Institution: Kingston University

Unit of Assessment: 11, Computer Science and Informatics

a. Context

The critical mass and longevity of the Unit's research have allowed it to generate positive impacts on **economy, society, culture, quality of life, health and public policies**. These outcomes were made possible by the support of a dedicated team and a focused strategy aimed at ensuring engagement with **industry, national and international bodies** by establishing long term relationships with main stakeholders, participating at decision-making organisations and exploiting intellectual property.

The quality and variety of impacts generated by the Unit can be illustrated by the following examples. Novel visual surveillance systems improve **safety and security** of the general public through collaborations with police services and transport authorities while providing **economic benefits** to SMEs and large companies. Advances in processing sporting event videos have contributed to the **social impact** brought about by the change in the public perception of disabled athletes. Development of mobile health systems delivers **better care** and **societal and cultural change** to patients and vulnerable groups. Participation in international and national government agencies and standards bodies ensure dissemination of novel practices which aim at **better quality of life and informed decision making**.

Such impacts have been accomplished through engagement with industry, governmental departments and policy makers. It has been achieved by a strategy focused on building trusting and lasting relationships with a wide range of stakeholders, participation in decision-making bodies and commercial exploitation of intellectual property.

b. Approach to impact

The Unit has achieved impact from its research through **engagement with industry and national and international public bodies**. Those objectives are supported by staff dedicated to enterprise support and business development. In addition, to tailor advice and support to individual researchers seeking to ensure impact from their research, the enterprise and business development staff offer events to increase staff awareness and train staff in impact mechanisms such as KTPs, industrial projects, patents, intellectual property and networking. They also facilitate contact with industrial partners through professional networks and dissemination activities such as the organisation of showcase events targeted at companies.

Engagement with industry

The Unit's strategy has been focussed on **building trust and fostering** the establishment of **long term relationships** with industry. This has been achieved using various schemes which include KTPs, sponsored PhD scholarships, supply of trainees and job candidates, support of SMEs (e.g. the University has a role as a broker between London SMEs and potential European partners within the Enterprise Europe Network London) and organisation of industry relevant events such as school annual industrial lectures, IP training, discussion forums (video analytics for CCTV, 2011) and professional workshops (IET Imaging for Crime Detection and Prevention, 2009-11-13). Success of this strategy can be illustrated by the decade long relationship with a **UK SME**, Ipsotek Ltd. The Unit has also been very active in funded EU FP6 and FP7 projects, where it currently collaborates with the following **industrial partners**: Ansaldo, Altsom, Bombardier, NXP, PaleBlue, SAGEM, Telefonica and Thales.

The Unit's approach has proven to be successful in supporting engagement with industry, raising funds from KTP schemes and industrial sources (50% of which originated from overseas industry). The Unit's applied research, addressing practical problems, has been particularly sought by **SMEs** across a variety of industries including media, food processing, pharmaceutical, building, safety and security, manufacturing and software engineering. Its expertise in video based tracking of people in sporting events led DeltaTre Media Ltd, with whom it had previously collaborated on an

FP7 project (2002-2005), to commission a system dedicated to wheelchair rugby and basketball. Its deployment by **Channel 4 at the 2012 London Paralympics** resulted in **social impact** on the public perception of disabled people and the award of a **BAFTA**.

The Unit has also transferred its technology and expertise to a number of **large national** (BAe Systems; Siemens Research UK Ltd; Roke Manor Research Ltd; Transport for London; Rome Public Transport Authority -ATAC; BT Group PLC) and **international companies** (LG Electronics, Korea; Robert Bosch GmbH, Germany; SYAC Group, Italy; Barco View SA, Belgium; Philips, Netherlands; Nestlé S.A., Switzerland; Vodafone, UK; Deutsche Telekom, Germany; NTT Docomo, Japan; Motorola, USA).

Although many of these collaborations have taken place within EU Framework Programmes, the majority have been conducted through bilateral relationships. For example, the Advanced Engineering Systems division at **Robert Bosch GmbH** approached the Unit at the main event of the computer vision community (2009 IEEE International Conference on Computer Vision) where the Unit was presenting novel research on video-based action recognition. Eventually, following months of interactions, including an onsite visit, Bosch GmbH contracted the Unit to conduct research on CCTV-based action recognition (2010-2011).

Engagement with governmental departments and policy makers

In parallel with enterprise partnerships, the Unit has recognised the importance of engaging with other types of stakeholders such as **standards bodies, governmental departments and policy makers**.

Police, security and safety services have relied on the Unit's expertise by being their partner in many funded projects involving **security organisations** (PITO -now the National Policing Improvement Agency; the Home Office Scientific Development Branch; Greater Manchester Police; Metropolitan Police; National Firearms Centre), **defence agencies** (UK Ministry of Defence; Swedish Defence Research Agency; US Department of Homeland Security; US Air Force Office of Scientific Research) and a **safety authority** (the Railway Safety & Standards Board).

Its close collaboration with UK police forces has led the Unit to contribute to the Video-based Threat Assessment and Biometrics Network, whose work has shaped **UK government** initiatives such as the Home Office Imagery Library for Intelligent Detection Systems (2004-present). National recognition in visual surveillance has developed into international exposure. As a result of this work, the **Swedish Defence Research Agency** funded a senior academic to provide expert knowledge on intelligent CCTV technology to support their national investment strategy for research on sensor technology (2007-12). Moreover, the **US Department of Homeland Security** requested the Unit's expertise on the extension of their multi-camera surveillance to robot-based monitoring of larger environments (2009).

The Unit has also been highly active in transferring the product of its research to **standards bodies** (International Telecommunication Union, IEEE Multimedia Interest Group, Wireless World Research Forum) and **healthcare organisations** (World Health Organization and NHS).

'm-health' – a concept first introduced by Prof. Istepanian in 2003 - has been developed through years of interactions with leading telecom and network companies, i.e. Vodafone (UK), Deutsche Telekom (Germany), Philips (Netherlands), NTT Docomo (Japan) and Motorola (USA). However, it was a partnership involving the **UK government's Department for International Development** which led to major impact. Its deployment for chronic disease management in post-conflict Iraq resulted in improved health outcomes for diabetic patients and pregnant women, and led to the establishment of two centres of excellence in Iraq for m-health and e-health.

c. Strategy and plans

The Unit's strategy to ensure maximum impact of conducted research is organised around **three main objectives**:

1. to build trust and foster the establishment of long term relationships with commercial organisations and main stakeholders

2. to participate actively in the work of professional organisations and decision-making entities

3. to exploit commercially the intellectual property generated from research activities

The Unit's work on aortic abdominal aneurysm has the potential to improve the speed and quality of radiologists' analysis by bringing down processing time from 2 hours to 30 seconds while providing more reproducible results. Following the award of a patent in 2011, international certifications are now required for commercialisation. Consequently, a **large clinical trial** (500-sample data set) is being conducted by Lausanne (Switzerland) and St George's Vascular Institute (UK) to achieve European (CE) and Food and Drug Agency (FDA) certifications, by 2014 and 2015 respectively.

To strengthen relationships with stakeholders in the field of **medical imaging**, the Unit collaborates with the medical engineering and health sectors in the UK (St George's Vascular Institute and Surrey University) and overseas (USA, Switzerland, Netherland, Malaysia and India). This research has attracted funding from a major international company, **Nestlé**, which has sponsored research and development of fat quantification software aimed at assessing the effect of dry milk in producing fat in children, in order to improve their product range.

The Unit has recently created a **creative games-development studio**, inKUbator, led by industry professional Hope Caton (writer of 'Tomb Raider: The Last Revelation') to ensure commercial impact of its game research and development, whose focus is on serious games for **education and health**. inKUbator involves **industry leaders**, i.e. Google, Microsoft, Colossal, Crytek, Splash Damage, Turbulenz, Unity, Two-Way-TV and Sony, with whom the Unit nurtures a close relationship by offering placement students, inviting them as speakers and meeting them in the main relevant industrial events (e.g. Eurogamer Expo 2012). A 'smoking cessation' game is currently being evaluated in collaboration with Barts and the London School of Medicine and Dentistry. It is expected that the commercial partner will initiate its commercialisation in 2014.

d. Relationship to case studies

The two case studies exemplify positive impacts produced by the Unit. They highlight the benefits of the Unit's strategy which builds on a wide range of stakeholders, e.g. industry and governmental departments, using long lasting commercial relationships as the initial step towards impact.

1. Social and economic benefits from development of sports tracking technology

Relationship between the Unit and the DeltaTre SME dates from 2002 when they collaborated as part of a FP7 project on visual surveillance. Since then, the Unit has developed a new expertise in the video-based tracking of people in sporting events which was called upon when DeltaTre became involved in the broadcast of the London Paralympics with Channel 4. The Unit developed a system which was deployed during the event. In addition to economic impact, this deployment contributed to the social impact brought about by the change in the public perception of the disabled. The work was awarded a BAFTA.

2. Economic benefits from sales of people-tracking and crowd-monitoring technology

Exploitation of research in visual surveillance has generated benefits in terms of safety, security and economy. Such impact has been achieved not only through a decade long relationship with an SME (Ipsotek Ltd), which has been built on a variety of schemes including KTPs, sponsored PhD scholarships and staff supply, and more recent contacts with a large UK company (BAE Systems), but also interactions with a wider range of stakeholders including the general public, security organisations, defence agencies and safety authorities.