Institution:	University of Northumbria at Newcastle

Unit of Assessment: 11 – Computer Science and Informatics

a. Overview This UoA, based in the Department of Computer Science and Digital Technologies (CS&DT) in the Faculty of Engineering and Environment, has seen a very large growth in research activity since 2008, when just one member of staff was submitted to the RAE, compared to 13 in this REF submission. The Department has focused investment in two complementary major areas of research:

1. Computer and Electronic Security Systems (CESS): Staff are carrying out research in personal and computer security (e.g. biometrics, network intrusion, digital watermarking).
2. Computational Intelligence (CI): Staff work in health informatics and affective computing (e.g., bioinformatics, machine learning, visualisation for identification and learning).

b. Research strategy

b1. Strategic Aims 2008-2013. In RAE 2008, one member of staff was submitted as part of UoA25 (General Engineering). The strategy for 2008-2013 has been to grow the volume, quality and impact of research focusing on the areas of **digital security** and **health informatics.** To achieve these aims the following objectives were identified:

1. The appointment of, and investment in, new high-calibre staff from a world-wide recruitment process.
2. The creation of new complementary research themes translating fundamental research into applied research.
3. Raising the aspiration, vision and quality of research of existing staff.
4. Building capacity and capability via collaborative research strengthened by international partnerships.

To achieve these objectives we have: (i) appointed 12 staff through both strategic development and staff replacement. The recruitment process focused on the quality of applicants' research outputs, involved recently-appointed staff in appointment decisions and used Skype screening interviews for overseas applicants; (ii) consolidated into two research groups by appointing two Professors to bring together staff and build upon areas of existing research excellence; and (iii) developed research via project funding, PhD studentships, conference attendance, sabbaticals, and use of research capital to develop facilities.

To exploit the synergy between the research themes and high-quality research elsewhere within the Faculty we have collaborated in PhD supervision and in research projects: e.g., with Professor M Angelova (Mathematics) on EU FP7 and MRC bioinformatics projects, **Aslam**, **Bouridane** and **Vickers** with Professor Z Ghassemlooy (Engineering) on EU COST ACTION IC1101, **Hossain** with Dr R Bass (Health and Life Sciences) on EU Grant #2012-2645. The University's Visiting Professor/Research Fellow scheme has brought in additional expertise alongside travel funding and sabbatical periods for staff to spend concentrated time developing research projects within these priority areas.

b2. Achievement of Strategy 2008-2013 A new academic base has thus been established during the period with 12 high-quality appointments across two complementary research groups.

Computer and Electronic Systems Security: This group was built around computer security (e.g., biometrics, network intrusion, digital watermarking) and is led by Professor **Bouridane** (who joined in 2009 from Queens University, Belfast) with expertise in image processing, pattern recognition and image forensics (including biometric recognition, media security, and cyber-security). **R Jiang** (ECR, joined in 2013) undertakes research in interactive intelligent systems, 2D/3D animation, and visual biometrics. **Khelifi** (ECR, joined in 2010) conducts research on image processing, pattern recognition and classification working with **Bouridane. Boubchir** (ECR, joined in 2013 from the University of Strasbourg) works in image/video processing for visual biometrics and media forensics. **Soler** (ECR, joined in 2013) works in wireless network protocols. **Vickers**

works on sonification and auditory display, and network and cyber security.

Computational Intelligence Group (CI): The research in this group is mainly focused on health informatics and affective computing (e.g. bioinformatics, machine learning, visualisation for identification and learning), and is led by Professor **Hossain** (joined in 2011) with expertise in computational intelligence for modelling, optimisation and real-time solution for various application domains. **Zhang** (joined in 2011) and **Y Jiang** (ECR, joined in 2011) have expertise in artificial intelligence, affective computing, intelligent user interfaces, machine learning, natural language and speech processing, and intelligent virtual agent development. Their interests also overlap with those of the CESS group. **Aslam** (joined in 2011) specialises in wireless ad hoc and sensor networks, working with Hossain. **Yang and Jin** (ECRs, joined in 2011 and 2012 respectively) work in intelligent digital media processing algorithms, heuristic optimisation, bio-inspired computing and game theory, and reasoning under uncertainty, investigating with applications to model-based diagnostics and biological informatics. **Shum,** (ECR joined in 2012) specialises in character animation and motion analysis for virtual reality and serious games applications.

In pursuing the fourth objective at b1 above we have participated in, and led on, several interdisciplinary and multidisciplinary projects with national and international collaborators who have enhanced the Unit's research profile, quality and volume: **Bouridane** - Co-Investigator of funded projects with Qatar University (Qatar Science Foundation, NPRP 09-864-1-128, 2009) and King Saud University (King Abdulaziz City of Science and Technology); **Hossain** - EU funded project (Grant Number: 2012-3645, 2012) to establish co-operative research and academic activities between six EU and eight Asian partners on e-health, green technology, cyber security, and the EU FUSION project (Grant Number: 2013-545774, 2013) to promote multidisciplinary and multilateral research and academic cooperation among 20 Asian and European partners; **Khelifi** - with the Algerian Forensic Lab. funded by the Algerian "Programme National de Recherche" (PNR) Research Council to develop a secure template biometric system, 2009; **Shum** - with RIKEN Research Institute and the University of Tokyo to model human motion at the skeleton and muscle level, 2010-11; **Aslam** - with Cape Breton University of Petroleum, Canada, funded by the Atlantic Innovation Fund (Canada) to develop a delay and rate-sensitive communication protocol for industrial control systems application, 2010.

The Unit's trajectory of development illustrates a marked change in research activities with the following success indicators since 2008:

- Research income - totalling £217,000 over the REF period. Though as yet relatively modest this reflects a significant change in the understanding of, and approach to, seeking external funding for research, especially from prestigious sources.
- Current PhD registrations - increased from three to 27 with funding from a range of sources including national governments (Saudi Arabia, Pakistan, Oman).

b3 How future strategic aims and goals relate to research group structure

In line with the recently adopted University "Vision 2025" which aims to establish Northumbria as research-rich and business-focused with a global reputation for academic quality, the Unit's strategy for 2014-2018 is to focus upon and develop existing areas of strength. The Unit will continue to appoint new staff and aims to grow the number of Category A staff from 13 to 24 FTE by 2018. The Unit will also continue to expand its interdisciplinary research activities building on our recent success by targeting RCUK and EU Horizon 2020 funds, and doubling the number of PGR students. These aims will be achieved by continuing to: (i) invest in the existing areas of research (CESS and CI), as well as develop a new focus on Computer Games and Visual Effects, to interface and innovate with the games industry and computer interaction (to be led by **Vickers,** with multimodal visualisation expertise, working with **Shum**, with expertise in character animation and interaction motion analysis and character animation, and **Y Jiang** with expertise in visual effects); (ii) to develop research by current staff while also making strategic appointments using opportunities created by natural staff turnover; (iii) invest in staff development via PhD studentships, research funding and sabbaticals; (iv) support staff to increase the volume of high quality research outputs, as well as to present their work at top international conferences; and (v) increase the impact of research through a carefully managed impact strategy (see REF 3a).

New and developing initiatives: The Unit will continue to develop its international networks and its body of ECRs. Recent initiatives include an EPSRC grant won by **Khelifi** (EP/L006812/1: 'Temporal forensic analysis of digital camera sensor imperfections for picture dating') and **Shum** ('Interaction-based Human Motion Analysis') planned for submission in December 2013, to enable further engagement respectively with forensic agencies and the gaming industry. Commercialisation, research and consultancy, and partnerships under **Bouridane** and **Vickers** will be housed at Northumbria University's Warning Action Reporting Point (www.nuwarp.org.uk) and Computing Research Laboratory. **Hossain** will continue to grow interdisciplinary research in bioinformatics in collaboration with hospitals in the UK and also in Europe, north America and Asia.

These initiatives will be buttressed by staff appointments (both succession planning and recruitment internationally) and by income generation, making effective use of the Faculty-wide Research Grant Promotion Sub-committee, which offers support to staff in identifying grant opportunities and targeting specific calls, mentoring and developing high-quality applications for external funding of research.

c. People

c1. Staffing strategy and staff development

c1.1 Evidence of staffing strategy, relating to research strategy and physical infrastructure

Our staffing strategy since 2008 has had three components:

    i)   sustain and build capacity and volume in core research themes;

    ii)   develop and reward a high-quality research culture among staff; and

    iii)   strengthen the academic staff base and culture with high-quality appointments.

The success of the staffing strategy is exemplified through:

    i) Since 2008, three staff previously in post have developed their research: one is returned to REF 2014 and two have contributed to the impact case studies.

    ii) Use of University strategic funding to appoint two Professors, **Bouridane** (image engineering and security) and **Hossain** (computational intelligence).

    iii) The appointment of 10 further academic staff, four in computational intelligence and intelligent digital media (**Jin, Shum**, **Aslam**, **Yang** (ECR), **Zhang, Y Jiang** (ECR) and four in visual biometrics, image processing and pattern recognition (**R Jiang**, **Khelifi**, **Boubchir** and **Soler).**

c1.2 Evidence about career development support

Support for all categories of staff: The CESS and CI groups each run a fortnightly research seminar at which one of the group members presents their research, which complements a weekly external research seminar. This offers a friendly and supportive environment for: reporting and discussing research ideas and projects; networking; disseminating funding and development opportunities; and developing presentation skills among experienced research staff. Heads of CESS and CI meet with the Head of Department and key staff throughout the year to discuss overall strategy and funding and to plan support for future research, including workload allocations.

Individual academic staff have an annual appraisal, and complete a Personal Research and Innovation Plan (PRIP), a system of recording achievement and objectives in research. These are reviewed at departmental and research group levels. There is an annual call for Fellow/Reader/Professorial applications under the University Awards and Titles process and these are awarded on the basis of independent external assessors' recommendations. Applications are informed by the track record of publication quality, secured external funding, and international esteem factors. There is also a Faculty-wide sabbatical scheme with three routes: i) Experienced Researcher; ii) Research Development; and iii) Enterprise. Sabbaticals are awarded via a competitive application process informed by the track record of publication quality and external funding, and plans for external engagement and strategic development. Each proposal includes specific externally-facing outcomes. **Vickers** (2011), **Kendall** (2012) and **Laing** (2012) are recent beneficiaries, and this will contribute to developing future capacity.

At departmental level there are three budgets to support staff research: i) a staff development budget allocation; ii) a research contingency fund calibrated to 50% of the overheads from the previous year's research grant income; and iii) a QR budget distributed by the UoA lead (currently **Bouridane**). These budgets enable attendance at international conferences, networking and the purchase of small items of equipment. The budgets are complemented by annual research capital and a university-wide PhD scholarship scheme, both of which are competitive schemes rewarding research achievements.

At Faculty level, activity is managed through two sub-committees of the Faculty Research and Innovation Committee: Research Performance Monitoring and Research Grant Promotion. The former receives reports on grant bidding/success and on output volume and quality. The latter includes a specialist Research Funding and Policy Manager from the University Research and Business Services (RBS) department and provides direct support for the preparation of external research proposals.

The University provides a Research Staff Training and Development Programme covering Research Funding, Grant Proposal Writing, Skills for Supervising PGR Students, Dissemination and Outcomes, Ethics, Project and Data Management and Research Methods. These opportunities are available to all research staff. Northumbria has a research support blog with the latest research news, policy analysis, training events and funding opportunities. Its aim is to provide support and guidance and the means to understand the research funding environment.

Specific Early Career Researcher support: The Department has a support scheme for new academic staff that includes assigning a research-experienced mentor and a reduced teaching load (~50% for year 1). ECRs are prioritised in the annual research capital and internal PhD bidding schemes. Each new member of staff meets with the Research Development Manager to map out a personal research development plan progressing from international networking grant applications, through first grant scheme proposals to leading major bids. All new staff complete a Postgraduate Certificate in Higher Education Practice (PGHEP), which includes a specialist research module.

Research Assistants/Fellows (RA/RF): Access to all the support available to academic staff is available to RA/RF staff, including the University PGHEP and training programmes. Access to funding streams is via their supervisors, unless they are categorised as independent researchers, in which case they apply independently. RA/RFs also have the opportunity to teach and co-supervise projects and research students, subject to external funder constraints, to enhance their development and career prospects. For example, **Boubchir** is currently writing a proposal for funding from Qatar, NPRP (Automated Detection and Classification of Neonatal Epileptic Seizures Using Time-Frequency Imaging of Electroencephalography Signal to be submitted by 10th December 2013).

c1.3 Implementation of the Concordat to Support Development of Researchers: The University is committed to implementing the Concordat to Support the Career Development of Researchers and has an approved Action Plan summarising its strategic commitment to supporting and developing research and research careers and the means by which this will be realised. Staff are required to attend the training/staff development courses provided under the Action Plan. The Faculty Research and Innovation Committee has provision for an ECR member, and a cross-University ECR Forum facilitates interaction between ECRs and ensures that ECR perspectives inform relevant decisions. Northumbria holds the European Commission HR Excellence in Research Award.

c1.4 Info on international staff appointments, recruitment and visiting Scholars: The Unit has four Visiting Academics: Dr C Tanougast (University of Lorraine, Metz, France), Professor S A Hossain (Daffodil International University, Bangladesh), Dr S Almaadeed (Qatar University) and Dr N Rossiter (Emeritus) who are all involved in research collaborations, co-authoring of articles, preparation of proposals for research funding, and research training. As a result of the staff recruitment process described in paragraph b1, a high-quality, international staff base, including researchers from China (**Jin**, **R Jiang, Y Jiang**, **Yang**, **Zhang),** Algeria (**Khelifi**)**,** France (**Boubchir**) and Hong Kong (**Shum**) has been established.

c1.5 Evidence of how the submitting unit supports equality and diversity: The University is committed to providing an environment that values and encourages diversity, where there is equal access to opportunities and services, and in which all prospective and existing staff and students are treated fairly, with equity, dignity and mutual respect. Northumbria is committed to promoting and supporting equality and diversity in research, and this is reflected in several initiatives, e.g., research staff are included in the Equal Pay Audit, work-life balance opportunities are available and promoted to them, and the Concordat Action Plan is supported.

c2. Research students

c2.1 Information on PGR recruitment: PGR recruitment since 2008 has been very successful, with PGR numbers reaching 27 in 2013. PGR students are a mixture of full- and part-time, home and international. The large increase in PhD applications and recruitment (especially overseas students, who make up more than 80% of the cohort) is a direct result of the expansion of research expertise in the Department. 25% of our PGR studentships are internally-funded, with studentships won via a competitive University process. The remainder have scholarships from national governments and other funding bodies. All our PGR candidates have at least upper second class undergraduate and/or Masters degrees (or international-equivalent). Studentships are advertised internationally to enable the recruitment of the best quality candidates, which is assured in three ways: at the shortlisting and interview process (including references); by the Faculty's Postgraduate Research Director; and by the University's Graduate School. University and Faculty procedures (which govern our PGR processes) conform to the QAA Quality Code for HE for Research Degrees.

c2.2 Information on training and support mechanisms: PGR students must complete a PGR Development Portfolio at the start of their doctoral study which, through discussion with supervisors, allows them to monitor and adjust their own research and personal training needs. Formal confirmation of skills training completion is required at each annual progression point. The Graduate School provides a structured training programme, including workshops on the research environment, research management, research skills and techniques, and transferable skills such as communication, time management, personal effectiveness, health and safety, networking and career management. Lectures and seminars on specialist technical topics are delivered at the Departmental level.

All PGR students have at least two supervisors to ensure that sufficient specialism and depth of experience is provided. ECRs are involved in co-supervising PGR students alongside experienced academics with several completions. All supervisors must complete a University-level training course ("PGR Supervision") before (co-)supervising. Students present their work orally at least six times during their three years of study at departmental seminars. Selected students present their work at the annual University Research Conference to an audience from across the University. Students are encouraged to submit their work to peer-reviewed journals during their study. Funding is available to attend at least one international conference per year. Students are also encouraged to apply for travel grants, and eight students have been successful in obtaining funding from the Graduate School's Conference Bursary Scheme.

d. Income, infrastructure and facilities

d1 Evidence of investments (current and planned) in infrastructure and facilities: Since 2008 the Unit has benefited from University infrastructure and equipment investment of £183,789 (Computing Research Laboratory and nuWARP Laboratory including software and hardware) and will continue to develop its dynamic and positive research environment over the next three years, building on the £387,000 (since 2008) investment from the University's Research Capital Investment Fund (RCIF) and Research Development Fund (RDF). Northumbria has also invested extensively in IT infrastructure and software to support recent academic appointments. Other investment includes two high-performance computer platforms required for computer-intensive tasks, including various tools (cameras, sensors, robots). The research groups have specialised software for digital forensics and media processing and dedicated research space supported by RCIF and RDF funding, with equipment totalling £175,000. This capital investment in specialist equipment and software has directly supported the key research themes during the REF period

(e.g. £40,000 to build the CESS Honeypot network).

d2 Information on the research funding portfolio, including future plans: External funding of research, while not yet large, has grown significantly in the past five years and is increasingly being awarded by major and prestigious sources such as the EPSRC, TSB, or important international partners. The number of research bids has increased from three in 2008 to 27 in 2012/13. In **CESS**, **Vickers** secured Technology Strategy Board funding (TSB BK008B, 2010-2011; £137,000) for a joint project with industrial partners (RMT accountants, PEM IT Services, Security Risk Management Ltd., and the IAAITC). The project created a system for network sonification which has subsequently led to a patent filing (UKPA GB1205564.6, 2012). More recently, we were awarded an EPSRC/GCHQ Research Institute in the Science of Cyber Security ('Choice Architecture for Information Security', EP/K006568/1, 2012-2016; £880,000, joint with Newcastle University). **Bouridane** has held a joint research grant with (i) Qatar University (grant: NPRP 09-864-1-128 a total of $850,000, with $160,000 awarded to Northumbria from Qatar Science Foundation (equivalent to EPSRC), 2009) to develop an automatic Arabic writer recognition system for forensic science. Within **CI**, **Hossain** was awarded €2,496,450 (€740,000 to Northumbria) in 2012 as the coordinator of EU cLINK (Centre of Excellence for Learning, Innovation, Networking and Knowledge) to foster research partnerships between eight emerging Asian countries and four other EU countries to reinforce existing academic and research collaborations developed through previous EU projects. **CI** is also partner in the €3,049,875 EU FUSION (funding to Northumbria expected to be in the region €300,000) project (2013) which aims to enhance international cooperation between seven South Asian and eight European universities by facilitating transfer of know-how and best research training.

d3 Information on consultancies and professional services: Research outcomes and expertise have been translated into practice via Knowledge Transfer Partnerships with National Salvage Group (**Bouridane**, 2010-2012, £8,000), Atlantic Geomatics (**Ali**, 2009-2011, £91,000), Corbridge Medical Group (**Ali** with Professor Cook of Health and Life Sciences, £138,000), Level Business (**Vickers**, 2011, £15,000) and via a UK Government-recognised Warning, Advice, and Reporting Point (nuWARP) for SMEs, a service to support defence against cyber attacks (HEIF, April 2010, £102,000).

e. Collaboration and contribution to the discipline

e1 Support for and exemplars of research collaborations: Members of CESS and CI have active academic collaborations with other national and international universities. We define collaboration as resulting in at least one co-authored output or joint funding bid. Examples include (but are not limited to):

- **Bouridane**: University of Metz, **France** (Dr C Tanougast); University of Marseille, **France** (Prof S Bourennane); King Saud University, **Saudi Arabia** (Dr R Sammouda); Qatar University, **Qatar** (Dr S Al-Maadeed); Ecole Polytechnique Montreal, **Canada** (Prof M Sawan).

- **Shum** (ECR): University of **Edinburgh** (Dr T Komura); Tokyo University, **Japan** (Dr S Takagi); **Hong Kong** Baptist University (Dr E S L Ho); Université Rennes 2, **France** (Dr F Multon); Trinity College Dublin, **Ireland** (Dr L Hoyet).

- **Hossain:** Limere Lyon, **France** (Prof Y Ouzrout); University of Bremen, **Germany** (Dr I Rügge); Crvinus University, **Hungary** (Dr Z Szabó); United International University, **Bangladesh** (Prof C M Rahman); University Putra **Malaysia**, (Prof N K Noordin); University Benevento, **Italy** (Prof M Savino); Royal **Bhutan** University, (Prof O Kafly).

- **Aslam:** Dalhousie University, **Canada** (Prof W Phillips, Prof W Robertson and Prof J Ilow); Imam University of **Saudi Arabia** (Dr R. Islam).

- **Zhang:** University of **Birmingham,** (Prof J Barnden).

- **Vickers:** Canberra University, **Australia** (Dr S Barrass); University of **Reading** (Prof A Badii); University of Ontario Institute of Technology, **Canada** (Prof S Marsh).

Vickers worked with Security Risk Management (SRM) Ltd on the 2010-2011 TSB-funded project BK008B. This led to a patent filing and to SRM Ltd identifying a new business opportunity. A partnership agreement between Northumbria and SRM Ltd has been drawn up to further exploit

(both academically and commercially) the results of that research. **Bouridane** worked with Dr S Almaadeed (Qatar University) which has resulted in two funded projects from Qatar Foundation (NPRP 09-864-1-128 and NPRP 6-249-1-053).

e2 Support for and exemplars of interdisciplinary research

The University organises a dedicated programme of interdisciplinary Research Forums around a number of themes, which bring together researchers from across the University. Staff are invited or nominated to attend on the basis of their known interests or by self-nomination. Members of CESS and CI are actively involved in interdisciplinary research projects, e.g. **Vickers** with T Shaw (Inertial Music Group – external) on an Arts Council-funded project to build he Sonic Cosmos: A musical exploration into our galactic neighbourhood', an audio-enhanced model of the solar system, selected for exhibition at the British Science Festival 2013. **Bouridane** with Prof M Sawan (Ecole Polytechnique de Montreal, Canada) and Qatar Science Foundation to develop a prototype system for colorectal cancer detection, and Prof S Bouzerdoum (Wollongong University, Australia) to develop a Through The Wall Radar object recognition system.

e3 Exemplars of leadership in the academic community

Items relating to conference organisation, membership/leadership of professional societies, keynotes and invited research seminars, editorships and other esteem indicators are listed below by members of staff.

- **Aslam**: **i) Invited Keynotes** - 6th Annual Communication Networks and Services Research Conference, Canada, 2008; **ii) Conference Organiser** - co-organiser IEEE ICC Workshop on Wireless Sensor Actor and Actuator Networks, Canada, 2012, co-organiser, 2nd Intern. Conf. on Ambient Systems, Networks and Technologies, Canada, 2011; **iii) Program Co-Chair** - IEEE GLOBECOM Workshop USA, 2010, and 2nd Intern. Workshop for Smart Homes in Tele-Health, China, 2009.

- **Bouridane** (Professor): **i) Member EPSRC Peer Review College** (2005-date) and **Overseas Grant Reviewer** to Agence Nationale de la Recherche, France (ANR, 2013-date) and Australian Research Council (ARC, 2013-date); **ii) Associate Editor** - Springer J. of Real Time Image Processing**:** 2010-date**,** and EURASIP J. of Image and Video Processing: 2012-date); **iii) Technical Program Co-Chair -** IEEE/EURASIP Workshop on Visual Information Processing, Paris, 2013; **iv) Visiting Professor** - Ecole Centrale de Marseille, France, 2011), King Saud University (Saudi Arabia, 2009), and Universite de Lorraine at Metz (France, 2010; and **v) International Invited Talks** - Universite de Lorraine, Metz (France), 2012, and King Saud University (Saudi Arabia), 2010.

- **Hossain** (Professor): **i) Guest Editor** - J. of Computers, Academy Publisher, USA (2010-2012); Mediterranean J. of Computers and Networks, (2012); **ii) Keynote Speaker** - Int. Conf. on Computer and Information Technology, Bangladesh, (2008); **iii) Conference Organiser** - Co-Organiser 6th Conf. on Software, Knowledge, Information Management and Applications, China, 2012; **iv) International Invited Talks** - Université LUMIERE Lyon 2 (France), 2010, and Courvinus University (Hungary), 2011.

- **Khelifi** (ECR): **i) Guest Editor** Journal of Electrical and Computer Engineering, special issue on 'Recent Advances of Media Security: Algorithms and Implementations', (2013); **ii) International Invited Talks** (Centre for the Development of Advanced Technology, Algeria, (2011).

- **Shum** (ECR): **i) Overseas Grant Reviewer** - Portuguese Foundation for Science & Technology, 2012.

- **Vickers** (Reader): **i) Editor** - Securing Critical Infrastructures and Industrial Control Systems, IGI Global, 2012; **ii) Associate Editor** - ACM Computers in Entertainment; **iii) Editorial Board Member** - J. of Music, Technology, and Education, Intellect Press; **iv) International Invited Talk** - Researcher in Residence, RMIT University (Australia), 2008; KTH University, Stockholm, 09/2013.

- **Zhang**: **i) Special Issue Guest Editor** - Intern. J. of Distance Education Technologies, 2012; **ii) Track Chair** - 6th Intern. Conf. on Software, Knowledge, Information Management and Applications, China, 2012; **iii) International Invited Talk** - SEURAT-1 Annual Meeting, Lisbon (Portugal), 2013.

- **Jin** (ECR): **i) International Invited Talks** - School of Information Science and Engineering, Central South University (China), June 2011. The Institute of Mathematics, Chinese Academy of Sciences (China), April 2010, and Max-Planck-Institut for Informatik (Germany), Dec. 2009.