BU STUDENTSHIPS 2023

PROJECT DESCRIPTION

PROJECT TITLE

Next generation of MoCap system

PROJECT SUMMARY

The motion capture system is designed to capture human or animal body motion data for motion modeling. It has found extensive applications in animation and game production, sport and rehabilitation training, and movie VFX production. However, traditional motion capture methods, such as Vicon and Xsens, typically require a set of cameras, skin-tight suits with numerous markers or sensors, and green screen compositing. These requirements make it expensive and inconvenient for small and medium-sized enterprises (SMEs) to incorporate motion capture into their product development processes.

The aim of this project is to develop a novel MoCap system, which can capture motion data from a single footage with arbitrary backgrounds, can capture facial expression, hand and body motion simultaneously, and can capture both skeletal motion data and full-body shape motion data. Currently, there are three kinds of methods for human body motion modelling from footages, (1) Human Body Modelling Using Depth Sensors, which perform 3D reconstruction from depth or RGB-Depth (RGBD) images such as the Kinect sensor. This kind of methods can work in real time. However, depth sensors are not available on the consumer-level laptops and smartphones. (2) Multi-View Human Body Modelling, which uses multiple, sparsely-deployed RGB cameras to observe a scene. It can recover not only the movements of skeletons, but also the possible non-rigid temporal deformations from multi-view image sequences. It is required to track the skeletons while consistently estimating the surface variations over time. This kind of methods usually require deploy multiple RGB cameras (at least two cameras) and lead to a large computational burden. (3) Single-View Human Body Modelling. Unlike specialized setups or dedicated equipment for 3D reconstruction, reconstruction using a single RGB camera such as the integrated camera on smart phones, has much more potential value for real-life applications. There have been intensive research on the issue of estimating human body pose and shape from a single image. However, due to the high dynamics of the human body and the ambiguity that results from perspective projection, automatic human modelling using monocular RGB videos is limited by many assumptions of light source directions or intensities, as well as the insufficient constraint of single-image silhouettes or a good parametric model as the input. Particularly, full-body motion capture remains challenging.

This project aims to advance motion capture (MoCap) technology from a single footage approach to developing the next generation of MoCap system that can work on regular laptops and smartphones. The main challenges include multiple object reconstruction from crowded scenarios and reconstructing personalized body shape details and clothing geometry.

The ideal applicant for this project should have programming experience in C, or C++, or Python, or JavaScript.

ACADEMIC IMPACT

As a part of HCI, the Interactive and Intelligent UI enables virtual avatars to perform human-like communications with real humans. It is required to deliver sensible conversations, appropriate body gestures and facial expressions; and be able to detect the motion and emotions of human users. By performing such human-like functions, the virtual avatar will be able to play an active role in assisting the mankind in countless applications, such as healthcare, training, education, marketing and decision making, to name but a few. Taking healthcare as an example, we all are aware of the acute pressure the NHS is under and it usually takes a long wait even to see our GP. If some/most of the GP's tasks can be undertaken by intelligent virtual avatar, it will not only save the NHS a huge budget, but also significantly shorten the waiting time. In addition to the role of a GP assistant, in healthcare alone there are many other applications where intelligent virtual avatar can play an important assisting role.

Research-wise however, despite some preliminary progress, due to the fundamental challenges, it is still at a very early stage. Many research questions are either not answered, nor are they even asked. The aim of this PhD project is to investigate and create novel algorithms and techniques leading to the development of the aforementioned Interactive and Intelligent UI. The research outputs will benefit REF directly.

SOCIETAL IMPACT

Communities in UK are facing certain common social and economic challenges related to improving the R&D ability of SMEs and start-ups, including strengthening collaboration among different fields of SMEs and collaboration between universities and industry, encouraging SMEs to invest in R&D. In fact, SMEs have been one of the main economic players, particularly in ICT and in the creative industry. For example of Bournemouth & Poole, in the report of Tech Nation 2017, the digital Gross Value Added (GVA) was around £ 352 million, the digital high growth firms reached 26% of growth rate, and 199 Start-ups birthed in last year. In Continental Europe, for example of the business start-ups in France, in the INSEE Premiere 2018, the total number of business start-ups increased by 7% in 2017, reaching the highest since 2010. This project will tackle the challenges by enhancing the SMEs R&D's ability within ICT and creative industry.

PGR DEVELOPMENT OPPORTUNITIES

We will arrange regular supervision meetings. The student will therefore benefit by understanding the global picture of the project; getting advice from the supervising academics; and reporting the problems.

In the same time, the student will be exposed to the knowledge and practice relevant to his investigation, such as the necessary tutorials for data mining, computer graphics and HCI.

The training courses from the Doctoral College, such as research methodology, academic writing and presentation, research ethics, project management, career development, will help the students develop their research skills in a wide context.

Additionally, the student will have opportunities to present his research outcomes on prestigious conferences (e.g. Siggraph, SigCHI) and participate in high-profile public engagement activities.

SUPERVISORY TEAM	
First Supervisor	Hongchuan Yu (NCCA)

Additional Supervisors	Jian J Zhang (NCCA) Changhong Liu (Psychology)
Recent publications by supervisors relevant to this project	https://scholar.google.com/citations?user=k0u7iVkAAAAJ&hl=en&oi=ao

INFORMAL ENQUIRIES

Please contact the lead supervisor on the following email for informal enquiries:

Dr Hongchuan Yu

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ELIGIBILITY CRITERIA

The BU PhD Studentships are open to UK, EU and International students.

Candidates for a PhD Studentship should demonstrate outstanding qualities and be motivated to complete a PhD in 4 years and must demonstrate:

- outstanding academic potential as measured normally by either a 1st class honours degree (or equivalent Grade Point Average (GPA) or a Master's degree with distinction or equivalent
- an IELTS (Academic) score of 6.5 minimum (with a minimum 6.0 in each component, or equivalent) for candidates for whom English is not their first language and this must be evidenced at point of application.
- Good computer programming ability is essential.

ADDITIONAL ELIGIBILITY CRITERIA

An ideal candidate should have a background in computer science, mathematics, engineering or a relevant subject.

HOW TO APPLY

Please complete the online application form by **the deadline advertised on the project webpage.**

Further information on the application process can be found at: www.bournemouth.ac.uk/studentships