WP5: Dissemination

The **Second AComIn Doors Open Days** were held at IICT-BAS on 17-18 April 2015. The event programme included demonstration of SmartLab devices and software as well as over 40 poster presentations. These posters described new results achieved in the developing of core technologies for simulations and data processing as well as innovative applications of the SmartLab equipment for solving some practical problems. The scientific program of the event also included presentations of eleven AComIn post-docs and of several young scientists from IICT-BAS who carried out research projects using actively the SmartLab devices. The event attracted great interest: it was attended by more than 150 representatives of the State Administration, Ministries and NGOs, as well as scientists from various institutes of the Academy of Sciences and Universities, representatives of Bulgarian companies, students, pupils and citizens. The Doors Open Days were announced and widely presented by several Bulgarian media (TV channels, radios, newspapers and information websites).

Scientific Events Supported by AComIn

The 10th International Conference „Large-Scale Scientific Computations" (LSSC'15) was held on 8-12 June 2015 in Sozopol. The meeting provided a forum for exchange of ideas between scientists, who develop and study numerical methods and algorithms, and researchers, who apply them for solving real life problems. The conference addresses a wide range of recent achievements in the field of scalable numerical methods, algorithms and their applications and gathered more than 120 scientists from around the world. The scientific programme of the event included five plenary invited talks, 10 special sessions and sessions of contributed talks. Seven of the special sessions are directly related to the AComIn project activities. The LSSC'15 proceedings is published as a special volume of Springer Lecture Notes in Computer Science and contains five papers co-authored by AComIn researchers where the project is acknowledged.

The International Workshop „Big Data in Natural Language Processing, Education and Digital Collections" was held on 29 June 2015 in Sofia. The events was aimed at providing a discussion forum for experts investigating hot research issues or implementing novel applications in: Cloud computing, Natural language processing, Information retrieval, Knowledge discovery, Data visualization, Big Data in NLP, eLearning and Digital Collections, Educational analytics, Data analytics for social media, Content development and metadata management, Business intelligence etc. The workshop gathered 18 participants from Bulgaria, USA, Malta, Qatar and Germany and was a very useful meeting where comments and suggestions helped to shape or improve AComIn results in the area of image sentiment analysis and educational analytics.

The 10th International Conference „Recent Advances in Natural Language Processing" (RANLP-2015) was held on 5-11 September 2015 in Hissar. The forum consisted of four tutorials given in two days (5-6 September 2015); main conference (7-9 September 2015) with six invited talks, 56 oral presentations, 39 poster presentations, and a parallel Student Research Workshop with three oral presentations and two poster presentations; as well as five workshops held on 10-11 September 2015, where five invited talks and 46 papers were presented. The event was attended by 164 participants from around the world. The RANLP-2015 proceedings was uploaded at the Anthology of the Association of Computational Linguistics (ACL), USA, and contained three AComIn - related papers with authors from IICT-BAS.

The International Workshop on Information Fusion was held on 25 September 2015 in Sofia. The event was aimed at addressing new challenges, sharing innovative solutions, and discussing future research directions in the area of Information Fusion and signal processing applications. The scientific program of the Workshop included four invited talks and nine scientific presentations. The event was attended by 26 participants from Bulgaria, France, Belgium and Ukraine. Selected papers from the Workshop will be published in a Special Issue of the Journal Cybernetics and Information Technologies.

The Workshop „Advanced Industrial Control Applications" (AICA'15) was held on 8 October 2015 in Sofia with the aim to present, discuss and disseminate the AComIn project results in the areas of control, optimization and intelligent systems, robotic and mechatronic systems as well as their practical applications. The scientific program of the workshop consisted of two invited talks and 15 scientific presentations. The event was attended by 32 participants from several institutes of the Bulgarian Academy of Sciences and Bulgarian universities.

The International Conference „Advanced Computing for Innovation" (AComIn 2015) was held on 10-11 November 2015 in Sofia. It aimed at providing a forum for international scientific exchange between Central/Eastern Europe and the rest of the world in several fundamental for computational intelligence topics enabling radical progress and development of novel applications. The conference was composed of four thematic tracks, a number of special sessions and demonstrations. The scientific program of the event included four invited talks and 41 scientific presentations. Selected papers from the conference will be published as a Special Volume of the Springer's series Studies in Computational Intelligence. The conference was attended by 80 participants from Bulgaria, Sweden, United Kingdom, Italy, Germany, Serbia, Ukraine and FYROM.

The last **AComIn Doors Open Days** will be organized on 15-16 January 2016 in IICT-BAS, Sofia.

AComIn Appreciation

On 14 July 2015 AComIn was presented to the **Mayor of Sofia Municipality** at a Meeting of the Science, Technologies and Innovation Expert Council, associated to the Mayor of Sofia Municipality, held in IICT-BAS.

On 18 June 2015 **Prof. Galia Angelova**, the Coordinator of AComIn, was awarded by the Minister of Education and Science with the **Big Award Pitagor** for successful leadership of international projects.

WP7: Project Management

The fourth AComIn Steering Committee Meeting was held in Sofia on 11 November 2015 immediately after the Closing of the International Conference AComIn 2015. The Progress Report for project year 3 was presented together with a summary of the Work Packages Achievements, Use of Resources, Deviations from Schedule and explanation and analysis of the reasons for not being in schedule. There was also a brief assessment how AComIn results meet the requirements of the project Performance Indicators fixed in the Technical Annex. The discussion and Steering Committee Member opinions are reflected in Deliverable D7.8 „Steering Committee Conclusions Regarding Year 3". The fulfilment of project Performance Indicators is discussed in Deliverable D7.7 „Input for EC Review". Both Reports D7.7 and D7.8 are publicly accessible at the project site http://iict.bas.bg/acomin/deliverables.html.

One of the final project management tasks is the support of the AComIn post-evaluation with external reviewers selected by the European Commission. This evaluation will take place in the Work Package WP6 by the end of March 2016. The Report about the Assessment of IICT's research and innovation potential will be publicly presented in Sofia on 24 March 2016. It will be uploaded at the AComIn site as Deliverable D6.2.

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Project Coordinator: Prof. Galia Angelova

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AComIn: Advanced Computing for Innovation

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AComIn Newsletter №6

Advanced Computing for Innovation

November 2015

AComIn Mission: to strengthen the research and innovation capacity of the Institute of Information and Communication Technologies – Bulgarian Academy of Sciences (IICT-BAS) by increasing the knowledge and skills of its researchers in emerging areas as well as by purchasing modern research infrastructure. AComIn should help the institute to successfully accomplish its strategic mission: by 2016, i.e. 5 years after its creation, IICT-BAS has to become a leading RTD Centre in Eastern Europe, providing facilities and working conditions comparable to the average standards of the EU Centres of Excellence in ICT. The institute will support the sustainable regional and national growth and employment by providing RTD results to advanced industrial organisations; it will be a focal point of high-quality research and training in advanced ICT topics.

Progress Report (April 2015 – November 2015)

WP1: Strengthening the IICT - BAS Human Potential

Employed Incoming Post-docs

Dr. Jovana Ružić was appointed to a post-doc position in AComIn in September 2015. She came from the Institute of Nuclear Sciences „Vinča" at the University of Belgrade, Serbia. Her research plans for activities in AComIn include experimental investigation of the influence of process parameters on the mechanical, tribological and physical properties of metal matrix composites obtained by powder and casting metallurgy. In her research she is using the Laser Particle Sizer and Tomograph XTH 225 from the SmartLab equipment. Some preliminary results were reported in the talk „Optimization and Application of Advanced Laser Nanoparticle Sizer on Wide Range of Materials" (with authors Jovana Ružić, Stanislav Gyoshev, Nikolay Stoimenov, Kristina Jakimovska, Aleksandar Vencl, and Dimitar Karastoyanov) presented at the International Conference AComIn 2015 on 11 November 2015. Her supervisor in AComIn is Prof. Dimitar Karastoyanov.

Dr. Konstantinos Liolios joined the AComIn team in August 2015. He came to IICT-BAS from the Democritus University of Thrace, Xanthi, Greece, where in 2014 he defended his PhD thesis entitled „Analysis of hydrodynamic behaviour, transport and removal of pollutants in porous media: Investigation in horizontal subsurface flow constructed wetlands". In the frame of the AComIn project Dr. Liolios is going to conduct research on advanced computing and numerical applications including multiscale and multiphysics simulations of strongly heterogeneous media with strongly nonlinear and/or anisotropic behavior as well as high-performance computing in engineering and environmental problems. Some initial results of his work were reported in the talk „A Computational Investigation of the Optimal Reaction Type Concerning Bod Removal in Horizontal Subsurface Flow Constructed Wetlands" (with authors K. Liolios, V. Tsihrintzis, K. Georgiev and I. Georgiev) presented at the International Conference AComIn 2015 on 10 November 2015. His supervisor in the project is Assoc. Prof. Krassimir Georgiev.

Short Employments of Experienced Researchers

Prof. Ludmil Zikatanov arrived from the Pennsylvania State University, USA as an AComIn guest professor. During his stay in IICT-BAS (25 May – 24 June 2015) he conducted joint research with his local host, Prof. Svetozar Margenov, in the area of developing high performance solution methods for large scale systems arising after discretization of partial differential equations and image segmentation. One of the topics was on developing techniques for analysis of Schur Complement based preconditioners for heterogeneous elliptic problems within the subspace correction methods framework. In collaboration with Prof. Margenov, Prof. Lazarov, and Prof. Kraus a novel approach has been proposed - it considers piece-wise harmonic bases in the corresponding subspaces. Such bases minimize energy and usually lead to stable projections. In collaboration with Prof. Margenov and Dr. Harizanov, Prof. Zikatanov worked also on developing novel methods for image segmentation with constraints. They have created an original paradigm for defining admissible intensity function, admissible segmentations as well as an algorithm for segmenting images. The algorithm is based on constructing optimal spanning trees in the graph defined by the pixel/voxel similarities in the image. Prof. Zikatanov co-organized (with Prof. Vassilevski) a special session entitled „Multilevel Methods on Graphs" as part of the 10-th International Conference on Large Scale Scientific Computing (LSSC'15) that was held in Sozopol, 8-12 June 2015. At the conference he also presented plenary talk „Subspace Correction Methods: Theory, Practice, and Robustness" which discussed the mathematical foundations of multilevel methods and their application in reservoir simulation.

Prof. Darina Dicheva and Prof. Christo Dichev came from the Winston Salem State University, USA, as AComIn guest professors in the period 1-30 June 2015. The conducted joint research in the area of educational data mining and the technology transfer were aimed at improving the quality of educational services and the subscription rate for the Bulgarian online eLearning portal UCHA.SE. The portal is a platform with educational videos and exercises, which can be used to support formal and informal education. During their stay in IICT-BAS Prof. Dicheva and Prof. Dichev participated in several working meetings with the UCHA.SE team that were focused on analyzing what information can be possibly extracted from the portal logs and used to contribute to the targeted goal. The portal keeps records reflecting the training-related activities of about 400,000 users; a „learner model" and an „educational resource model" were designed after their detailed analysis. Using machine learning methods, predictive associations have been discovered (represented as rules) among learner's attributes and his/her involvement in the portal activities. The results were reported in two talks. The first one entitled „Emerging Applications of Learning Analytics in Bulgaria: the Case of UCHA.SE" was presented at the International Workshop on Big Data in NLP, Education and Digital Collections, held on 29 June 2015 in IICT-BAS. The second talk „Emerging Applications of Educational Data Mining in Bulgaria: the Case of UCHA.SE" (with authors Ivelina Nikolova, Darina Dicheva, Gennady Agre, Zhivko Angelov, Galia Angelova, Christo Dichev, and Darin Madjarov) was presented at the International Conference AComIn 2015 on 11 November 2015. Both talks were followed by a lively discussion on the possibilities and advantages of using educational data mining in Bulgarian e-learning portals and other training-oriented applications. Another direction of the collaborative work was studying the trends and opportunities offered by current Open Educational Resources (OER) development and examining emerging practices in the light of their use in Bulgarian K-12 and higher education. The results of this study were presented in the article „Trends and Opportunities in Computer Science OER Development" (Christo Dichev, Darina Dicheva, Gennady Agre, and Galia Angelova) published in the Journal Cybernetics and Information Technologies, Sofia, Volume 15 (3), 114-126, 2015.

and application of the principles of friction, wear and lubrication as well as phenomena connected with these processes. The research program of Dr. Vencl in AComIn contains topics related to the project area „New Materials and Nano Technologies". He conducts experiments with the SmartLab thermocamera and applies it as a diagnostic and monitoring tool for the plain bearings. It was shown that, by continuous measuring of the plain bearings contact temperature, it is possible to predict the value of friction in the plain bearing, an important parameter connected with the dissipation of energy in systems. Assoc. Prof. Vencl collaborates intensively with the AComIn team, including the post-docs, and with colleagues from the Technical University of Sofia. The following papers have been published with his host Prof. Dimitar Karastoyanov: (i) Vencl A., Bobić I., Kandeva M., and D. Karastoyanov. Tribology of Metal Matrix Micro- and Nanocomposites, Tribological Journal BULTRIB, Vol. 5, 2015, pp. 10-19, ISSN: 1313-9878 and (ii) Kandeva M., T. Grozdanova, D. Karastoyanov, B. Ivanova, K. Jakimovska and A. Vencl. Abrasive Wear under Vibrations of the Spheroidal Graphite Cast Iron Microalloyed by Tin, Journal of the Balkan Tribological Association, 22, 2, 2016, Ref. No. 1394, ISSN: 1310-4772 (IF 0.443).

WP2: Purchasing SmartLab Equipment and Building User Communities

Technology Transfer Workshops

The Workshop on **Microstructure Material Analysis** was held on 17-18 April 2015 at IICT-BAS and gathered about 30 participants from Bulgarian universities, academy and industry. The scientific program started with the presentation of Prof. Alexander Karamanov from the Institute of Physical Chemistry, Bulgarian Academy of Sciences entitled „Structural Characterization of the Yellow Pavement Stones of Sofia". The talk was devoted to the complex study of the composition, structure and technology for production of this prominent symbol of Sofia, which was declared as national cultural heritage in the beginning of 2014 by the Sofia Municipal Council. The study was conducted in a close cooperation with Dr. Ivan Georgiev, a post-doc in AComIn, who was responsible for microstructure analysis and characterization of porosity and inclusions distribution using the SmartLab tomography XTH 225. In his talk „Assessment and Diagnostics of Computer Hardware Performance by Digital Radiography, Thermography, and Computed Tomography" Assist. Prof. Julius Afzali from the Technical University of Sofia presented some promising results obtained in close collaboration with colleagues from IICT-BAS with the extensive use of AComIn SmartLab devices. The program continued with poster presentations of particular applications in the area of composite and porous materials. New results concerning segmentation of Computer Tomography (CT) data with volume preservation were presented by Dr. Stanislav Harizanov, a post-doc in AComIn.

Assoc. Prof. Aleksandar Vencl is employed as an incoming experienced researcher in AComIn on 1 September 2015. He comes from the University of Belgrade, Serbia, from the Tribology Laboratory of the Faculty of Mechanical Engineering. Dr. Vencl is an expert in Tribology, a science and engineering discipline of mechanical engineering which studies phenomena and processes on the interacting surfaces in relative motion, including the study

Assoc. Prof. Milena Dobreva from the University of Malta visited IICT-BAS as an AComIn guest scientist in the period 12 June – 11 July 2015. The aim of her visit was to pursue joint research in order to assess the potential synergies between digital libraries' content and the educational resources. Together with her hosts Prof. Angelova and Assoc. Prof. Agre, Dr. Dobreva made an overview of the educational use of digital libraries as conceived and implemented by the developers of these resources. Some of the conclusions are that the digital library community is definitely willing to play a role in training and learning: this is manifested in the development of education-related personas, scenarios, and in branding digital libraries as educational environments. These could be seen as innovation opportunities for the eLearning domain, but also as a factor delaying the use of digital libraries in eLearning because the educational communities do not adopt widely the currently available services and tools. The mismatch of supply and demand is inevitable because the educational sector neither articulated clearly the need to tap into vaster digital resources, nor suggested how exactly this should happen in practical terms (e.g. what technological tools used in the classroom or for personal learning would benefit from linking to vast collections of digital resources). The results of the collaborative work were reported in the talk „Integrating Digital Cultural Content in Educational Applications" presented at the International Workshop on Big Data in NLP, Education and Digital Collections, held on 29 June 2015 in IICT-BAS. A more detailed description of the study is presented in the paper „Bridging the Gap between Digital Libraries and eLearning" (with authors Milena Dobreva, Galia Angelova and Gennady Agre) published in the journal Cybernetics and Information Technologies, Sofia, Vol. 15 (4), 2015, 92-110.

The Workshop on **3D Digitization and Virtual Reality** was held on 18 April 2015 at IICT-BAS. The workshop was opened with a talk given by Assoc. Prof. Vessela Statkova, entitled „3D Visualization of Artefacts" in which she presented results of a joint pilot project between AComIn and the Master Program „Multimedia and virtual reality" at the Academy of Music, Dance and Fine Arts (AMDFA), Plovdiv. Afterwards Dr. Kristina Jakimovska, a post-doc in AComIn, gave an introductory talk about 3D laser scanning and made a practical demonstration of the scanning process. The demonstration session continued with presentation of alternative methods for 3D image acquisition based on the photogrammetry technique as well as of 3D printing by means of the SmartLab 3D printer. The later technology was demonstrated using the 3D models designed by Master Students from AMDFA and 3D scanned paleo-anthropological artefacts. The Workshop continued with poster presentations about 3D digitization of cultural heritage, applications of 3D technologies in the design of clothing, games, and virtual reality. The workshop was attended by 35 participants from Bulgarian universities, academy and industry.

The Workshop on **Advanced Computing for Innovation - Industrial Applications** was organized as an associated event to the 23rd International Symposium on Control of Power Plants, Industrial and Ecological Systems held in Bankya on 14-15 May 2015. The workshop was aimed at demonstrating the potential of some unique devices from the AComIn SmartLab. The presented talks concerned mapping of acoustic noise and microwave radiation, acoustic fields reconstruction, research on moving and interaction between spheroid tetrahedrons in ball mills, high speed briquetting of metal waste using rocket engine, inspection and observation by means of infrared thermal camera, etc. The workshop gathered 66 participants working in the areas of power generation, mining and processing industry as well as from the Academy and several Bulgarian technical universities.

In the period of 19-27 May 2015, the AComIn project in collaboration with three Bulgarian SMEs - Smart Fab Lab, Digital Spaces Living Lab and B2N organized the **First Intensive Tutorial on Digitization and Creation of 3D Replicas of Cultural Heritage Objects and Use of New Technologies and Mobile Applications for Museums.** The tutorial was designed for familiarizing young researchers from IICT and museum experts with some newest technologies for digitizing and creating 3D models and replicas as well as with the utilization of some specialized mobile applications. The tutorial aimed at creating initial practical skill for developing

3D replicas of cultural heritage objects. Eight participants from six Bulgarian Museums as well as four participants from Bulgarian academic institutions and universities working in the area of Cultural Heritage preservation took part in the tutorial.

The Workshop on **Advanced Techniques in Non-Destructive Testing** was held in the period 18-19 June 2015 in Sozopol. The event was organized by the AComIn project in cooperation with the Bulgarian Society for Non-Destructive Testing. The aim of the workshop was to demonstrate the potential applications of the AComIn SmartLab devices in the area of Non-destructive testing. Two keynote lectures were given by Acad. E. Gorkunov from the Institute of Engineering Science, Russian Academy of Sciences, and by Prof. S. Zolotarev from the Institute of Applied Physics of the National Academy of Sciences in Belarus. More than 15 talks were given during the two days of the workshop, which described some novel techniques, equipment, and advanced applications for non-destructive testing. During the poster session were presented more detailed characteristics of the AComIn SmartLab devices as well as some of their pilot applications. About 35 representatives of industrial and academic organizations took part in the Workshop.

The Workshop on **Advanced Material Characterisation, Modelling, and Numerical Simulations** was held in Albena on 28 June – 1 July 2015. The event was organized as an associated event to AMITaNS'15, the 7th Conference of the Euro-American Consortium for Promoting the Application of Mathematics in Technical and Natural Sciences. The workshop was devoted to advanced techniques for material characterization, nonlinear modelling, and emerging numerical techniques used in the computational and engineering practice. Three invited keynote lectures were given by Prof. Svetozar Margenov (IICT-BAS), Prof. Gabriella Bolzon (Polytechnic University, Milan), and Prof. Anatoly Filippov Gutkin (Russian State University of Oil and Gas, Moscow). In addition the workshop program included 13 talks and posters. Six talks were given by participants from IICT, three by foreign scientists and four by participants from the Institute of Mechanics, Bulgarian Academy of Sciences. More than half of the speakers were female and young scientists. Some 21 representatives of industrial and academic organizations took part in the Workshop.

The Workshop on **Mathematics in Industry** took place in Sofia on 14 September 2015. The event was held as an associated workshop to the 113th European Study Group with Industry, organized by IICT-BAS in the period 14-18 September 2015 in cooperation with the Faculty of Mathematics and Informatics, Sofia University „St. Kliment Ohridski", the Institute of Mathematics and Informatics - BAS, and the European Consortium for Mathematics in Industry. The Study Groups with Industry are an internationally recognized approach for Technology Transfer between academic mathematicians and industry. This week-long Study Group provided a forum for industrial scientists to work together with academic mathematicians on problems of direct industrial relevance. Five representatives of Bulgarian SMEs and one representative of a German startup presented particular problems from their work. The Programme on 14 September 2015 included presentations of AComIn results that are relevant to the Study Group topics. Some 43 participants from industry and academy attended the event.

Know-How Transfer Meetings

In July-September 2015 several meetings with potential Users of the AComIn Speech Lab were organized. The meetings included demonstrations of the speech processing prototypes, developed in the frame of AComIn, and discussions of potential applications in various scenarios of practical importance. The first set of meetings (held on 17 June and 25 June 2015) was devoted to the Large Vocabulary Continuous Speech Recognition of Bulgarian Language for Professional Dictation Transcription Services. The invited parties included Ciela Norma AD, Sofia Municipality and the NGO „Civic Participation and Direct Democracy". During the meetings was demonstrated a prototype of a large vocabulary continuous speech recognition system for Bulgarian in the legal domain. The demonstration included also an adaptation to a new speaker (selected from the invited participants) and an evaluation of the perceived accuracy for the new speaker. The discussed topics included the technological background, application areas, accuracy of transcription and implementation issues. It has been concluded that the demonstrated technology is already mature for wider industrial usage.

The second set of meetings (on 24 June and 30 June 2015) was devoted to the problem of real-time subtitles generation during Television broadcasting. Two Bulgarian SMEs - Convergent Media Ltd. and Doli Media Studio Ltd. were invited. During the meetings a prototype of a large vocabulary continuous speech recognition system for Bulgarian was demonstrated both on specialized domains and on unrestricted domains, with and without speaker adaptation and in the presence of environmental noise. The discussed topics included unsupervised real-time speaker adaptation, adaptive language model and noise robustness. It was concluded that the demonstrated technology has to be further developed for wider industrial usage.

The meeting on 30 September 2015 was devoted to the speech synthesis as a crucial technological tool for the visually impaired people. The invited parties included the Union of the Blinds in Bulgaria. During the meeting new technologies for the synthesis of naturally sounding voice using advanced concatenative methods as well as statistical methods for automatic phonological and prosodical speech description were presented.

A set of meetings with representatives of industrial companies devoted to know-how transfer on Acoustic Imaging were held in April – September 2015. The meetings included demonstrations of the SmartLab Acoustic Camera as well as discussions of its potential applications in different practical settings. The first meeting was with Dundee Precious Metals Inc. – an international mining company that is engaged in the acquisition, exploration, development, mining, and processing of precious metal properties. In Bulgaria the company is mining in the village of Chelopech and in Krumovgrad. Ground-based equipment of the mine generates unwanted amount of acoustic noise. It was demonstrated that the SmartLab Acoustic Camera could be suitable for noise source localization and noise characterization; the obtained data could be used for the noise suppression via acoustic cloaking or other approaches.

The second meeting was with two bearing manufacturing companies - SKF Bearings Bulgaria Co. and the Timken Company, Romania. The standard bearing testing approach requires the bearing to be placed into a special device and measured by vibration signals processing. It was shown that the Acoustic Camera could provide non-contact acquisition of acoustic signals, emitted by the bearing analysed. Thus all tasks related to equipment diagnostics and monitoring of noise in the working environment may be performed on place, in industrial conditions, without dismounting.

During the meeting with AtomToploProekt Ltd. the possibility of assessing acoustic emissions of power plant equipment in Bulgaria was discussed. Such an approach may be used for performing non-destructive testing tasks.

The potential of the SmartLab Acoustic Camera was also demonstrated in a series of meetings with Bulgarian high education institutions, mostly in Technical University – Sofia: the Faculty of Machine Engineering including the Laboratory for Noise and Vibration and the Air Transport Department at the Faculty of Transport.

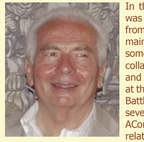
WP3: Networking with Leading EU Partners

Incoming Short Visits

Dr. Roxana Radvan and Dr. Dragos Valentin Ene from the National Institute for Research and Development in Optoelectronics, Bucharest, Romania visited IICT-BAS as AComIn guests in the period 16-19 April 2015. They took part in the Door Open Days – an event organized on 17-18 April in the frames of the project AComIn, where Dr. Roxana Radvan gave a lecture entitled „LINOVA-OPTIMA - Optoelectronics in Cultural Heritage" that briefly overviewed the recent research activities and achievements of her research group on non-contact optical methods for monitoring monuments conservation status and ecological, non-contact, reversible interventions concerning the restoration and preservation of cultural heritage. The emphasis was given on advanced laser techniques for conservation of artworks. Dr. Dragos Ene's lecture „PILOT Project - Platform for Cultural Heritage Transdisciplinary Valorization" considered techniques for investigation of cultural heritage, involving 3D printing, 3D scanning, laser Doppler vibrometry and radar investigations. Dr. Radvan and Dr. Ene had several meetings with the AComIn project participants where they discussed the possibilities for future cooperation using the SmartLab equipment for non-invasive study and digitization of artefacts.

During the period 16-19 April 2015 **Prof. Ivan Petrović** from the Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia visited IICT-BAS. Prof. Petrović coordinated the project ACROSS (Centre of Research Excellence for Advanced Cooperative Systems) funded by the European Commission via FP7 Capacity „Research Potential" programme – the same instrument that supports AComIn. Prof. Petrović participated in the AComIn Doors Open Days and presented the lecture „Autonomous Navigation of Mobile Robots in Unknown and Dynamic Environments" that included a brief overview of recent scientific activities and achievements of his research group on autonomous navigation of mobile robots. The emphasis was given on the algorithms for real-time motion planning and control, active SLAM for complete model building as well as moving objects detection and tracking. Recent developments on autonomous navigation of aerial vehicles were also briefly presented. Prof. Petrović had several meetings with the AComIn project participants where the possibilities of future cooperation were discussed.

Incoming Visits of Project Partners



In the period 16-25 April 2015 IICT-BAS was visited by **Prof. Virginio Cantoni** from the University of Pavia, Italy. The main goal of the visit was to discuss some technical details on execution of a collaborative activity between AComIn and the University of Pavia. The task aims at the creating of 3D models of the famous Battle of Pavia in 1525. Prof. Cantoni had several meetings with members of the AComIn team where some problems related to processing of 3D models of historical images as well as their 3D printing were discussed. Prof. Cantoni also took part in the AComIn Doors Open Days, organized on 17-18 April 2015 in IICT–BAS.

Outgoing Visits to Project Partners

Group of Bulgarian researchers involved in the AComIn project: Prof. Galia Angelova, Prof. Dimitar Karastoyanov, PhD students Nikolay Stoimenov and Stanislav Gyoshev as well as Prof. Kostadin Kostadinov (a Deputy Minister of Education and Science and former AComIn innovation consultant) visited Pavia, Italy in the period of 10-14 June 2015. The visit was connected to the exhibition „The Battle of Pavia in 1525" opened in Visconti Castle, Pavia – an event that blends Art and Technology in order to provide a modern view to the restoration of historical events. AComIn participates in the exhibition with 3D figures of historic actors from the Battle of Pavia, printed on the SmartLab 3D printer and based on 3D models created in a collaboration between the AComIn team and researchers from the Computer Vision and Multimedia Lab (headed by Prof. Virginio Cantoni) at the University of Pavia. The exhibition also presents 3D tactile matrices of six existing historical tapestries displaying the Battle of Pavia, printed with the 3D colour printer of SmartLab. The main research and development activities in Bulgaria were carried out by the PhD students Nikolay Stoimenov and Stanislav Gyoshev from IICT-BAS under the supervision of Prof. Dimitar Karastoyanov.

On 11 June 2015 the delegation visited the University of Pavia, Faculty of Engineering (where the Department of Computer Science is located) and met colleagues from the Computer Vision and Multimedia Lab. Prof. Galia Angelova gave a presentation entitled „The AComIn Project and its Focus on Automatic Image Tagging" to scientists from the University of Pavia.

The day before the exhibition Opening (12 June 2015) the delegation took part in a Press Conference with local and national Italian Journalists, accredited for the event, where Prof. Kostadin Kostadinov spoke about the importance of the socially significant science producing visible results for the people.

The exhibition opened on 13 June 2015 and was attended with great interest by Officials and more than 200 representatives of the scientific and cultural elite of Pavia and the Lombardy region. The Bulgarian participation in the preparation of the exhibits was highlighted in all presentations and welcome speeches as well as in the posters and promotional materials. A large poster with information about BAS, IICT and AComIn project was placed in the exhibition hall. The exhibition was advertised as an EXPO 2015 satellite event and was viewed by dozens of thousands of visitors in the period June-November 2015.

During the period 6-15 October 2015, **Assoc. Prof. Stefka Fidanova** visited the University of Pavia, Italy, to perform joint research with colleagues from the Computer Vision and Multimedia Lab headed by Prof. Virginio Cantoni. During her stay Dr. Fidanova gave a lecture entitled „Ant Algorithm for Image Edge Detection" and explained how the method could be applied to completely optimization problems. She also presented an ACO-based technique for image edge detection. The lecture was attended by scientists from the Computer Vision and Multimedia Lab as well as by M.Sc. and PhD students from the Computer Science Department of the University of Pavia. Dr. Fidanova had also several discussions with Prof. Cantoni and Prof. Porta about extending the application of the proposed methods on problems arising in biology and image processing.

Assistant Professor Atanas Nikolov visited Pavia and Sampieri, Italy in the period 18 June – 18 July 2015 with the aim to conduct collaborative work with Prof. Virginio Cantoni from the Computer Vision and Multimedia Lab. This research was a continuation of the joint work in the area of Ear Recognition that started earlier and resulted in a joint paper presented at the First International Workshop on Biometrics – BIOMET'14. During his stay Atanas analysed the newest results in the area of Ear Recognition as well as different types of ear representations in the Ear Database, containing 100 basic 3D models of human ears (with their corresponding video clips, created using the SmartLab 3D laser scanner in June 2015). The analysis also included: selecting the optimal methodology for post-processing of 3D ear models as well as generating derivative representations from 3D ears as 2D intensity projections and 3D range (depth) images; design of simple structure of a website for database access, as well as considering the content of a license agreement for the database usage.

During the last days of his visit to Italy Atanas Nikolov took part in the International Computer Vision Summer School (ICVSS'15) held in Sampieri, Sicily. The school lecturers were world-renowned experts from related academic and industrial sectors. Atanas Nikolov participated in a poster session where he presented his poster on Video Stabilization and experimental tests with video clips made by the AComIn SmartLab equipment.

From 5 to 31 July 2015 **Assoc. Prof. Kiril Simov and Assoc. Prof. Petya Osenova** visited the group of Prof. Piek Vossen at the Faculty of Arts, VU University of Amsterdam. The aims of the visit were to establish better connections with one of the best groups in Natural Language Processing (NLP) in Europe and worldwide, to exchange expertise and to share experience. During the stay the main activities were focused on cleaning and validation of the enriched BulTreeBank WordNet for the next release as well as on evaluation of automatic extension of WordNet mapping for Bulgarian, using the Core WordNet developed in IICT-BAS, Wikipedia and ImegaWiki. The two research groups also carried out investigations on Word Sense Disambiguation tasks using the knowledge-graph tool UKB developed by the IXA group, Basque country. Experiments were done with Bulgarian (BulTreeBank) and English data (SemCor). The results have shown improvement when syntactic relations are added for both languages. On 29 July 2015 Prof. Kiril Simov and Prof. Petya Osenova gave a lecture entitled „Word Sense Annotation, Disambiguation and Knowledge Transfer for Bulgarian". During the visit an agreement was achieved to continue the collaboration on experiments with knowledge resources on big data and to prepare a common publications on Semantic Role Labelling that will be presented at the International Conference AComIn 2015.

In the period 30 October - 30 November 2015 **Assoc. Prof. Dimo Dimov** visited the Computer Vision and Multimedia Lab of the University of Pavia, Italy. The main aim of the visit was to continue a joint research work and to discuss further collaboration beyond the frames of AComIn project. During his stay Dr. Dimov had several meetings: on 21-23 October 2015 he visited the University of Salerno where he had several talks with Dr. Daniel Richio (leader of Face Detection and Recognition Lab), Prof. Andrea Abate and Dr. Stefano Ricciardon on preparation of a joint paper on the 3D Ear Data Base, as well as on a joint project proposal to an appropriate call of Horizon 2020. On 28 October 2015 Prof. Dimov visited the JRC (Joint Research Centre) in Ispra, where he discussed with Dr. Dario Tarchi (Radar Technology Department leader) possible effective cooperation in the field of MIMO (Multi Input Multi Output) radars and/or related fields. Assoc. Prof. Dimov had also several meetings with Prof. Cantoni and Prof. Claudio Cusano on preparation of a new joint research on „Biometric Authentication by 3D Ear Curvature Statistics: Comparing Alternative Approaches". On 14 October 2015 Dr. Dimov together with Dr. Stefka Fidanova and Dr. Kiril Alexiev took part in an introductory lecture held in the Almo Collegio Borromeo of Pavia where they presented the research topics of IICT-BAS and the AComIn project.

Assoc. Prof. Kiril Alexiev visited the Computer Vision and Multimedia Lab of the University of Pavia, Italy, in the period 13 October - 10 November 2015. During his stay in the Lab, headed by Prof. Cantoni, he discussed with the Italian colleague novel approaches for using the rich variety of sensors in the advanced smart phones for automatic authentication. The implementation of algorithms for biometrical identification in the smart phones has been recognized as the most promising direction for future joint work. A patent proposal has been discussed and a preliminary study in the field was carried out. Dr. Alexiev delivered three presentations – in the College „Borromeo" in Pavia, in the Joint Research Centre (JRC) in Ispra and at the Permanent Doctoral Seminar at Pavia University, entitled: „The Contemporary Smart Phone – a Communication Tool and/or a Measurement Lab?". New possibilities for joint research activities were discussed with the group of Dr. Tarchi (Radar Technology Department leader) at JRC related to the monitoring of the South EU border with various mobile sensor systems installed on drones.

WP4: Development of IP and KT Plan and Innovation Capacity Building

On 23 July 2015 the European Patent Office registered an application for a patent named „Nail" developed by a group of scientists from the Embedded Intelligent Technologies Department of IICT-BAS. The application concerns a nail with a special shape - it has three spherical surfaces and three edges. The nail cross-section forms so called Reuleaux triangle; using these nails will provide a greater resistance to collapse of the structure, a greater security of wooden buildings as well as a greater resistance to the transverse force actions.