

Research Role Profile

Job Title:	Research Fellow A
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Responsible to:	Head of research group, or principal investigator
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Responsible for:	Not applicable
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Job Summary and Purpose:
To undertake research in accordance with the specified research project(s) under the supervision of the principal investigator.

Main Responsibilities/Activities
<p>To undertake a range of research activities within a specified research area, assuming responsibility for specific areas of projects and making use of new research techniques and methods, in consultation with the research award holder or supervisor. This may include fieldwork, interviews, laboratory experimentation, critical evaluation and interpretation, computer-based data analysis and evaluation or library research.</p> <p>Using initiative and creativity to identify areas for research develop new research methods and extend the research portfolio. Analysing and interpreting results of own research. Write up results and prepare papers for submission to appropriate journals and conferences, and other outputs as required and/or appropriate. Attend appropriate conferences for the purpose of disseminating research results of personal development. The post holder may also contribute to writing bids for research grants and will contribute to collaborative decision making with colleagues in areas of research.</p> <p>Collaborate with the research project team across multiple University and industry partners on joint research challenges and integration to develop new tools and technologies.</p> <p>Pursue and advocate responsible and open research and innovation to ensure ethical, fair and inclusive advances in science, technology and use of data.</p> <p>Continually to update knowledge and develop skills, and translate knowledge of advances in the area into research activity.</p> <p>To plan and manage own research activity in collaboration with others. To carry out administrative tasks associated with specified research funding, for example risk assessment of research activities, organisation of project meetings and documentation. Implementation of procedures required to ensure accurate and timely formal reporting and financial control.</p> <p>To contribute to teaching in the Faculty by carrying out student supervision and/or demonstrating within the post holder's area of expertise and under the direct guidance of a member of departmental academic staff, as appropriate.</p> <p>The post holder may occasionally be required to supervise more junior research staff.</p>

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Person Specification

The post holder must have:

A doctoral degree in a relevant discipline (although individuals who have almost completed a doctoral degree may be appointed). Consideration may also be given to individuals who do not hold a doctoral degree but have required skills based on a number of years experience in specified / relevant fields

The post holder will have authority over some aspects of project work and must be capable of providing academic judgement, offering original and creative thoughts and be able to interpret and analyse results.

Relationships and Contacts

Direct responsibility to the principal investigator or academic supervisor. The post holder may be asked to serve on a relevant Faculty committee. There may be additional reporting and liaison responsibilities to external funding bodies or sponsors. The post holder may work on original research tasks with colleagues in other institutions.

Special Requirements

To be available to participate in fieldwork as required by the specified research project

All staff are expected to:

- Positively support equality of opportunity and equity of treatment to colleagues and students in accordance with the University of Surrey Equal Opportunities policy.
- Help maintain a safe working environment by:
 - Attending training in Health and Safety requirements as necessary, both on appointment and as changes in duties and techniques demand
 - Following local codes of safe working practices and the University of Surrey Health and Safety Policy
- Undertake such other duties within the scope of the post as may be requested by your Manager.

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Addendum to Role Profile

Job Title:	Research Software Engineer/Research Assistant in Computer Vision and Audio-Visual AI (Research Fellow A)
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<p>Job Summary and Purpose:</p> <p><u>This information sheet should be read in conjunction with the accompanying generic Research Fellow RA1A Role Profile and will be used for shortlisting processes. More specifically the post holder will be expected to:</u></p> <p>Contribute to the EPSRC Prosperity Partnership in Future Personalised Object-Based Media Experiences led by the University of Surrey with the BBC and Lancaster University.</p> <ul style="list-style-type: none"> (i) Design, develop and implement computer vision and audio-visual AI software and hardware for object-based capture, representation, production and neural rendering of audio-visual content to enable dynamic adaptation for user personalisation at the point of delivery. (ii) Lead the development of computer vision and audio-visual AI software tools and libraries for use by researchers across the partnership, industry collaborators and open-source release. (iii) Conduct research to advance computer vision, audio analysis, machine learning and audio-visual AI for object-based audio-visual content capture, representation and rendering from video. (iv) Pro-actively engage with responsible and open research to ensure ethical, fair and inclusive design of computer vision, audio and AI technologies for personalised media experiences. (v) Collaborate with other staff on the project to develop pilot and proof-of-concept systems for object-based capture, representation and neural rendering of personalised media experiences. (vi) Develop tools and technologies to support object-based production of personalised experiences and support their use in production with creative industry partners and collaborators. (vii) Collaborate with other partnership researchers and creative professionals on the production and user evaluation of personalised media experiences. (viii) Work with other researchers on the project to develop research software libraries and systems to facilitate reproducible research and public engagement. (ix) Publish and present research in high-quality international journals and conferences. (x) Onsite collaboration with project partners as required to conduct research and integrate tools and technologies for personalised object-based media capture, production and delivery. (xi) Contribute to participative research engagement events and activities with stakeholders. (xii) Meet on a weekly basis with partnership staff, contribute to partnership meetings and present results at other sites as required. (xiii) Pro-actively organise and manage your own time and research-related activities. (xiv) Report orally and prepare papers reporting progress and delivery of project outcomes, and be able to communicate at both technical and high-level for example with project research partners. (xv) Perform any other duties associated with the project, as deemed appropriate to the grade by the Principal Investigator. (xvi) Promote the research and activities of the partnership and the Centre for Vision, Speech and Signal Processing (CVSSP) in national and international forums.
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Main Responsibilities/Activities

- Undertake the development of research software and hardware for computer vision, audio and audio-visual AI, using methods arising from research or to enable research to take place.
- Meet on a weekly basis on campus with CVSSP staff.
- Attend project meetings and present results at other sites as required.
- Collaborate with project partners in design and development of tools, production, user-testing and evaluation of technologies for personalised object-based media experiences.
- Give oral and written reports on project progress and outcomes. Report at both a technical low-level and conceptual high-level to a range of audiences including the public and industry.
- Pro-actively engage with open, responsible and inclusive AI research and data privacy.
- Take part in, organise and/or deliver demonstration of project progress and outcomes to a range of different audiences at events in-person and online
- Continually update knowledge and develop skills.
- Carry out routine administrative tasks associated with a specified research project, for example risk assessment of research tasks, organisation of project meetings and documentation. This will entail planning own day-to-day research activity within the framework of the agreed programme, dealing with problems that may affect the achievement of research objectives and deadlines and implementing procedures required to ensure accurate and timely delivery.

Person Specification

The post holder must have:

- Master's degree in electronic engineering, computer science or a related subject, or equivalent professional experience
- At least 1 year's experience in software development relevant to computer vision, machine learning, audio and/or video processing.
- Experience in software development in topics such as computer vision, audio signal processing, machine learning, deep learning, and/or sensor systems.
- Ability to work independently, with strong organisational and time management skills.
- Good writing and communication for different levels of technical/non-technical audience.

The post holder would ideally have:

- Skills and experience of development using languages such as Python and C++ with relevant computer vision, signal processing, machine learning and/or deep learning tools (TensorFlow, PyTorch, Keras, OpenCV etc.).
- Research experience in computer vision, audio or machine learning, and/or experience of software development while working closely with researchers working in computer vision, audio and/or machine learning, including developing new algorithms related to research
- A track record of publishing papers, open-source software tools and/or research datasets
- Experience of collaboration and technology transfer to partners outside academia.

Relationships and Contacts

Direct responsibility to Principal Investigator Prof Adrian Hilton and Prosperity Partnership Research Stream Leaders. Informal enquiries are welcome and should be directed to Prof Adrian Hilton a.hilton@surrey.ac.uk

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Additional Background Information

This post is part of an **EPSRC Prosperity Partnership “Future Personalised Object-Based Media Experiences Delivered at Scale Anywhere”**, led by Prof Adrian Hilton in the Centre for Vision, Speech and Signal Processing (CVSSP), University of Surrey, with the BBC and Lancaster University.

The goal of the EPSRC Prosperity Partnership is to realise a transformation to future personalised content creation and delivery at scale for the public a home or on the move.

Personalised media experiences have the potential to transform the way content is created and consumed. Our research will address the key challenges for personalised content creation and delivery at scale using AI and Object-Based Media (OBM). The ambition is to enable media experiences which adapt to individual preferences, accessibility requirements, devices and location. The partnership builds on the BBC’s pioneering work in OBM and its ability to run large-scale trials with its audience and programme content. University of Surrey’s expertise in audio-visual AI for machine understanding of captured content will allow efficient creation of personalised OBM experiences. Lancaster University’s expertise in software-defined networking will develop adaptive systems for delivery of personalised experiences to millions of people whilst maintaining cost and energy efficiency (see further details below).

The postholder will be responsible for designing and building the computer vision, audio and audio-visual AI software and hardware for object-based capture, representation, production and rendering of audio-visual content from video for personalised rendering at scale. The postholder will develop software libraries and tools to be used for production of personalised object-based media experiences. The postholder will be based in CVSSP and work under the direction of Prof Adrian Hilton (Principal Investigator) and the Research Stream Leads (Co-Investigators).

Centre for Vision Speech and Signal Processing (CVSSP) at the University of Surrey

The Centre for Vision, Speech and Signal Processing (CVSSP), part of the Department of Electronic and Electrical Engineering at the University of Surrey, is an International Centre of Excellence for research in Audio-Visual AI and Machine Perception, with 180 researchers, a grant portfolio of £30M (£21M EPSRC) from EPSRC, EU, InnovateUK, charity and industry, and a turnover of £7M/annum. The Centre is internationally unique in bringing together expertise in both audio and visual machine perception, with the central goal of creating machines that can see and hear to understand the world around them. The Centre has state-of-the-art multi-camera UltraHD visual and spatial audio capture and analysis facilities supporting research in real-time audio-visual processing and visualisation. CVSSP has an AI compute facility with 240GPUs for deep learning and >1PB of high-speed secure storage. National standing is evidenced by sustained EPSRC investment, including two Programme Grants (2013-19, 2015-21), Prosperity Partnership(2021-25), Digital Economy Centre DECaDE (2020-25), three Platform Grants in Audio-Visual Research (2003-08, 2008-14, 2017-22), and as a lead partner of the BBC Data Science and Audio Research partnerships. The centre has an outstanding track record of pioneering research leading to successful technology transfer with UK industry and spin-out companies. CVSSP also leads the AI@Surrey interdisciplinary network of over 300 research in AI and machine learning across the University of Surrey.

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Prosperity Partnership Summary: Future Personalised Media Experiences

Personalisation of media experiences for the individual is vital for audience engagement of young and old, allowing more meaningful encounters tailored to their interest, making them part of the story, and increasing accessibility. The goal of the BBC Prosperity Partnership is to realise a transformation to future personalised content creation and delivery at scale for the public at home or on the move.

Evolution of mass-media audio-visual 'broadcast' content is moving to Internet delivery; this creates exciting potential for hyper-personalised media experiences delivered at scale to mass audiences. This radical new user-centred approach has the potential to disrupt the media landscape by directly engaging individuals at the centre of their experience, rather than predefining the content as with existing fixed 'one-size-fits-all' media formats (radio, TV, film). This will allow a new form of user-centred media experience which dynamically adapts to the individual, their location, the media content and producer storytelling intent, together with the user device and network compute resources available for rendering personalised content. The BBC Prosperity Partnership will position the BBC at the forefront of this 'Personalised Media' revolution enabling the creation and delivery of new services and positioning the UK creative industry to lead future personalised media creation and intelligent network distribution to render personalised experiences for everyone anywhere. Leading this advance beyond fixed media to personalisation is critical for the future of the BBC and the UK creative industry, opening new horizontal markets.

Realisation of personalised experiences at scale presents three fundamental research challenges: capture of object-based representations of the content to enable dynamic adaptation for personalisation at the point of rendering; production to create personalised experiences which enhance the perceived quality of experience for each user; and delivery at scale with intelligent utilisation of the available network, edge and device resources for mass audiences. The BBC Prosperity Partnership will address the major technical and creative challenges to delivering user centred personalised audience experiences at scale. Advances in audio-visual AI for machine understanding of captured content will enable the automatic transformation of captured 2D video streams to an object-based media (OBM) representation. OBM will allow adaptation for efficient production, delivery and personalisation of the media experience whilst maintaining the perceived quality of the captured audio-visual content. To deliver personalised experiences to audiences of millions requires transformation of media processing and distribution architectures into a distributed low-latency computation platform for flexible deployment of OBM and compute intensive tasks across the network. This will achieve efficiency in terms of cost, time and energy use, while providing optimal quality of experience for the audience within the system constraints.

Personalisation is expected to be the primary driver for growth in the \$2.3tn global media industry over the next decade. The UK media industry is worth over £100billion annually to the UK economy (6% GVA) and employs over 3.2million people. Personalised media has the potential to provide a significant boost to the UK's media industry and is projected to drive growth by £2billion/annum by 2030 with 100k additional jobs. This partnership aims to position the UK media industry as the global leader in delivering personalised media experiences to audiences across the globe.

Example Use Cases to drive research which will deliver business impact and demonstrate the potential of personalised media to renew the BBC mission of Public Service for ALL include:

News/Documentary - Individuals consume news according to personal interest, location, activity, device, language and time availability. Personalisation will dynamically adapt the

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content and rendering to the individual to intelligently prioritise information to their requirements. This will provide future news services tailored to the individual from a trusted source maintaining the integrity of the BBC whilst adapting to individual audience preferences. Mass-user trusted personalisation requires network services at scale to intelligently prioritise and render content for the individual.

Drama - User-centred personalisation of TV and radio drama aims to enhance the storytelling experience to engage the individual. Prioritisation based on the narrative importance of the audio and visual cues together with accessibility of the content (i.e. intelligibility of speech according to individual hearing requirements, spatial layout/contrast of visual cues for understanding the story). Requirements may change dynamically according to the individual, device, location, and activity. Dynamic rendering of OBM at scale will maximise individual engagement in the story.

Education - Intelligent personalisation of content tailored to individual understanding, interest, learning style and pace will support improved educational experiences in the classroom and at home. Collaboration with BBC Education will create and evaluate personalised interactive educational experiences using OBM to adapt according to individual learning requirements for each topic.

Live Events (Sports and Music) - Creating the sense of 'being there' at a live sports or music event is the ultimate goal of personalised immersive content production. The potential for future network media to transform a live event into objects and dynamically render personalised content for individual audience members is a key enabler for future immersive experiences of live events. OBM will enable user-centred rendering to maximise the sense of immersion. Achieving this at scale requires intelligent utilisation of network/device compute and transmission resources to transform the raw video to objects and dynamically adapt the rendering for individual users and their devices.

Other use cases of interest include: **Multiplayer interaction at live events;** and **Legacy content**

Project partners

BBC; Lancaster University; AudioScenic; BT; Charisma AI; Dimension Studios; Fgment Productions; Foundry; Framestore; Imagination Technologies; Imagineer; Intel; Mirriad; NetworkMedia; SalsaSound; Sony; Synthesia; Telefonica.