy. The main research problems include image enhancement, feature extraction, image segmentation, object recognition, image registration, and motion analysis. We developed a number of image processing and analysis methods, and a system for tiled multi-projector visualizations on flat or cylindrical surfaces for large panoramic visualizations and simulation of virtual environments. In astronmical image analysis we researched methods for crater detection from visible and range images. IPG has available various research equipment. A high-performance computing cluster is used for research of complex information processing algorithms. IPG also has equipment for realization of virtual reality and augmented reality systems including active and passive 3-D stereo visualization of virtual environments, and a position tracking device. Our research group participates in working groups WG2 and WG4. We are interested in collaboration with other groups in BigSkyEarth consortium on problems where our expertise in image processing and analysis can contribute to solution of multidimensional data analysis and visualization challenges. We can also contribute our expertise in software development. For further information please contact prof. Sven Lončarić.

Croatia
Dr Sven LONCARIC
sven.loncaric@fer.hr

Dr. Sven Loncaric is a full professor of electrical engineering and computer science at School of Electrical Engineering and Computing, University of Zagreb, Croatia. He has 30 years of professional experience and has been active in the area of image processing and computer vision research since 1990. He was principal investigator on several research projects and he also collaborated with industry in the area of image processing and analysis, machine vision for visual inspection, and other applications. He completed his Master of Science degree in signal processing at University of Zagreb in 1989. He was a Fulbright scholar and earned his doctoral degree in electrical engineering from University of Cincinnati, OH, USA in 1994. Dr. Loncaric was an assistant professor of Electrical and Computer Engineering at New Jersey Institute of Technology, NJ, USA from 2001-2003. He has published more than 180 papers in scientific peer-reviewed journals and at international conferences. Dr. Loncaric was Chair of the Department of Electronic Systems and Information Processing at the School of Electrical Engineering and Computing, University of Zagreb, Croatia. He is the founder and director of the Center for Computer Vision at University of Zagreb.

Deep Learning methods for satellite enhanced high fidelity pastureland

Practical farming tasks frequently need analysis of pastureland at a level of resolution than is feasible even with observation systems currently under construction. In this case drone based observations incorporating multi- and hyper-spectral imaging are popular. However hybrid models taking account of historical satellite imagery at a lower resolution has the potential to direct and enhance drone based observations. We see potential for cooperation in developing projects based on the downstream use of earth observation data to this end.

Ireland
Dr Robert ROSS
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Robert Ross is a Senior Lecturer in the School of Computing in the Dublin Institute of Technology. Robert's current research focus in on the Interactive Systems and the application of Data Analytics. Robert holds a Joint Honours BSc in Computer Science & Experimental Physics (1st Class) and an MSc by research from University College Dublin, and a PhD in Situated Dialogue Systems from the University of Bremen in Germany.Robert currently has 4 PhD students, and is a collaborator on the Irish multi-regional research centers ADAPT and CeADAR where he coordinates research projects with a number of postdoctoral researchers. Robert is currently applying Data Analtyics and Big Data Science techniques to Business Processes, Statistical Machine Translation, and Behavior Recognition, and looks forward to working with the Earth and Astronomy Communities.

Mining meteorological information from EO data and Numerical Weather Models simulations

Information about atmosphere properties (e.g. Precipitable Water Vapor) can be derived form different EO data (e.g. Aqua/Terra-Modis, interometric SAR, GPS, etc) and Numerical Weather Model (NWM) simulations. Methods to mine this information to assimilate EO data into NWMs is needed to provide accurate weather forecasts at a regional scale.

Italy
Dr Giovanni NICO
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Giovanni Nico (M'00–SM'06) received the Laurea and Ph.D. degrees in physics from the University of Bari, Bari, Italy, in 1993 and 1999, respectively. He is currently a Researcher with the Istituto per le Applicazioni del Calcolo, National Research Council (CNR), Bari. He is also an Adjunt Professor of physics with Politecnico di Bari, Bari, and Università della Basilicata, Matera, Italy. He held visiting positions at the Instituto Dom Luiz, Lisbon, Portugal, and the German Remote Sensing Data Center, German Aerospace Center (DLR), Oberpfaffenhofen, Germany. He was a Postdoctoral Fellow with the Joint Research Centre, European Commission, and

the European Space Agency. His main research interests are in the fields of statistical signal processing, synthetic aperture radar processing, space geodesy and atmospheric physics.

European Project to promote gender balance in the field of astroinformatics and big data science

Most countries participating in this COST action have strong ties with the countries bordering on the Mediterranean. I would like to discuss the possibility for an EU funded project which, by making use of the most innovative e-learning platforms will favor minorities and underrepresented components of our society (i.e. women) to enter this new field of research.

Innovative publishing

I would like to discuss a project aimed at building a new type of e-book, adaptive, interactive and capable to adjust to the needs of a rapidly changing field of activity (using astroinformatics as a template case).
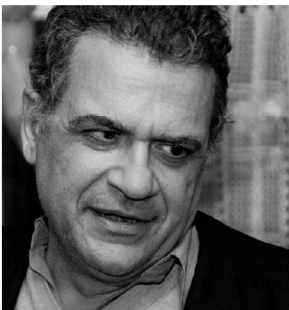
Italy
Prof Giuseppe LONGO
longo@na.infn.it

Giuseppe Longo is full professor of astrophysics at the University Federico II in Napoli, visiting associate at the California Institute of Technology, associate to the Italian National Institute of Astrophysics and a member of the oldest European Scientific Academy (Accademia Pontaniana). He is among the pioneers of the emerging field of Astroinformatics and his main research interests are in the mining and visualization of massive astronomical data sets. For his expertise he has been a member of the NSF panel on interdisciplinary computing, of the Gordon and Betty Moore foundation evaluation panel for the big data project. He has been chairman of the IVOA interest group on Knowledge Discovery in Database, national delegate of the COST Action i-283 "Computational Infrastructures in the Astronomical data grid". Recently he has been appointed to the committee for public outreach of the University Federico II

Bayes, Deep Learning and Big Data applications in Cosmology, data minded scientific education programs

Computational Cosmology has been essentially using all sorts of big data techniques form the very begging of its existence. I personally used Neural Networks for galaxy classification 12 years ago, then Bayesian approach and Markov Chain Monte Carlos methods not only to estimate cosmological parameters but also to forecast the results from future observations and as a side result provide better cost structure of planned experiments. With the advancement of IT and industrial applications of machine

learning the link between industries and scientific communities became of crucial importance. Moreover, the release of deep learning and other AI libraries by large corporations like Google, Facebook, Microsoft provide scientists with unprecedented tools for their data analytic jobs. Also given Amazon's Mechanical Turk project and/or its scientific equivalent GalaxyZoo can make the whole developing world be a part of international scientific research simply by providing high quality data sets. Here, i'd like to present our research and efforts in data minded education, largest available data analytic libraries and advocate for stronger collaboration between industry and fundamental science.

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Big Data 3D Visualization technologies, Computer Simulation, 3D Printing

Collaborative projects to be initiated in the fields of Big Data 3D Visualization technologies, Computer Simualtion, 3D Printing, and dissemination / outreaching toward industry / SME.

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3D Visualization, with focus on 3D printing of landscape and urban models

3D Visualization is an important part of Big Data Analysis both for Austroinformation and geoinformation sciences. It provides better understating compared with other types of traditional visualizations. 3D Visualization can be achieved using computer based virtual system. However in case of education or public awareness, we need real tangible models. 3D printing Visualization is the technology of turning digital data into physical, tangible models. Recent developments in the area of 3D Printing provide the possibility of making arbitrary models with high details and low cost. Depending on the application, the current state of the 3D printing technology offers multi-color and multi-materials for custom models.

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Realtime Data Processing and Visualisation, Data driven scientific process

Yehia Taher is an Associate Professor at the University of Versailles and a member of the ADAM team at the DAVID laboratory since September 2012. He obtained his Ph.D. in Computer Science from Claude Bernard Lyon 1 University – France (2005 – 2009). He was awarded a 3-year Ph.D. scholarship granted by the French Rhône-Alpes local government for investigating the problem of adaptability of Web service based applications. He was also awarded a six-month mobility scholarship granted by the French Rhône-Alpes local government through its Explora'doc scholarships scheme for funding an academic visit he spent – as part of his Ph.D. studies – at the Business Process Management research group at Queensland University of Technology in Australia, under the supervision of Professor Marlon Dumas. This visit served to validate his Ph.D. results from both theoretical and practical perspectives. After his PhD, and prior to join the University of Versailles, he spent more than two years and half at the European Research Institute in Service Science (ERISS) as a postdoctoral researcher. He was mainly involved in three EU projects funded by the European Union, namely: S-Cube, Cockpit, and 4Caast. Within these projects, his research activities revolved around the Service-oriented systems, E-Commerce, E-Government, and Cloud Computing while leading several work-packages, tasks, and deliverables. Apart from his research activities, he is participating to the supervision of many Ph.D. and Masters students. He is also greatly interested in international collaborations; he is currently collaborating in a number of projects with partners from the Netherlands, Brazil, and Lebanon. He has more than 30 publications in international conferences and journals. He is a member of various programme and organization committees of scientific workshops and conferences and acts as a reviewer for a range of major scientific journals.

Yehia Taher
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Open, flexible, and scalable analytics on massive spatio-temporal data

The rasdaman ("raster data manager") Big Array engine allows flexible queries on massive n-D datacubes, such as 2D imagery, 3D image timeseries, 4D cosmological simulations. Aside from the ISO Array SQL candidate standard it offers geo interfaces for spatio-temporal access and analytics - in fact, these standards have been crafted by the rasdaman team. We are seeking collaborations aiming at community services on large-scale earth & sky data sets.

Peter Baumann
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The Gothard Datascope project

We are designing and building the Gothard Datascope, a data analysis system with priorities of optimally fast I/O processes, to support the work with very massive databases. A big capacity of normal architecture and a GPU cluster will also be a component in the Datascope. It will primarily support the computation needs of the Eötvös Loránd University, Hungary. Currently, 20 scientific projects are proposed which we will introduce, while collaborations are warmly welcomed.

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Big data analysis, high-performance computing, optimization

Accelerating the development and deployment of advanced communication technologies and complex databases will require a comprehensive strategy integrating efforts from invention to deployment. The concurrent high-performance computing systems are composed of hundreds of thousands of computational nodes, as well as deep memory hierarchies and complex interconnect topologies. Existing high performance algorithms and tools already require courageous programming and optimization efforts to achieve high efficiency on current supercomputers. On the other hand, these efforts are platform-specific and non-portable. Since most of the existing optimization algorithms and tools are not optimized for modern computer architectures and cannot efficiently exploit massively parallel systems, one aim of our research is to identify and to analyse the general problems and modern trends in this research area.

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Software development partner

We are group of scientists and engineers that are involved in several R&D projects. Currently three projects are ongoing:
1. Consultancy in developing optimization algorithms for workforce optimization. We are hired to research and investigate what is the current state-of-the-art in workforce optimization, and propose a solution that will be built as a part of a current customer software system. Currently we are working in developing solution.

2. Software development partner of leading Big Data Company dealing with raster images.

3. Wearable medical devices. We have R&D a system that integrates wearable medical device measuring heart rate, android phone app and cloud computing application. Currently in negotiation with a private company to implement this solution.

I and my team are open to collaborate on software (and hardware) R&D projects as SME or University partner.

Blagoj Delipetrev
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No title

Spain
Dr Marco QUARTULLI
mquartulli@vicomtech.org

Marco holds degrees from the University of Bari, Italy, and the University of Siegen, Germany. He has worked on remote sensing ground segment engineering, metric resolution image understanding, archive mining and content-based image retrieval for Advanced Computer Systems ACS SpA, Italy and for the German Aerospace Center (DLR), Germany. He joined Vicomtech-IK4 in Spain in 2010. There, he is working on the analysis of very large volumes of high dimensional data for the multimedia and the geospatial analysis domains.