Job Description

Job title	Research Associate (Fixed Term) in Computer Vision and Computer Graphics
Department/School	Department of Computer Science
Job family	Education and Research
Grade	7
Reporting to	Dr Christian Richardt
Responsible for	Some co-supervision (with PI) of doctoral, postgraduate or undergraduate students may be required.
Location	University of Bath premises

Background and context

To feel truly immersed in virtual reality, one needs to be able to freely look around within a virtual environment and see it from the viewpoints of one's own eyes. Immersion requires 'freedom of motion' in six degrees-of-freedom ('6-DoF'), so that viewers see the correct views of an environment. As viewers move their heads, the objects they see should move relative to each other, with different speeds depending on their distance to the viewer. This is called motion parallax and is a vital depth cue for the human visual system. VR games support motion parallax easily, but it is entirely absent from existing 360° VR video.

The goal of this project is to create a new form of immersive 360° VR video – 6-DoF VR video – that will achieve unparalleled realism and immersion by providing freedom of head motion and motion parallax. Specifically, the aim is to accurately and comprehensively capture real-world environments, including visual dynamics such as people and moving animals or plants, and to reproduce the captured environments and their dynamics in VR with photographic realism, correct motion parallax and overall depth perception. 6-DoF VR video is a significant virtual reality capability that will be a significant step forward for overall immersion, realism and quality of experience.

This project is associated with the Centre for the Analysis of Motion, Entertainment Research and Applications (CAMERA) at the University of Bath (Departments of Computer Science and Health). The aim of CAMERA is to create research impact through cross-disciplinary innovation – focusing on applications of vision, graphics, machine learning and HCI to entertainment, elite sport and rehabilitation. CAMERA also undertakes commercial work with the Creative Industries.

Job purpose

To achieve 6-DoF VR video that enables photorealistic exploration of dynamic real environments in 360° virtual reality, this project will develop novel video-based capture, 3D reconstruction and rendering techniques. We first explore different approaches for capturing static and dynamic 360° environments, which are more challenging, including using 360° cameras and multi-camera rigs. We have started with 6-DoF 360° VR photographs (i.e. static scenes) and want to extend our approach to 6-DoF VR videos.

The main focus of this job is to research and develop novel algorithms for reconstructing the 3D geometry of the environments from the captured imagery by extending multi-view geometry/photogrammetry techniques to handle dynamic 360° environments. Extending image-based rendering to 360° environments will then enable 6-DoF motion within a photorealistic 360° environment with high visual fidelity, and will result in detailed 360° environments covering all possible viewing directions.

Our aim is to publish the resulting research and results in leading computer vision and computer graphics venues, specifically CVPR/ICCV/ECCV, IJCV and/or SIGGRAPH (Asia)/Transactions on Graphics.

You will join the vibrant Visual Computing group at Bath, which comprises 30 doctoral students, 5 post-doctoral researchers, 2 research software engineers and 11 academics, and presents many opportunities for collaborative work and shared publications.

Alongside the standard duties of performing research, and its dissemination through publications and presentations, the candidate will also be expected to be involved in the supervision of PhD students and may have some teaching duties at undergraduate or graduate level.

We are working to improve the gender balance within the department’s population and particularly welcome applications from women.

Main duties and responsibilities	
	Responsible to the PI (Dr Christian Richardt) for:
1	Research and develop new approaches for 3D reconstruction of static and dynamic real-world environments from one or more input images or videos.
2	Contribute to the design and execution of the project, e.g. timetabling and meeting project milestones, and participating in regular discussions with collaborative partners.
3	The production of working prototypes to demonstrate and evaluate new and existing technologies in the appropriate areas.
4	Working with researchers and research software engineers within the project team and wider research group to achieve project aims and disseminate research results.
5	Writing up results of research and contributing to the publication of results in leading peer-reviewed academic conferences or journals.
6	Document research and results, including the development and maintenance of a code base, production of papers in leading conferences and journals, and public dissemination of research outputs (via presentations and posters), as appropriate.
7	Participate regularly in research group meetings and prepare and deliver presentations to the project team, internal and external collaborators and industrial partners.
8	Assist with the supervision of postgraduate students and undergraduate project students and the assessment of student knowledge.
9	Continually update knowledge and understanding in field or specialism to inform research activity.
10	Identify sources of funding and provide assistance with preparing bids to funding bodies.
11	Contribute to the development of research objectives and proposals for own or joint research projects, with assistance of a mentor, if required.
12	Provide assistance to the departmental teaching effort to gain teaching experience, for example via tutoring or occasional lecturing.

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Person Specification

Criteria	Essential	Desirable
Qualifications		
PhD in Computer Vision, Computer Graphics, Robotics or a strongly related discipline	✓	
Experience/Knowledge		
Excellent background knowledge of standard computer vision, graphics and geometry approaches	✓	
Evidence of published research in high-quality peer-reviewed journals and/or conferences	✓	
Track record of production of clean and robust research code	✓	
Demonstrated significant depth and breadth of specialist knowledge of subject matter (structure-from-motion, multi-view geometry and stereo, geometry processing, and/or SLAM)	✓	
Experience with video post-production pipelines and workflows		✓
Experience with SfM/MVS/SLAM software and research code		✓
Experience with CNNs and neural rendering in particular		✓
Teaching experience and interest		✓
Post-doctoral experience		✓
Skills		
Strong programming skills in C++ and/or Python	✓	
Strong mathematical ability (particularly linear algebra)	✓	
Excellent oral, interpersonal and written communication skills	✓	
Ability to conduct individual research work	✓	
Ability to organise and prioritise own workload	✓	
Ability to write research reports and to effectively disseminate outcomes	✓	
Ability to prepare research proposals		✓
Use of industry-standard software (Nuke, Premiere etc.)		✓
Attributes		
Innovation and developing creative solutions	✓	
Commitment to excellence in research	✓	
Enthusiasm and self-motivation	✓	
Organisation – able to plan and deliver work to meet required deadlines	✓	
Tenacity – working to achieve own and team objectives and to overcome obstacles	✓	
Ability to work independently and as an effective team member	✓	