

<b>Institution: University of Westminster</b>
<b>Unit of Assessment: 11 Computer Science and Informatics</b>
<p><b>1. Unit context and structure, research and impact strategy</b></p> <p><b>1.1 Unit context and structure</b></p> <p>The University of Westminster's Computer Science and Informatics research is based within the <b>School of Computer Science and Engineering (SCSE)</b>, part of the <b>College of Design, Creative and Digital Industries (DCDI)</b>. DCDI was established in August 2018 with the aim of bringing digital, creative and media studies closer together, and providing a stronger basis for collaboration within these areas. SCSE merges two previous departments, Computer Science and Engineering, both entered into UoA11 in REF2014. While researchers in Computer Science were primarily focused on software-related research, the Department of Engineering's focus was on hardware and computer systems. Merging these two areas within one School provided a natural foundation for collaboration, shared infrastructure, facilities, and interdisciplinary research. Planning and monitoring of research within the subject area is now directly overseen by the School Research Lead (<b>Kiss</b>), College Research Director (<b>Kale</b>) and Head of School, who are responsible for the day-to-day management of all research within the Unit, including administration of QR funds, staff research and impact time and postgraduate bursaries.</p> <p>Organisationally, the research strengths of the UoA are concentrated in its <b>research groups (RG)</b>, representing cutting-edge research across a number of areas.</p> <p><b>Parallel, distributed and intelligent systems</b> are investigated at both lower fundamental levels, and also at the level of industry, research and public sector utilisation. The <b>Centre for Parallel Computing (CPC)</b> (<b>Kiss, Terstyanszky, Pierantoni, Michalas, Dagdeviren</b> and 6-8 research associates) has a highly successful track record in investigating new models and developing novel solutions for cloud computing applications and generating impact through industry and public sector collaborations. The CPC has secured funding from ten EU projects within the REF period, with an overall value of over £40 million, over £4 million for the group. Significant results were produced in the areas of science gateways and cloud orchestration, with products (e.g. WS-PGRADE science gateway framework, the CloudSME Simulation Platform or the <a href="#">MICADO</a> cloud orchestrator) utilised by large industry and academic user communities. The <b>Distributed and Intelligent Systems RG (Getov)</b> investigated smart extreme-scale platforms with a focus on performance, energy and security, logic engineering for autonomy and management, and advanced concurrent computation and communication models.</p> <p>The <b>Health and Social Care Modelling RG (Chausalet, Chahed, He</b> and 2-3 research fellows) conducts state-of-the-art analytics and computing research assisting professionals in healthcare services to rethink how they manage large and complex systems through a better use of big data. The Research Group is also an integral part of the <a href="#">Health Innovation Ecosystem (HEI)</a> that was established (late 2018) with internal funding from the <a href="#">Quintin Hogg Trust</a> (£427K), the Higher Education Innovation Fund and the University itself (£850K). Led by <b>Chausalet</b>, the HIE pursues interdisciplinary innovation in national and international health research, integrating social and health sciences with new areas of advanced analytics, data science, machine learning, imaging technology and artificial intelligence. Since 2018, over <b>£1M income</b> has been generated, links have been forged with over 20 external collaborating organisations, research <b>networking events</b> were organised and attended by over 140 early career staff and students from across the University.</p> <p>Multimedia, image and video processing and computational games are important research areas within the School. The <b>Computational Vision and Imaging Technology (CVIT) RG (Triantaphillidou, Psarrou, Villarini)</b> focuses on image and video formation, processing, analysis, visualization, interpretation and evaluation, while the <b>Serious Games RG (Economou, Mentzelopoulos)</b> investigates factors and approaches that contribute to effective serious games</p>

design and adaptation of serious games in various domains. **Triantaphillidou's** collaboration with Transport for London resulted in determining optimum levels of image compression suitable for face recognition in CCTV recordings, which were implemented through the ITT Bus Build Specification as part of the requirements for all London bus route tenders.

Various cutting-edge topics in **computer engineering** are investigated by the **Applied Digital Signal Processing and VLSI (Kale, Reni, Coskun)**, and the **Wireless Communications RGs (Budimir, Kontogiannis, Tarczynsky)**. These groups conduct industry-facing applied research and development for systems and sub-systems applied in novel commercial products (e.g. for the European Space Agency and Airbus Defence and Space). Targeted application areas include medical diagnosis systems, especially non-invasive methods for human health monitoring and diagnosis and automated malaria diagnosis, cyber security enabled drone flight infrastructure and positioning systems, real-time processing applications for the media and creative industries, environmental monitoring, detection and intervention, and autonomous vehicles and transport applications, among others.

Fundamental and applied computer science research is carried out in the areas of semantic computing, pattern search and recognition, deep learning, question-answering systems and conversational user interfaces by the **Cognitive Computing RG (Kapetanios, Angelopolou)**. Programming principles, modelling methods, architectures, infrastructures and tools for the design and development of modern, medium to large scale, software systems are the focus for the **Software Systems Engineering RG (Bolotov)**.

## 1.2 Research Strategy

The research vision of SCSE is to conduct **high-quality, applied research with global impact** by harnessing and translating fundamental knowledge within the discipline into 'real-world' practice, through collaboration with end users from industry and the public sector. The aim is to achieve **research excellence and impact** by transcending the usual boundaries between science, engineering and medicine, as well as art, media and social sciences. Examples of such interdisciplinary collaboration include the **HIE (led by Chausalet)** that focuses on interdisciplinary innovation in national and international health research and knowledge exchange, or the **CPC's (led by Kiss)** extensive work within the manufacturing sector, in collaboration with over 100 industry players. Computer scientists have also participated in the work of all four cross-disciplinary [Research Communities](#) established by the University in 2019: Arts, Communication and Culture, Diversity and Inclusion, Health Innovation and Wellbeing, and Sustainable Cities and the Urban Environment. This has resulted in significant internal funding, e.g. **Kapetanios'** review on health professionals' perspectives and engagement with Artificial Intelligence, focusing on marginalised social communities (funded by the Diversity and Inclusion Research Community).

Following our submission to REF2014, it was recognised that the Unit needed to define a clearer core research programme and establish a stronger organisational and operational structure for the management of research. The main focus of the strategy resulting from this has been to **increase the volume and quality** of research while also **increasing research income and ensuring long-term sustainability** of research excellence. These goals have been delivered through changes in our staff recruitment strategy, creation of a sabbatical scheme and new mentoring / staff development activities, stronger support for funding application preparation and management, and enhanced financial and administrative support for PhD students.

**Research strategy**, supported by the wider University restructuring of research management and infrastructure (including the University-wide Graduate School and dedicated Research and Knowledge Exchange Office [RKEO]), has focused, in particular, on the following key areas:

**Quality of research:** It was recognised post-REF2014 that there was a particular need to **improve the overall quality of research** produced across the Unit. To achieve this, SCSE sought to develop a strategy to **support staff in producing high-quality research** with impact according to fair and transparent criteria, as well as to **recruit new members of staff with significant**

**research profiles** at all levels. All members of staff were encouraged to join one of the existing research groups in the School. Research track record and potential became a criterion when recruiting new members of staff. Readers, Professors and RG leaders were included in all interview panels. Support for staff with a significant responsibility for research has been considerably strengthened since 2014 through the strategic implementation of the University's newly adopted and transparent online **Workload Allocation Model (WAM)**, in which research hours are directly incorporated into staff timetables as a part of their overall workload and evaluated by a panel. The evaluation is based on a set of criteria including the quality of their research plan, quality of outputs, income generation, impact activities and research leadership. **Starting and early career researchers** are specifically supported in this scheme by ringfencing additional research hours. Through the WAM process, the School directly supports research, setting each individual member of staff clear and transparent personalised objectives, such as the production of internationally-recognised publications, awarded research projects and impact activities, and allocating hours for research and impact activity at different levels on this basis.

Research income: Research income generation and post-award management are supported by the central **Research and Knowledge Exchange Office**. SCSE receives specific support from an assigned full-time **Research Development Partner (RDP)** with primary responsibility for identifying funding opportunities and supporting preparation of research proposals. The RDP is in regular contact with the UoA Lead, sharing information about selected and filtered upcoming funding opportunities, providing statistics about submitted and successful/unsuccessful research funding applications, and discussing ongoing practices and potential improvements. Such structures and processes have helped to increase both the quantity and quality of applications, and the Unit has consequently received awards and financial support from a diverse range of sources, including the European Commission's 7<sup>th</sup> Framework and H2020 programmes, Innovate UK, the European Space Agency and EPSRC. Annual external research income increased by 5% when compared to REF2014 (£626K on average per year, £4.4million overall, compared to £3million in REF2014). Further details are provided in section 3.

Support for doctoral and early career researchers: The School currently has 24 doctoral researchers. 40 completions were recorded in the current REF period, similar to the numbers reported in REF2014 (42 completions). These numbers have been kept up by regularly submitting strong bids for internal funding of doctoral programmes (e.g. Quintin Hogg Trust; see REF5a), and proactively supporting individuals to include PhD opportunities when applying for research funding. Quality of provision was also kept high. Based on the 2019 Postgraduate Research Student Experience Survey, UoA11 PhD students indicated almost **95% overall satisfaction** with the course, putting it in the upper part of the highest quartile within the UK in Computer Science. Doctoral students are specifically supported by the **School's PhD Coordinator (Tarczynsky)** who overviews admission processes and supports the students and their supervisors during the programme. The School also works closely with the University-wide **Graduate School** (established just prior to REF2014) to ensure PhD students and supervisors are supported and informed of opportunities and resources available for improved completion success and timeliness. The Graduate School also offers a range of developmental activities, including seminars and networking events to facilitate sharing of best practice, which are supplemented by more discipline-specific training at School-level. Further details are provided in Section 2.

Support for interdisciplinary research: All staff are encouraged to engage in **interdisciplinary research** which combines theory- and practice-oriented approaches, leading to better and closer links with business, industry and the public sector. The backbone of the School's strategy is to go beyond a conception of interdisciplinary research as merely concerning the use of computerised tools, applications and platforms by other disciplines. Instead, the Unit looks to successfully **formulate research questions** which cannot be answered by one discipline alone, for example the development of more effective algorithms inspired by problem-solving in nature or solving problems in nature by going beyond the state-of-art in algorithmic design and implementation. SCSE researchers are expected to collaborate both internally within the College and the wider University, and externally with academics at other institutions, nationally and internationally, as well with those in business and industry. Specific drivers for interdisciplinary research are the

newly established [Research Communities](#) with strong participation from UoA11 researchers (see above).

Open research environment: The essential UKRI and REF open access requirements are achieved through the University's **Virtual Research Environment** (VRE) and institutional repository, [WestminsterResearch](#), which is run by a dedicated Open Access team (see REF5a). However, recognising the ongoing issues concerning lack of transparency and reproducibility of experimental results within the discipline, SCSE has sought to go beyond this by extending considerably the amount of its research being made open access via high-profile journals and other media, as well as providing corroborating evidence by explicitly describing or providing links to any data being used for experimental studies. The School supports the creation of **open source software** that is managed and widely available in open source code repositories, such as GitHub. A [dedicated organisation for the University of Westminster](#) has been set up on GitHub supporting open source projects at the School, another GitHub organisation compiles the [open source projects of the CPC](#), and there are significant contributions to various large-scale open source software developments, for example the [MiCADOscale](#) application-level cloud orchestrator, with major contribution from the CPC, is also run as a [GitHub project](#).

### 1.3 Impact Strategy

The UoA's Impact Strategy is an integral part of the overall Research Strategy. A key feature of the latter is **raising staff awareness of the impact agenda** and ensuring, via objective-setting processes (supported by WAM), that all research-active staff generate **in-progress impact statements**, collected and recorded on an annual basis, which replicate the major headings in the REF impact case study template. Monitoring of such statements allows the Unit to identify needs and support required to **realise, further develop or strengthen impact activities**. After collection, the quality of and potential synergies between these impact statements are analysed and discussed at common forums within the School, for example Away Days, and are uploaded to a common repository. Impact is also assessed as part of the yearly research hour allocation process. Other external facing activities, such as maintaining a **portfolio of external engagements**, including contributions to public lecture series or public-facing events and media work, are also collected and analysed at School level. Impact activities are further supported at University level by both a dedicated **University Impact Officer** who supports and advises staff when formulating and building their impact case-studies, and the School's **Research Development Partner**, who has responsibility for horizon scanning and bid preparation for external impact-related funding.

Impact projects are typically **multidisciplinary**, involving several research groups from the School and beyond. For example, the Automated Body Composition Assessment in Population Studies project, funded internally from QR money, targeted the reduction of obesity by applying novel image processing and scalable and concurrent data processing mechanisms in a flexible cloud computing environment. The project was a multidisciplinary collaboration between **Prof. Jimmy Bell** from the School of Life Sciences conducting research on automated body composition assessment, supported by image processing expertise from the CVIT (**Triantaphillidou, Psarrou and Villarini**), and distributed computing research by the CPC (**Kiss, Terstyanszky**). Two UoA11 impact case studies (**Triantaphillidou, Kiss**) were significantly strengthened as a result.

Further facilitators for the success of this strategy have been the Unit's success in establishing significant and far-reaching cooperation with public sector organisations and industry, inside and outside the UK, across multiple research domains. Examples include the CPC's (**Kiss, Terstyanszky, Pierantoni**) collaboration with European hospitals (e.g. Charité University Medicine Berlin) within the [ASCLEPIOS project](#), or the collaboration of **Kapetanios and Angelopoulou** with the Great Ormond Street Hospital in the automated assessment of pain and distress in children, both in the area of healthcare. Examples of successful industry collaboration include **Triantaphillidou's** work with **Huawei**, the long-standing collaboration between **Kale** and **Airbus**, and the CPC's (**Kiss, Terstyanszky, Pierantoni, Michalas, Dagdeviren**) collaboration with over 100 SMEs from the manufacturing and technology sectors within the [CloudSME](#),

[CloudiFacturing](#) and [DIGITbrain](#) projects. More details of these collaborations are provided in Section 4.

The processes for collecting and monitoring potential impact case studies described above have two key objectives in supporting the **vitality and sustainability of impact activities** across the Unit. First, the process encourages all research active staff to think about potential impact at an early stage of their research and to collect and analyse evidence related to this impact as the research progresses. Second, the monitoring process also supports the fair and transparent selection of impact case studies for REF2021.

#### 1.4 Future research strategy

The future research strategy of the School is based on further strengthening and developing the above listed areas in order to increase both the volume and the quality of research outputs, and to generate significant impact. The major pillars of this research strategy post-2021 are:

Enhanced quality of research based on the involvement of increased number of research-active staff: Building on the existing WAM hour allocation process, a clear, transparent and inclusive framework has already been defined (see details in Section 2) enabling early-career, currently not research-active staff to receive a **clear potential pathway towards taking on a significant responsibility for research**. Such formalised processes will define clear pathways for early/mid-career researchers to achieve progression. The involvement of non-research-active staff in research activities will be supported by **staff development activities** (e.g. the Researcher Development Programme run by the RKEO, and focused, organised and transparent support for participation in conferences and research events), the gradual and accountable **allocation of research hours** in order to build and gain significant responsibility for research (e.g. formal processes for the assessment of research outcomes and allocated hours for these purposes in connection with the annual WAM meetings), and **mentoring support** provided to early/mid-career researchers (a pilot programme of which has already started in 2019/2020 at University level in the form of Mentoring Circles, with senior researchers offering group-based mentoring sessions).

Significant increase in external research income: We aim to **double the average yearly income from research grants** by 2023. Significant future income is already secured (e.g. both **Kale** and **Pierantoni/Kiss** won large EU grants starting in 2021). We also aim to increase the number of researchers bringing in significant external funding. Current research income is primarily generated by a smaller number of senior researchers (e.g. **Kale, Kiss, Triantaphillidou**). During the next REF cycle, focus will be shifted to further extending income generation by **involving and supporting early-career researchers** in such activities. This will be achieved by mentoring support (e.g. inside successful research groups and also across groups), and specifically supporting early-career researchers by assigned WAM hours for research proposal preparation.

Increased impact of conducted research: Building on the currently existing monitoring and impact case study preparation activities, the School's impact strategy aims to support **increased impact generation** through activities to build new and strengthen existing industrial, business and public sector collaborations. This will be encouraged via joint grant preparation activities, research collaborations and jointly organised events (e.g. industry-focused research seminars and information events).

## 2. People

### 2.1 Staffing strategy

Research profile and output quality as a **selection criterion for new staff** have been prioritised throughout the assessment period. Consequently, a number of new researchers have been appointed, covering areas such as image processing (**Villarini**), cyber security (**Michalas**), distributed computing (**Pierantoni**), and data science (**He**). In addition, one member of staff (**Triantaphillidou**) transferred to the unit from the Faculty of Media, Arts and Design in order to further strengthen the subject area of image processing and facilitate collaboration.

Wherever funding is available, early-career researchers are also employed on **externally-funded research projects** (for example, in the CPC and the HIE). Both existing (**Dagdeviren** on the CloudSME, CloudiFacturing and DIGITbrain projects) and new members of staff (**Pierantoni** on the COLA and ASCLEPIOS projects) have joined already active or newly started externally-funded research projects as co-investigators.

The introduction of a semester-long **sabbatical scheme** has benefited several staff members since 2014, including **Kapetanios, Angelopoulou, Bolotov** and **Triantaphillidou**, by enabling them to concentrate on a focused piece of research work and providing the opportunity to enhance and extend their research profile. Sabbaticals were awarded based on a formal application process and were evaluated and selected based on the quality of the proposed project and the benefits provided for the unit. The outcome of the awards was assessed in the form of a final report.

**Research hours are allocated** based on a transparent and consistent annual exercise. During this process all research active staff can apply for research hours in two main categories. There are a specific number of hours ringfenced for **starting or early career researchers**, without significant responsibility for research in the past. Such researchers can apply for up to 150 research hours pro rata (out of 1504 hours of annual total workload) and are assessed based on the quality of their research plan, relevant research background, proposed research activities, and defined tangible expected outputs. More experienced researchers can apply for **hours based on the various research levels** specified at University level, and can get up to 250, 350 or 425 hours, based on the targeted and achieved level. The assessment criteria consist of quality of research plan, income generation, publications, impact activities, and research leadership. Applications are assessed by a panel including the Head of School, an Assistant Head of School and the School Research Lead, with the College Research Director invited to observe the process to assure consistency with other schools. **Readers and Professors** are assessed separately from this process by the Head of School (Readers) and a University panel (Professors) and standardly allocated up to 425 hours. Additionally, every member of staff receives 174 hours for scholarly activity, that may also incorporate research.

Staff members can bid for additional ad-hoc support from the School research development budget to assist their research-related activities, such as **participation in conferences, networking activities, and purchasing equipment or services**. The application is through a standard form and assessed and awarded by the Head of School. Such support is **linked to longer-term development plans** to support the individual academic's progression as a fully-developed researcher and the return on this investment is monitored via the yearly research hour allocation process, as described above.

At census date, there were **23 members of staff (21.3 FTE)** with significant responsibility for research. The vast majority of REF eligible staff are employed on a permanent contact, with only two members of staff (a combined 0.8 FTE) on fixed-term research only contracts (employed on externally-funded research projects). Most staff with significant responsibility for research are employed full-time, with only three individuals in fractional positions. These ratios reflect the strategy of the school to **build a research profile** for the long term relying on full-time research active staff with permanent contracts. At the same time, those individuals employed on fixed-term contracts lead well-defined work packages in externally-funded projects and therefore their experience and contribution are crucial to maintain the high quality of these research outputs.

The current demographic profile of the UoA demonstrates a **healthy balance between early/mid-career and senior researchers**. 11 out of the 23 members of staff with significant responsibility for research are in the early stages of their research career, while the remaining 12 have significant research background and experience. As staff with significant responsibility for research are spread across the various research groups where more experienced colleagues can mentor and support early/mid-career researchers, the current structure provides a good framework to train and support the next generation of research leaders within the School.

**Staff development:** Research in the School is fundamentally based on **teamwork** within research groups. These teams contain early-career researchers who are guided by senior research staff as part of their professional development. Visiting professors (e.g. **Prof John Jarvis** at the CVIT) and researchers (**Dr Pamela Greenwell** at the CPC) from academia and industry also enhance the activities of research groupings and contribute to mentoring of less experienced researchers.

**Staff development** related to research is supported both centrally by the University and also at School level. The RKEO centrally organises the University-wide **Researcher Development Programme** (see REF5a). The programme targets researchers at all stages of their career and covers four thematic areas: (1) impact and engagement, (2) funding for research and knowledge exchange, (3) publishing data, ethics and integrity, and (4) career development. The content is delivered in the form of 1-2 hour long live sessions and short pre-recorded videos, made available monthly. The RKEO also organises regular **grant writing workshops** where members of staff can take their in-preparation grant proposals and discuss these with colleagues and with the support team. The Graduate School organises various **training and discussion events related to PhD student supervision**. At School level, regular (monthly) **research seminars** are organised where internal (researchers, PhD students) or external speakers (research collaborators, industry partners) present and discuss their work with an audience comprised of academic staff and students. To support early career or doctoral researchers, internal **preparatory conference presentations** are also organised within the School (e.g. Health and Social Care Modelling RG).

Besides mentoring within Research Groups, the School also participates in the College **Mentoring Circles** pilot that was run for the first time in the 2019/2020. The Mentoring Circles scheme is open to early-career academics (grades below Reader) from the three Colleges, one circle group per college. Each circle consists of 8-10 mentees and two mentors (typically Professors with significant experience and background). From UoA11, one mentee and one mentor (**Kiss**) contributed to the scheme in its first year. Based on its success (the feedback from both mentees and mentors was overwhelmingly positive, e.g. 93% mentees reported that they would like to continue to meet with their cohort for further peer discussions and 93% said they would be interested in participating in the mentoring scheme again), the scheme is planned to continue throughout the next REF cycle.

**Early career researchers** have been specifically supported by various College/School level funding opportunities. For example, in 2019/2020 three ECRs (**Reni, Villarini, Dagdeviren**) were awarded £4,000 seed funding each to establish their research and build the basis for further funding and opportunities. These funds enabled significant further results, including external funding (**Villarini** was awarded the Royal Academy of Engineering Leverhulme Trust Fellowship with a value of £53.156), and high-quality research outputs.

## 2.2 Doctoral researchers

Doctoral researchers play a vital role in the School's research. Supervising doctoral researchers regularly leads to high-quality outputs, significant impact and interesting new research directions, often resulting in external funding. There were **40 PhD completions** in the current REF period and the school currently has **24 active doctoral researchers**. The majority of these students are self-funded, with seven of them being supported by various School (previously Faculty) or University-based scholarships (e.g. Quintin Hogg Scholarship, FST Studentship, Cavendish Research Scholarship) or external scholarships (e.g. JY Park PhD Studentship in Imaging Science). The studentships are either fully-funded scholarships (fees and a stipend) or fee waivers. The value of a **fee waiver** is £5,360 pa for home students and £13,700 pa for overseas, while the **stipend** is £17,338 pa. Scholarship opportunities are openly advertised, with awards going to candidates with the best academic credentials, who satisfy the conditions of the support. **Doctoral researchers' expenses** (e.g. publication or conference fees) are covered by various university-wide sources (e.g. Globally Engaged Research Scholarship Scheme, Professor

Geoffrey Petts Memorial Fund, or the University of Westminster 125-Fund), as well as by the School.

Doctoral researchers are located in dedicated **research rooms** in the School's Central London building, where they can work in close proximity to each other and their supervisory team. Doctoral researchers have their own workstations and also get access to more **specialised computing resources** on demand, for example the school's high-performance computing cluster and its private cloud computing resource, or specialised multimedia or wireless communication laboratories (see Section 3). Doctoral researchers share the research rooms with Research Associates/Fellows, typically working as part of a research group, and therefore have the opportunity to interact with more experienced but typically recently graduated post-docs. In this way, doctoral researchers are able to better **engage with externally-funded projects** and become **part of a research grouping** within the School.

All doctoral researchers have a Director of Studies and at least one Second Supervisor. Supervisors receive dedicated time in their WAM (60 hours for Director of Studies and 15 hours for other supervisors) for supporting the students. There are several doctoral researchers whose topic is cross-disciplinary, and they are supervised by corresponding **cross-disciplinary teams** spanning multiple Schools. For example, **Kiss** and **Terstyanszky** have supervised doctoral researchers in collaboration with the School of Life Sciences and Westminster Business School, **Tarczynsky** with the Department of Social Sciences, and **Economou** and **Mentzelopoulos** with Psychology.

Proactive and responsive support of our research degrees program is led by the **School Research Student Coordinator (Tarczynsky)** and aligned with the wider University provision, which has evolved considerably since 2014. The University-wide **Graduate School** provides a focal point for doctoral researchers offering a range of developmental activities, including seminars and networking events to facilitate sharing of best practices, and supports the personal and professional development of doctoral and early career researchers.

Key stages of student progress are rigorously monitored as part of the **Annual Progress Review (APR)** process at both School and Graduate School levels. An independent member of staff, suitably trained, ensures examiners adhere to the University regulations, chairs MPhil-PhD transfer and PhD vivas, and ensures that processes are rigorous, fair, reliable and consistent.

All doctoral researchers undertake the University's **Doctoral Research Development Programme (DRDP)**, the local implementation of the Vitae Researcher Development Framework (RDF). DRDP includes academic, research and transferable skills delivered through University-wide and discipline-specific sessions. These are specifically geared towards the students' needs at each stage of their PhD. Doctoral researchers are also able to enrol on relevant **modules/sessions** from MSc courses. Additional activities include the Graduate School Annual Lecture, and networking events such as the Graduate School Assembly and Annual Fair (further details in REF5a).

The SCSE **annual research conference**, primarily intended for research students, helps expose students, their supervisors and other academics in the School to a wide spectrum and diversity of research, well exceeding that of topic-based conferences. The conference also features high-profile external presenters (e.g. **Prof Simon Taylor** from Brunel University London in 2019), as invited speakers.

At an individual level, several of our PhD students achieved significant national and international recognition. Examples include: **Hykoush Asaturyan** (supervisor: **Villarini**) was invited for a four-month scholarly visit by the Harvard Medical School (USA) in 2019; **Mohsen Mesgarpour** (supervisor: **Chaussalet**) was runner-up for the [OR Society Doctoral Award](#) in 2017; **Oliver Van Zwanenberg** (supervisor: **Triantaphillidou**) won Best Conference Paper award during the 2020 IS&T International Symposium on Electronic Imaging (Burlingame, California, USA); **Ed Fry** (supervisor: **Triantaphillidou**) won Best Student Paper award during the 2018 IS&T International



Symposium on Electronic Imaging (San Francisco, California, USA); **Yaprak Eminaga** (Supervisor: **Kale**) won best written and presented paper award at the 11th Conference on PhD Research in Microelectronics and Electronics (2015), and best presented paper at the 4th International Conference on Frontiers of Signal Processing (2018).

### 2.3 Equality and Diversity

The School of Computer Science and Engineering is strongly committed to **equal opportunities**, with a diverse staff and student body drawn from a range of different social and national backgrounds. We recognise that tackling unconscious bias requires a number of approaches.

At the institutional level we require all staff undertake an on-line 'diversity training' module. We have a number of networks within the University, such as the LGBTQ+ staff network, BME staff network and Women of Westminster, that support colleagues who are traditionally under-represented in research. These networks feed into the newly formed University of Westminster Equality Diversity and Inclusion Committee. The University are members of the Women in Science and Engineering network. The University of Westminster was the first university to be awarded the post May-2015 Athena Swan Bronze award (see REF5a). Two **Royal Academy of Engineering Visiting Professors, Prof Yewande Akinola** and **Prof Sarah Main**, have also been appointed who actively promote and address issues related to E&D through workshops and brainstorming sessions.

At the School level, colleagues with caring responsibilities have been able to access part-time/flexible working hours, as agreed with the Head of School. SCSE is committed to implementing policies to **ensure equal opportunities for researcher recruitment and development** with respect to gender, race, nationality and other forms of diversity. The University requires all procedures to meet the standards of the Athena Swan charter, and all appointment panels within the School are gender-balanced. All members of interview panels are required to undertake recruitment training, which has a particular emphasis on E&D issues. This is the case, too, for promotion procedures. A quarter of readers and professors are women, which is only marginally fewer than the overall representation of women within the whole School (30%) and within REF eligible staff (35%). The staff group is very diverse in terms of international background and has 23% BME representation.

At the individual level, members of the UoA are involved in various organisations and initiatives promoting and supporting diversity. For example, **Angelopoulou** carries out consultancy work with the Equality Challenge Unit, an advisory body that monitors equality in higher education and administers Athena SWAN and Race Equality charter marks. WAM is also used to ensure transparency of and equal access to resources for research, including, for example, sabbaticals, start-up funding, funded PhD students, conference attendance and training, and support for submission of funding applications. Staff who have needed to take extended periods of leave due to caring responsibilities, parental leave or ill health are contacted shortly before their return by their Line Manager/Head of School and plans are implemented to enable them to pick up their research effectively and with appropriate support.

**Doctoral researchers with protected characteristics** are encouraged and specifically supported during application, admission and throughout their research studies. Both the University and UoA11 make it very clear on all forums (website, advertisements and hard copy materials) that we welcome applications from potential doctoral researchers with protected characteristics and from diverse backgrounds who are currently under-represented. 42% of our current doctoral researchers are female, and **approximately 80% are from a black or ethnic minority background**. Many scholarship schemes, e.g. the Quintin Hogg Fund Studentship, specifically list equality, diversity and inclusion as one of the selection criteria, and welcome BAME candidates and proposals that engaged with the decolonising and diversifying of disciplines and/or the university.

*Equality and diversity considerations related to REF processes and submission:* UoA Leads and all internal readers involved in the evaluation process leading up to this submission received **training on all relevant aspects of equality and diversity** related to REF2021. UoA Leads also met regularly with staff to ensure as much transparency as possible throughout the process of constructing the submission. In UoA11, both one-to-one meetings between the UoA lead (**Kiss**) and eligible staff, and several group meetings took place to explain fully the REF eligibility and output and impact case-study selection processes. Following University policy, outputs were selected by taking the minimum one output per researcher selected on a quality basis, with the remaining pieces comprising the highest-rated pieces in the available output pool, as graded by a minimum of two (in most cases three) internal reviewers. Evaluation was also guided by suggested grades and comments from an independent external advisor who is a former REF UoA11 panel member. Where assessments resulted in the same grade, representation of staff with protected characteristics and of research areas across the submission was taken into consideration in the final decision.

### 3. Income, infrastructure and facilities

#### 3.1 Income

External research funding received by the unit (£626K per year on average, or £4.4 million overall) showed an increase on the numbers reported in REF2014 (£600K per year on average, or £3 million overall), and a dramatic, almost 5 times increase when compared to RAE2008. The numbers demonstrate that the significant increase reported in 2014 was part of a consistent strategy promoting increased external income generation, and that this strategy was successfully continued in the current REF cycle.

While the majority of the income is generated by some specific very successful research groups/individuals (e.g. **Kiss**, **Kale**, **Triantaphillidou**), there is a growing trend of early and mid-career researchers also successfully bidding for funding and building up their research profile (e.g. **Mentzelopoulos**, **Angelopoulou**, **Pierantoni**, **Villarini**).

Overall, income has been derived from 56 projects and smaller contracts, contributing between £5,000 and £700,000 each. The largest funding source, as in the previous REF period, was **EU funding**. This incorporated some large collaborative projects which the UoA either coordinated or played a very significant role in. The largest examples of income include [COLA](#) (coordinator **Kiss**, £715K), [Advanced Forest Fire Fighting](#) (contributor: **Kale**, £670K), [CloudiFacturing](#) (contributor **Kiss**, £645K), [CloudSME](#) (coordinator **Kiss**, £560K), [ASCLEPIOS](#) (coordinator **Kiss**, £486K), [DIGITbrain](#) (contributor **Kiss**, £350K), [SCI-BUS](#) (contributor **Terstyanszky**, £290K). Consultancy and **industry/government funded applied research** provided the second largest income source, including KTPs. Examples include a KTP project with Switchfire Ltd. (**Psarrou**), SBRI Integrated Care with Docobo Ltd. (**Chausalet**), understanding human spatiotemporal visual sensitivity to real scenes in the presence of noise sponsored by DSTL (**Triantaphillidou**), the development of low-complexity, low-power processor and processing engines for the European Space Agency (coordinator **Kale**, £300K), and mobile phone camera image quality sponsored by Huawei (coordinator **Triantaphillidou** - £341K).

The Unit works closely with its dedicated **Research Development Partner** (RDP) who regularly circulates funding opportunities and supports staff to target possible sources of funding, helping to match our expertise to available opportunities and funding council priorities. The RDP also supports the grant preparation process by providing and uncovering on-demand grant specific information, assisting the costing of applications, and administering the internal peer-review and approval process prior to submission.

In order to improve the quality and maximise the chances of proposals, each funding application needs to go through an **internal peer review process** before submission and approval. This peer review, conducted via the Virtual Research Environment (VRE), typically involves two members of staff giving their independent opinion on the proposal. Written feedback from this review is

utilised by the team preparing the application to improve its quality. The review and approval process are conducted and documented in a transparent way on the VRE that provides auditable evidence regarding every step of the process.

### 3.2 Infrastructure and facilities

SCSE provides a **vibrant and supportive environment** for a wide range of discipline-focused, interdisciplinary and multidisciplinary research. The School has well-equipped, specialised **research laboratories** available for use by staff and doctoral researchers. The technical and material support for these facilities is coordinated at the level of the School. Their day-to-day operation, championing their expansion and facilitating their use, is overseen by dedicated groups of researchers who are the prime users of the laboratories.

The **Parallel and Distributed Computing Laboratory (Kiss, Getov)** comprises a high-performance computing cluster (purchased in 2015 with **investment of £214K**) of 256 cores, 10TB storage and Infiniband networking; a GPU cluster of 20 GPUs; and a cloud cluster (OpenStack cloud resource of 20 nodes with 16 cores each). These facilities are **complemented with access to external resources**, mainly as part of ongoing European collaborations. Such external facilities include dedicated [CloudBroker Platform](#) installations enabling access to heterogeneous public (Amazon and [CloudSigma](#)) and private ([SZTAKI](#) Hungary, Czech National High-Performance Computing Center [IT4I](#)) cloud resources. The value of such resources from external cloud providers was approximately **£10K per year**.

The **Computational Vision and Imaging Technology RG laboratory** led by **Triantaphillidou** is equipped with state-of-the-art equipment (estimated value **£75K**) that allows the evaluation of imaging system performance and visual quality, focusing in particular on digital cameras (such as CCTV, commercial, mobile), all types of image displays, colour and light measurement equipment, specialised, very high-quality displays, high performance workstations, image quality testing software and a large number of commercially calibrated test charts.

The **Applied Digital Signal Processing and VLSI Research Group laboratory** led by **Kale** comprises equipment for Real-Time DSP (hardware and software), FPGAs, GPUs and Microcontrollers, Digital Radio Communications, GNSS signal generators and tools, digitally configurable analogue front-end FPGA platform for the GNSS and software defined radio receivers, IoT and sensor networks and platforms, Biomedical instrumentation and diagnostic systems and prototypes as well as Energy harvesting systems, with prototype build and test stations and 3D printing facilities. The current value of the kit in the lab is estimated to be in excess of **£250K**.

The **Wireless Communications Research Group laboratory** led by **Budimir**, with an **estimated value of £600K**, comprises equipment for advanced design of wireless circuits and systems from RF through Micro-/mm-wave to Terahertz frequencies for 4G, 5G (up to 20 Gbps), Beyond 5G (up to 100 Gbps) and 6G (Peak rate: 1Tbs (50x of 5G), Latency: 100  $\mu$ s (1/10 of 5G)) wireless technologies, wireless power transmission, electromagnetic field exposure, wireless sensors, Internet-of-Things (IoT), wireless Artificial Intelligence, M2M and biomedical applications. The lab is equipped with the latest RF and mm-wave instrumentation including a 67 GHz Agilent PNA (E8361A) vector network analyser for testing components for 4G and 5G mobile and ultra-wideband communications, a 20 GHz Tektronix spectrum analyser, noise figure meter, and a 6 GHz Agilent MXG vector signal generator (N5182A).

The **Serious Games at Westminster laboratory**, led by **Economou**, makes use of equipment and facilities provided by the XRLab that represents a **£184K** investment by the University (University and School budgets and the Quintin Hogg Trust). Facilities in the lab include a range of VR equipment, such as Head Mounted Displays, VR-accessories such as (HTC Vive Object Tracker, VRGO Chair Controller), high quality VR 360 cameras, and Microsoft Kinects. Specialised software, such as Articulate Storyline and Adobe Captivate, are used also by the group to create game simulations.

The **Cognitive Computing Research Laboratory**, led by **Kapetanios**, estimated value **£7.4K**, owns equipment for conducting neurophysiological (motor and sensory evoked potentials, EEG and GSR) research and prototyping on-board vision-based perception on two robotized cars. The team also owns a high specification workstation, funded by the Dunhill Medical Trust, to work on the computational demands of deep learning algorithms. In addition, the team has access to a Motion analysis laboratory, including six marker-based IR motion cameras and the supporting software provided by iMotions A/S, Copenhagen, Denmark.

#### 4. Collaboration and contribution to the research base, economy and society

##### Research collaborations at national and international levels

Strong **collaborative links** are built and maintained with universities, research institutions and industry. These connections regularly lead to joint funding opportunities and collaborative projects that are maintained on a long-term basis. Primary examples include:

The Centre for Parallel Computing (CPC) (**Kiss, Terstyanszky, Pierantoni, Michalas, Dagdeviren**) has been involved in **ten collaborative EU FP7 and H2020 projects** since REF2014 (leading and coordinating four of these projects). As a result, the CPC has built a very large network of collaborators that spans over **20 European countries, more than 50 collaborating universities**, and **over 100 companies** (primarily from the manufacturing and technology sectors). Examples include: **UK and European universities** (e.g. University of Nottingham, Cardiff University, University of Zaragoza (Spain), Lund University (Sweden)), European research institutions (e.g. Fraunhofer and DFKI (Germany), INRIA (France)), and companies (e.g. Saker Solutions Ltd. and the Audience Agency (UK), CloudSigma AG (Switzerland), SimSoft Ltd. (Turkey), PodoActiva SL (Spain), CloudSME UG (Germany)). These collaborations resulted in significant socio-economic impact with **86 SMEs** (small and medium sized enterprises) from over **20 European countries** reporting an estimated cumulative **turnover increase of 100 million Euros**, approximately **550 new products or services**, **650 new jobs**, and **1,100 new business/commercial partners or customers**, and **public sector organisations**, such as the local government of the Aragon region of Spain reporting higher satisfaction towards government services, within the current REF period. CPC is also a co-founder of the [International Science Gateway community](#), collaborating with universities from the USA (e.g. Purdue University) and Australia (e.g. University of Melbourne) since 2009.

The Computational Vision and Imaging Technologies Research Group (**Triantaphillidou, Psarrou, Villarini**) has **joint projects with various academic institutions** (e.g. University College London, Royal Veterinary College (UK), University of Valencia (Spain)), large **public and commercial entities** (e.g. Ministry of Defence, Home Office, Transport for London (UK), Huawei Ltd (China)), and **SMEs** (e.g. SpectralEdge, Linguisticator, Utopia Ltd). **Outcomes of such research collaborations** were incorporated into CCTV recording systems applied by TFL, and utilised by Huawei for product picture quality verification, generating significant socio-economic impact.

The Distributed and Intelligent Systems Research Group (**Getov**) has developed an extensive and unique track record of international achievement and recognition in different parts of the world, collaborating with around 20 research and industry partners. For example, within "The Innovation and Foreign Experts Research Collaboration in High Confidence Software Technologies" project, that also involved a Visiting Professor appointment at Peking University (**Getov**), they worked with US (e.g. Iowa State University, Purdue University) and European (e.g. Polytechnic University of Milan) universities. Their research also generated significant impact, including the inclusion of their Message Passing for Java (MPJ) specification in the Open MPI (Message Passing Interface) software environment, and the industry utilisation of their research results by IBM Research Laboratory in Rueschlikon Switzerland, and ActiveEon and Atos in France.

The Cognitive Computing Research Group (**Kapetanios, Angelopoulou**) collaborated with the Deafness Cognition and Language Research Centre of University College London (funded by the Dunhill Trust). They have also been involved in collaboration initiated and led by the IEEE Standardisation Association, working group P7003 on algorithmic bias, with partners such as Georgia Tech and Columbia Law School (USA), Leiden Law School (Netherlands), Ernst & Young, University of Mainz (Germany). Impact of their research included the development of an **automated screening toolkit** to improve early screening for Dementia among British Sign Language users, saving costs associated with the diagnosis and treatment.

The Health and Social Care Modelling Research Group (**Chausalet, Chahed, He**) collaborates with **Universities in the UK and Internationally** (e.g. University of Nottingham, Bulgarian Academy of Sciences, George Mason University USA, Ecole des Mines de Saint Etienne (France), Persian Gulf University (Iran)) in the area of modelling and analysing healthcare systems. Additionally, HSCMG collaborates with **NHS Trusts** (e.g. King's College Hospital, London North West University Healthcare NHS Trust), **Clinical Commissioning Groups** (e.g. Surrey Downs, Crawley), **NHS Improvement**, and **SMEs** (e.g. Docobo, Optimity Advisors).

The Serious Games at Westminster Research Group (**Economou, Mentzelopoulos**) has three main areas of collaboration: **educational technologies** (e.g. Graz University of Technology (Austria), RMIT University Melbourne (Australia), Friedrich-Alexander-University (Germany), University of Thessaly (Greece)), **advanced interfaces and cultural technology** (e.g. University of Brighton, University of the Aegean (Greece)), and **serious games in healthcare** (e.g. Aristotle University of Thessaloniki (Greece)). The group also has extended **industry collaborations** through Keep+ EU projects (e.g. PC Power Int. Ltd and Amplified Global Ltd).

The Wireless Communications Research Group (**Budimir, Kontogiannis**) collaborates with several **Universities** in the UK (e.g. UCL, Imperial College, Queen Mary University London, University of Manchester, University of Cambridge) and worldwide (e.g. University of Colorado Boulder (USA), KTH Royal Institute of Technology (Sweden), University of Sydney (Australia), City University of Hong Kong, IIT New Delhi (India)). WCRG's activities include strong **industrial collaboration** with national and international companies (e.g. Keysight Technology UK Ltd., Filtronic Broadband Ltd., SONY Europe B. V. Ltd.). The team has a long track record of involvement with industry and start-ups, and more than 1000 copies of one of **Budimir's filter software** was acquired by companies and educational establishments.

The Applied DSP and VLSI Research Group (ADVRG) (**Kale, Reni, Coskun**) is especially strong in **industrial collaboration** and worked with and provided technology transfer for (among others) Airbus Defence and Space, European Space Agency, Mitsubishi Electric VIL, Dialog Semiconductor Ltd., Burr-Brown Europe Ltd., NOKIA Ltd., Ericsson Components AB.

Within the Software Systems Engineering Research Group, **Bolotov** leads international research collaborations on automated reasoning, resulting in high-quality **joint publications**, including researchers from the Moscow State University (Russia), University of San Sebastian (Chile), University of Poznan (Poland), University of Liverpool (UK), Ecole Polytechnique Fédérale de Lausanne (Switzerland).

#### **Indicators of wider influence, contributions to and recognition by the wider research base**

A list of selective contributions:

#### **Journal Editorship:**

**Editor in Chief/major role:** Editor in Chief *Journal of Grid Computing* (Springer) 2020- (**Kiss**), Area Editor for High Performance Computing, *IEEE Computer*, *IEEE*, 2008- (**Getov**),

**Member of Editorial Board:** *IEEE IT Professional* 2016-2019 (**Getov**), *International Journal of Computational Science and Engineering* 2005- (**Getov**), *Future Internet* (MDPI) 2020- (**Kiss**),

*Health Care Management Science* (Springer) 2006- (**Chaussalet**), *World Medical Health Policy* (Wiley) 2010- (**Chaussalet**), *BMC Health Services Research* (Biomed Central) (**Chaussalet, Chahed**), *Imaging Science Journal* (Taylor & Francis) 2011- (**Triantaphillidou**), *IEEE Transactions on Circuits and Systems* (**Kale**); *Journal of Navigation* (**Kale**).

**Special Issue Guest Editor:** *IEEE Computer* (**Getov**); *Concurrency and Computation, Practice and Experience* (Wiley) (**Kiss, Pierantoni**), *Health Care Management Science* (Springer) (**Chaussalet**), *Journal of Electronic Imaging* (**Triantaphillidou**), *Journal of Computational Intelligence and Neuroscience* (**Kapetanios, Angelopoulou**); *Sensors* (MDPI) (**Kapetanios, Psarrou, Angelopoulou**), *Expert Systems* (Wiley) (**Psarrou**), *Neural Computation and Applications* (Springer) (**Psarrou**), *Neurocomputing* (Elsevier) (**Psarrou**), *Neural Processing Letters* (Springer) (**Psarrou, Angelopoulou**), *Complexity* (Wiley) (**Angelopoulou**), *Journal of Universal Computer Science* (**Mentzelopoulos**), *Personal Ubiquitous Computing* (Springer) (**Mentzelopoulos, Economou**), *Energies* (MDPI) (**Kontogiannis**).

**Participation on Grants Committees:** National Science Centre of Poland (member 2019, chair 2020) (**Tarczynski**), Russian National Research University (2014-2020) (**Bolotov**), Fond de recherche du Quebec, Nature et Technologies (2014 – 2015) (**Chahed**), Norway Research Council (2019) (**Triantaphillidou**), Lifelong Learning for Intelligent Systems by CHIST-ERA (2016) (**Angelopoulou**), National Institute of Health Research Peer Review Panel 2007- (**Chaussalet**), EPSRC Peer Review College 2006-2016 (**Chaussalet**).

**National/International Committees:** IEEE Computer Society's Board of Governors 2016-2018, Secretary of Publications Board Executive Committee of IEEE Computer Society 2016-2018, Technical & Conference Activities Board Executive Committee of IEEE Computer Society 2017, IEEE CS Constitution and Bylaws Committee 2016, Executive Committee IEEE CS Technical Consortium on High Performance Computing 2017-2020, Chair of IEEE CS TCHPC Early Career Award of Excellence in HPC 2018-2020 (**Getov**); Member of the National Professors and Heads of Electrical Engineering Committee, Vice Chair of the IEEE UK & Ireland Section, Member IEEE Technical Committee on CAS Education and Outreach, Member of the IEEE waveform Digitization ADC/DAC Standards Committee (**Kale**); Vice President and Executive Board Member of Society of Imaging Science & Technology 2019-, Science Committee and Science Qualifications Board of the Royal Photographic Society 2016- (**Triantaphillidou**); BSI (British Standards Institute) SG42 on Responsible Artificial Intelligence (**Kapetanios**).

**Visiting Professor/Fellow:** Visiting Professor at National Key Lab of High Confidence Software Technologies Peking University China (2017-), Visiting Lab Fellow at Pacific Northwest National Lab Richland USA 2014-2016, Honorary Professor at Technical University of Sofia, Bulgaria (2012-) (**Getov**).

**Prizes/Awards:** State Order 'Saints Cyril and Methodius' (second ranked Bulgarian order) by the President of the Republic of Bulgaria 2020; Golden Core Award of IEEE Computer Society 2017 (**Getov**). Service Award USA Society of Imaging Science & Technology 2016 (**Triantaphillidou**). Best paper/presentation awards: International Symposium on Electronic Imaging 2020 (**Psarrou**) International Symposium on Bioinformatics and Biomedicine 2020 (**Chaussalet**).

**Invited keynotes:** IEEE International Conference on Electronics Circuits and Systems 2020 (**Kale**), International Conference on Recent Advances in Space Technologies 2019 (**Kale**), International Symposium on the Future of High-Performance Green Computing Tokyo Japan 2018 (**Getov**), TopHPC2017 Tehran Iran 2017 (**Getov**), 6<sup>th</sup> Sixth International Conference on Parallel, Distributed and Grid Computing (IEEE) 2020 (**Kiss**), 10th European Conference on Computational Chemistry Fulda, Germany 2015 (**Terstyanszky**), 6th EUCHEM Chemistry Sevilla Spain 2016 (**Terstyanszky**), 12<sup>th</sup> International Workshop on Science Gateways 2020 (**Kiss**), Operational Research Society Annual Conference 2016 (**Chaussalet**), AMSDA Demographics Workshop 2017 (**Chaussalet**), 41st International Spring Seminar on Electronics Technology, Zlatibor Serbia 2018 (**Budimir**), 17th International Symposium INFOTEH-JAHORINA, Serbia, 2018 (**Budimir**), High Performance Computing Conference Kyiv Ukraine 2018 (**Pierantoni**),

**Conference chairs:** IEEE Int. Computer Software and Applications Conference COMPSAC 2019 (**Getov**), IEEE CCGrid Conference Program Committee Vice-Chair 2014 (**Getov**), IntenetWare Symposium 2016 (**Getov**), International Conference on Imaging for Crime Detection and Prevention 2019 (**Kale**), Professors and Heads of Electrical Engineering Conference 2015-2020 (**Kale**), International Conference on Quantitative Modelling for the Management of Health and Social Care 2016 (**Chausalet**), *Workshop on Metrification and Optimization of Input Image Quality in Deep Networks* (**Psarrou**), UK Automated Reasoning Workshop 2014-2020 (**Bolotov**); Software Engineering Technologies & Applications symposium within COMPSAC 2017 (**Bolotov**), International Workshop on Science Gateways 2014, 2017 (**Kiss**), SPIE/IS&T Electronic Imaging: Image Quality and System Performance conference, 2012-2015 (**Triantaphillidou**), Academic Program Chair, Local Chair, Special Track Chair on Annual International Conference of the Immersive Learning Research Network 2015 – 2020 (**Economou**), Local co-chair: European Microwave Week Conference 2016 (**Budimir**).

**Refereeing academic publications or research proposals** (examples):

**Journals:** *IEEE Transactions on Signal Processing*, *IEEE Signal Processing Letters* (**Tarczynski**); *Neural Processing Letters* (Springer), *Data & Knowledge Engineering* (Elsevier) (**Kapetanios**); *IEEE Transactions on Power Systems*, *IEEE Transactions on Fuzzy Systems* (**Kontogiannis**); *Journal of the OR Society*, *IEEE Journal of Biomedical and Health Informatics* (**Chausalet**); *IEEE Transactions Circuits and Systems* (**Kale**); *Neural Computing and Applications* (Springer), *Imaging Science Journal* (**Psarrou**); *Journal of Applied Logic*, *Computer* (**Bolotov**); *International Journal of Interactive Mobile Technologies* (**Mentzelopoulos**); *Future Generation Computer Systems* (Elsevier) (**Kiss**, **Terstyanszky**); *Signal Processing* (IEEE), *Communications* (IEEE) (**Coskun**); *Concurrency and Computation, Practice and Experience* (Wiley) (**Kiss**); *Health Care Management Science* (Springer), *Supply Chain Forum* (**Chahed**); *Applied Soft Computing* (Elsevier); *Neural Networks* (Elsevier) (**Angelopoulou**).

**Research proposals:** EPSRC/ESRC (**Kapetanios**, **Chausalet**, **Kale**, **Bolotov**, **Angelopoulou**, **Budimir**); European Commission (**Getov**, **Psarrou**, **Kiss**); Innovate UK (**Kapetanios**); Newton Funds (**Kapetanios**); NIHR, MRC (**Chausalet**); Foundation for Polish Science (**Tarczynski**); IWT Research Council in Belgium, MITA Research Council in Lithuania, Bulgarian National Science Fund, Research Promotion Foundation in Cyprus (**Getov**); Dutch Research Council, Austrian Agency for International Cooperation in Education and Research (**Angelopoulou**); NSERC Canada, RGC Hong Kong, HiCi Kingdom of Saudi Arabia, MNRS Serbia (**Budimir**).

**Public engagement:** **Kale** was, for example, interviewed for the BBC Click Technology program “How wireless sensors could help fight forest fires” (2017) and “Wireless sensors to fight wild forest fires” (2018), appeared on the BBC World News, Click program, “Trailblazers: The Future of Firefighting” (2019).