SCHOOL OF ENGINEERING AND DIGITAL ARTS

Canterbury
INTRODUCTION

The School of Engineering and Digital Arts successfully combines modern engineering and technology with the exciting field of digital media. The School was established over 40 years ago and has developed a top-quality teaching and research base, receiving excellent ratings in both research and teaching assessments.

World-leading research

Our high-quality research has had significant national and international impact, and our spread of expertise allows us to respond rapidly to new developments. In the most recent Research Excellence Framework (REF), 98% of our research was judged to be of international quality.

We have research funding from the UK Research Councils, European research programmes, a number of industrial and commercial companies and government agencies – such as the Ministry of Defence, among many others.

Research in the School is supported by our research groups:
• Communications
• Instrumentation and Control
• Intelligent Interactions.

For details on individual academic research interests, see p21-p23.

Postgraduate resources

The School has a broad range of hardware and software for image acquisition and processing, and facilities for designing embedded systems using programmable logic and chip technology, supported by CAD tools and development software from international companies, including Cadence™, Xilinx™, Altera™, National Instruments®, and Mentor Graphics™. A full suite of MATLAB/Simulink® tools is available. Our instrumentation laboratory has multiphase flow and combustion test rigs, which can generate a range of real-life, albeit reduced-scale, industrial processes.
There are tools for the software design of RF, antenna and photonic systems (such as ADS™, CST™, HFSS™ and VPITransmissionMaker™) and subsequent testing with network and spectrum analysers up to 110 GHz, an arbitrary waveform generator to 12 GSa/s, a high-speed sampling oscilloscope to 100 GSa/s, an on-wafer prober and high-quality anechoic chambers.

Our extensive digital media computing resources include leading-edge PC workstations running Alias™, Maya® and Foundry Nuke, a photographic studio and a production studio with green screen.

Expert teaching
Our teaching is informed by our research, which means that you are learning at the forefront of your field. Our academics have a wide range of experience, both in industry and academia, which allows students to benefit from their real-world experience.

Industry collaboration
We ensure that all of our programmes meet the current needs of industry and we have worked with the world-leading visual effects company Framestore to develop our Computer Animation degree.

Our excellent reputation has allowed us to build up a wide range of contacts. Our Electronic Systems Design Centre and Digital Media Hub provide training and consultancy for a wide range of companies.

Many of our research projects are collaborative, and we have well-developed links with institutions worldwide.

Supportive environment
As a postgraduate student, you are part of a thriving research community and receive support through a wide-ranging programme of individual supervision, specialised research seminars, general skills training programmes and general departmental colloquia, usually with external speakers.

We encourage you to attend and present your work at major conferences, as well as taking part in our internal conference and seminar programmes.

Dynamic publishing culture
Staff publish regularly and widely in journals, conference proceedings and books. Among others, they have recently contributed to: IEEE Transactions; IET Journals; Electronics Letters; Journal of Applied Physics; Computers in Human Behaviour. For details of staff research interests, see p21.
Iulia Motoc is studying for a PhD in Electronic Engineering.

What attracted you to studying at Kent?
I did my undergraduate degree in Romania and my final year project was in biometrics. I enjoyed it so I decided to come to Kent to take the MSc in Information Security and Biometrics.

How did you find the transition to postgraduate study?
When I got to Kent, everybody was so friendly. The relationship between students and lecturers was great. The lecturers are here to support you with everything you need. I think the teaching here is really good too: it is very interactive.

How did you make the move into a research degree?
When I was about to submit my MSc thesis I went to my supervisor’s office and we were talking about me possibly doing a PhD and what my topic could be. He had this robot in his office and asked me: ‘Would you want to work on this for a European project?’ For me, this was the most amazing idea!

What does your own research involve?
I’m looking at locomotion and manipulation algorithms – in other words, control and how the robot moves. For instance, one challenge was to help the robot walk on different surfaces, such as tiles which are slippery or to keep its balance when changing surfaces, such as from carpet to wood. In the second part of my thesis I used the same kind of algorithm to allow the robot to move its arm towards a specific object. A robot should be able to pick up a cup on the first attempt and for a humanoid robot, this is a challenge. You have to make sure that you don’t overuse the joints and you don’t try to make a move that isn’t possible.

What is it you’ve most enjoyed about doing research?
You have an opportunity to do your own thing. You can examine what other people have done and then look into ways to fix certain issues. It’s not a typical nine to five job but it is very exciting. By the end of your thesis, you have a real sense of accomplishment. Also there were many academics in the School involved in the same European project. So I had the chance to work with several experts in the field.

Have you had the chance to develop other related skills?
The University does a lot of outreach work so I started going into schools to teach robotics. I’ve been involved in projects such as STEMNET and the Primary Engineer Leaders Awards. I prefer working with primary school children because they are younger and their ideas are very fluid. They don’t think about limitations. They just come up with an idea and say it. Doing the outreach work has given me more confidence. For instance, I’m much better at giving presentations now.

What are your career plans after your PhD?
I want to stay involved in robotics research and hopefully continue my outreach work as well. For the next 18 months, I’ll be working at Kent on an EPSRC-funded project to look at machine–human face recognition.
Sara Choudhrey is studying for a PhD in Digital Arts.

How would you describe your research?
My research is an investigation of digital Islamic art in the UK. Islamic art tends to be associated with hand-crafted methods, yet digital Islamic art goes beyond this: it demonstrates the continuity in tradition while adopting new approaches to art-making. For example, visual forms common in Islamic art, such as geometry and floral motifs, may be presented as an animation or even an interactive installation.

Why did you choose to do your PhD at Kent?
I had a background in multimedia and was looking to integrate that knowledge with my interests in Islamic art. One of my supervisors specialises in art history and digital media; the other is an engineer with knowledge of Islam and Islamic art. With the right expertise, and all the facilities I needed, Kent was the place for me.

Could you describe the practical elements of your research?
My own art practice combines a number of processes including construction and drawing of patterns, often combined with digital techniques. The process is always organic and experimental, which can lead to unexpected but exciting results. Being in an academic environment encourages you to question the ideas behind your work. For me, the theory and the practice inform each other. My other research activities have been quite varied as I enjoy being involved in different projects and meeting new audiences whether it’s through a blog, a workshop, an art exhibition or an academic conference.

One of the highlights of my research was curating a group exhibition of digital Islamic art in London. I focussed on the aspect of ‘hybridity’ in artistic practice and collated the audience’s responses. I was interested in their perceptions of the work and whether they identified it as ‘Islamic art’ or not. The experience was invaluable and I received a lot of positive feedback.

What are your future plans?
I’ve just passed my PhD viva and hope to continue my research as well as my art practice into a postdoctoral career. So far, it’s going well. I’m currently on a residency at Griffin Gallery in London and was recently awarded a travel fellowship that will allow me to visit Spain and Portugal to document the decorative arts of the Mudéjar. I will also be running an art project for those affected by the Grenfell fire: members of the community will be invited to learn about digital Islamic art, try their hand at pattern-making, and contribute towards an artwork installation to be exhibited at Maxilla Space, London.

Any advice for those who want to do a PhD in Digital Arts?
Kent is a motivating place – they steer you in the right direction and provide many opportunities along the way. So, if you have ambitious ideas, throw them this way and make the most of your time here!

For more details see www.sarachoudhrey.com
IMPRESSIONS CAREER PROSPECTS

A postgraduate qualification from Kent opens up a wealth of career opportunities by providing an impressive portfolio of skills and specialist knowledge.

Employers recognise that a postgraduate qualification demonstrates a wide range of skills. During your programme, you acquire a high level of academic knowledge and specialist practical skills.

In addition, we provide a comprehensive package of skills development training programmes, careers advice, and volunteering and paid work opportunities to help enhance your career prospects.

Transferable skills training

Employers look for transferable skills such as communication, time management, analytical skills, business awareness, teamworking and problem solving. Dealing with challenging ideas, thinking critically, the ability to write well and present your ideas are all skills you learn at Kent. This makes it possible to be successful within a wide range of careers, not just those directly related to your studies.

The University’s Graduate School co-ordinates the Researcher Development Programme for research students, providing access to a wide range of lectures and workshops on training, personal development planning and career development skills. The Graduate School also delivers the Global Skills Award programme for students following taught programmes of study, which is specifically designed to consolidate your awareness of current global issues and improve your employment prospects.

Exciting career options

Graduates from our programmes have excellent employment prospects: 92% of postgraduate students at Kent who graduated in 2017 and responded to a national survey were in work or further study within six months (DLHE).

Career prospects for our graduates are wide ranging. Recent graduates have gone on to work in areas including: web development and design; software, hardware or electronic engineering; broadcast journalism; teaching and lecturing; product development; e-commerce; and banking. They have become management consultants, patent examiners, stockbrokers and research scientists, and work for organisations including the BBC, British Airways, Mitsubishi, Lloyds Banking Group, Samsung, Madame Tussauds and the NHS. Others have set up their own companies or consultancies. See opposite for case studies.

Careers and Employability Service

Our Careers and Employability Service can help you to plan for your future by providing one-to-one advice at any stage in your postgraduate studies. It also offers online advice on employability skills, career choices and applications, and interview skills.

Further information

For more information on the careers help we provide at Kent, visit www.kent.ac.uk/employability
GRADUATE SUCCESS

Graduates from across our programmes have gone on to use the skills learnt at the School to great effect.

Our Computer Animation and Digital Visual Effects Master’s programmes are designed with a strong focus on current professional practice, which has helped our graduates secure jobs at some of the best film production companies in the UK. Recent successes have included three graduates who played a role in helping the film *The Jungle Book* win an Oscar for Best Visual Effects.

El Suliman (above), who graduated from our MSc in Computer Animation, was a senior animator on the film. He worked on a range of animals in the film, studying their physiologies and skeletons to ensure realism. Currently working in Singapore, El said that being part of an Oscar-winning team is ‘pretty amazing’, adding that ‘it’s a great feeling seeing your team’s work appreciated on such a large scale’.

He said that his studies at Kent had been ‘absolutely vital’. Since graduating, he has also worked in New Zealand as an animator.

Other Kent alumni involved in the film were MSc Computer Animation graduate, Bernard Wicksteed (animation), and MSc Digital Visual Effects graduate Marlene Chazot (software developer).

There is a strong research culture within the School, at both MSc and PhD level. Liz Valentine followed her undergraduate degree in Multimedia Technology and Design with a research Master’s. For her Master’s, Liz worked on a mobile museum guide for the Museum of Canterbury, which won several top awards in the BEA (Broadcasting Education Association) Festival of Media Arts.

After her studies, Liz worked as a researcher, a freelance multimedia producer and a developer, and in 2009 became a research scientist within BBC Research and Development, where she researches current and future trends with relation to technology and media. Liz is able to implement the knowledge that she gained studying at Kent and has the satisfaction of knowing that her research guides current and future technologies, which will either help people to make programmes and other content, or to consume it – as such, it will have an impact on people all over the country.

The School also has an international reputation for its research in information security and biometrics. Raluca Vasilachi, a graduate of the MSc in this area has found her studies at Kent to be of invaluable help in her career. She works for Accenture Technology Labs, Accenture’s research and development arm, where she is involved with the development of innovative biometric solutions such as Automated Border Clearance, and the introduction of biometric visas and residents’ cards. Raluca finds this expanding field fascinating and is happy to recommend Kent: ‘I would encourage anyone with an interest in IT security to look closely at Kent’s Information Security and Biometrics MSc and this exciting topic’.
There is a range of engineering programmes available within the School, which allows you to choose the programme that best reflects your interests. Below, we list the programmes on offer.

All our engineering programmes have IET (Institution of Engineering and Technology) accreditation, or accreditation is currently being sought.

Advanced Communications Engineering (RF Technology and Telecommunications) MSc

Location: Canterbury
Attendance: One year full-time; two years part-time
Start: September
Entry requirements: A 2.2 or higher honours degree in electronics, computer engineering or a related electronics discipline, physics or mathematics (especially applied).

This MSc provides you with in-depth knowledge of enabling techniques and technologies used in the telecommunications industry, such as antenna technology, RF components and systems, and high-speed fibre optic and satellite communications, as well as system expertise. It provides high-quality industrially relevant education and training, using specialist industry-standard software design tools, and benefits from guest lectures by industry experts.

Course content
Stage 1 compulsory modules currently include:
- Advanced Communication Theory
- Data Networks and the Internet
- Research Methods and Project Design
- RF System and Antenna Design
- Satellite and Optical Communications.

Stage 1 optional modules may include:
- Advanced Networking Systems and Technology
- Computer and Microcontroller Architectures
- Reconfigurable Architectures
- Wireless Communications.

Stage 2
• MSc Project

Please note that the modules listed are subject to change; contact us for the latest information on availability.

Advanced Communications Engineering (Wireless Systems and Networks) MSc

Location: Canterbury
Attendance: One year full-time; two years part-time
Start: September
Entry requirements: A 2.2 or higher honours degree in electronics, computer engineering or a related electronics discipline, physics or mathematics (especially applied).

The programme reflects the latest developments in the rapidly evolving world of the increasingly mobile internet, covering future systems such as 5th generation mobile (5G) and ultra-high-speed wireless and fixed access systems. You also have the opportunity to hear from industry experts through our strong links with telecommunications operators and equipment vendors.

Course content
Stage 1 compulsory modules currently include:
- Advanced Communication Theory
- Advanced Networking Systems and Technology
- Data Networks and the Internet
- Research Methods and Project Design
- RF System and Antenna Design
- Wireless Communications.

Stage 1 optional modules may include:
- Computer and Microcontroller Architectures
- Digital Signal Processing (DSP)
- Reconfigurable Architectures
- RF System and Antenna Design.

Stage 2
• MSc Project

Please note that the modules listed are subject to change; contact us for the latest information on availability.
Advanced Electronic Systems Engineering MSc

Location: Canterbury
Attendance: One year full-time
Start: September
Entry requirements: A 2.2 or higher honours degree in electronics, computer engineering or a related electronics discipline, physics or mathematics (especially applied).

Taking this programme allows you to choose from a wide range of options reflecting the different and varied research strengths of the School. You develop an understanding of advanced electronic systems (hardware and software) and how they are used in many applications. The options available enable you to specialise in the second term, or to maintain a broader perspective.

Course content
Stage 1 compulsory modules currently include:
- Computer and Microcontroller Architectures
- Digital Signal Processing
- Research Methods and Project Design.

Stage 1 and Stage 2 optional modules may include:
- Advanced Communication Theory
- Advanced Networking Systems and Technology
- Advanced Pattern Recognition
- Advanced Sensors and Instrumentation Systems
- Data Networks and the Internet
- Embedded Real-time Operating Systems
- Image Analysis with Security Applications
- Reconfigurable Architectures
- Wireless Communications.

Stage 2
- MSc Project

Please note the modules listed are subject to change; contact us for the latest information on availability.
TAUGHT DIGITAL ARTS PROGRAMMES

For these programmes, applicants must present a portfolio of work.

**Computer Animation MSc**
Location: Canterbury  
Attendance: One year full-time  
Start: September  
Entry requirements: A 2.2 or higher honours degree in animation, digital effects, fine art, architecture, multimedia, illustration, digital arts, computing and film making. All applicants must present a portfolio.

Oriented towards current industrial needs, technology and practice, this programme is a good route into this high-profile modern, creative industry, and was developed jointly by the School and Framestore.

Some parts of the course are delivered by guest and associate lecturers who work in industry.

**Course content**
Modules currently include:
- Acting in Animation  
- Action in Animation  
- Advanced 3D Modelling  
- Animation Principles  
- Digital Visual Art Set-up (intensive four-week introductory course)  
- Pre-visualisation  
- Professional Group Work  
- Visual Effects Project  
- Visual Training.

Please note that the modules listed are subject to change; contact us for the latest information on availability.

**Digital Visual Effects MSc**
Location: Canterbury  
Attendance: One year full-time  
Start: September  
Entry requirements: A 2.2 or higher honours degree in animation, digital effects, fine art, architecture, multimedia, illustration, digital arts, computing and film making. All applicants must present a portfolio.

This programme develops skills and knowledge within the field of high-definition digital effects, equipping you to become a CG generalist or specialist in the visual effects industry. It covers 3D model building, texturing, lighting, rendering, procedural animation, advanced compositing and high-definition digital effects. We have guest and associate lecturers delivering some parts of the course who work directly in industry.

**Course content**
Modules currently include:
- Advanced 3D Modelling  
- Digital Compositing  
- Digital Visual Art Set-up (intensive four-week introductory course)  
- Effects Animation  
- Film and Video Production  
- Pre-visualisation  
- Professional Group Work  
- Technical Direction  
- Visual Effects Project.

Please note that the modules listed are subject to change; contact us for the latest information on availability.
This MSc is designed for practitioners, professionals and graduates with an interest in information security, access control technologies, and application domains using biometric identification and verification systems.

**Course content**

Stage 1 compulsory modules currently include:
- Biometric Technologies
- Computer Security
- Image Analysis with Security Applications
- Research Methods and Project Design.

Optional modules may include:
- Advanced Java for Programmers
- Advanced Pattern Recognition
- Advanced Sensors and Instrumentation Systems
- System Security
- Object-Oriented Programming
- Trust, Security and Privacy Management.

Stage 2
- MSc Project (for Information Security and Biometrics)

Please note that the modules listed are subject to change; contact us for the latest information on availability.
Below is a list of modules currently on offer on our taught engineering programmes.

**Advanced Communication Theory**
You cover the principles of modern digital communications systems, in particular the design of optimal receivers and their performances, advanced modulation techniques (QAM), signal design for bandlimited channels, multichannel and diversity techniques in fading channels, multicarrier (OFDM) communications, and spread spectrum and CDMA systems. You are introduced to multiple input multiple output (MIMO) techniques and also discuss advanced channel coding techniques including convolutional codes, Turbo codes and LDPC/polar codes.

**Advanced Networking Systems and Technology**
Building on the Data Networks and the Internet module, you study high-speed access and transport networks, designed for multi-service operation. You examine the move of Internet Protocol operation into operators’ networks and the associated adaptations required. You also learn about advanced optical networks, ranging from the core network to fibre-to-the-home, such as the latest OTN and PON technologies. The module includes the latest concepts on network virtualisation, software-defined networks and X-as-a-service, and you have the chance to hear industry speakers discussing their views on ‘hot topics’.

**Advanced Pattern Recognition**
You study advanced methods for pattern recognition with an emphasis on multi-source systems. A detailed analysis of the Bayesian classification framework is followed by an introduction to error estimation and advanced feature selection and extraction techniques, and their application to financial data and systems. Multiple classifier systems, including intelligent and dynamically adaptable classifier combination strategies, such as genetic algorithms, are studied as the basis for the development of state-of-the-art systems.

**Advanced Sensors and Instrumentation Systems**
You cover modern sensors and advanced measurement systems for a diverse range of industrial applications. General measurement principles and concepts are introduced. The module focuses on digital imaging and intelligent measurement and monitoring techniques. Real-life industrial case studies are included to enhance your learning experience in the design and applications of cutting-edge instrumentation technologies.

**Computer and Microcontroller Architectures**
You master the basic techniques and concepts used in modern computer and microcontroller design. The module begins with an overview of modern computer architectures and architecture design including descriptions of the ALU, register design, memory and cache design, RISC and
CISC-based architectures and instruction sets. The laboratories and workshops illustrate the theory presented in the lectures, introducing example microcontroller platforms. The module also introduces the C and C++ programming languages and their use in embedded microcontroller design.

**Data Networks and the Internet**
You gain knowledge of the key protocols that underpin the internet and networking. The module starts by examining local network protocols, particularly those underpinning Ethernet and Wi-Fi networks, moving on to the personal area network protocols, now contributing to the Internet of Things. Then, you study the Internet Protocol itself, and its associated protocols that transport data and set-up connections across the internet. Network security, encryption and standard protocols are also studied. Network performance is examined through analysis and the use of an advanced simulation package.

**Digital Signal Processing**
You acquire a solid background in signal analysis, frequency and time domain representations using MATLAB®. You learn techniques including: aliasing, anti-aliasing and anti-imaging filters, ADCs and DACs, discrete Fourier transform and fast Fourier transform, Laplace transform, pole-zero placement methods for signal analysis, design and performance of finite impulse response (FIR) and infinite impulse response (IIR) filters. Examples of how these techniques are applied are provided.

**Embedded Real-time Operating Systems**
This module builds on your knowledge of computer architecture by introducing the concept of operating systems and real-time operating systems for embedded microcontrollers. Laboratory examples, based on the MBED microcontroller and design environment, are used to develop a practical understanding of operating systems used in a real-time environment. The course also considers hardware–software design choices and development and a review of modern heterogeneous computing architectures using a combination of microcontroller, GPU and FPGA technologies.

**Image Analysis with Security Applications**
This module focuses on image processing, image acquisition, quantisation and representation. It also covers the fundamentals of pattern classification and the role of classification in a variety of application scenarios, including security and biometrics.

**MSc Project**
The project may be carried out in industry or at the University. For industry-based projects, an industrial supervisor is responsible for day-to-day technical supervision, while your academic supervisor advises on the requirements for University assessments. University-based projects may be industrially sponsored or undertaken within one of the School’s research groups.
The project is assessed through presentations, and a dissertation at the end of the project period.

**Reconfigurable Architectures**

This module introduces programmable logic devices (PLDs and FPGAs). You explore their architectures and the development techniques that can be used to design circuits and systems with them. You then move on to more advanced topics in digital design. Lectures introduce PLD and FPGA technologies, and workshops and laboratories are used to introduce the VHDL programming language and FPGA design tools. You apply this knowledge within two substantial design projects, developed and tested in the laboratory.

**Research Methods and Project Design**

Working under the direction of your project supervisor, you write a full project proposal and acquire the skills necessary for your project. This may include: an appreciation of the methodologies of research, literature surveys, project management, the research process, computer-based data analysis, presentation skills, intellectual property rights (IPR) and research ethics.

**RF System and Antenna Design**

This module takes a simulation-based approach to the RF technologies applicable to modern mobile devices and wireless sensing nodes. You develop skills and techniques to characterise and match RF components and transmission lines and design efficient small antennas. Important aspects of wireless transmission and propagation between wireless devices, as well as RFID tags, are also considered.

**Satellite and Optical Communications**

This module introduces the physical aspects of communications and applies them to satellite and optical communication systems. Our exploration of satellite communications focuses on the satellite systems and sub-system designs, radio propagation, satellite antennas, and satellite communication link design and analysis. Coverage of optical communications ranges from key components to various multiplexing techniques and link analyses. Problem-solving and computer simulation are used to enhance your understanding.

**Wireless Communications**

This module concentrates on the latest mobile and wireless communication technologies and techniques, covering cellular networks from 3G, 4G to 5G mobile systems. The advanced wireless topics include high dense cellular mobile concept, adaptive modulation and coding, soft handoff, multiple access techniques, multi-user diversity/scheduling, wireless resource allocation and massive MIMO systems. 4G LTE and 5G standards are introduced. Your understanding of advanced mobile technologies is enhanced by a range of case studies and industrial seminars.
Below is a list of modules currently on offer on our taught digital arts programmes.

**Acting in Animation**
You develop an understanding of how thoughts and emotions are clearly and engagingly conveyed using 3D character models. In order to be a good character animator, you must not merely copy performances and reproduce them; you must be an actor through the technology and the techniques available to the animator.

**Action in Animation**
You look at the techniques used to produce articulate motion which is lifelike and convincing – this is the base of both comedic cartoon animation and realistic animation for compositing, for example, in creating stunts or armies for action and historical spectaculars, where cost or danger prohibit live shooting.

**Advanced 3D Modelling**
You study character design and animateable geometry, advanced UV surface mapping, fine surface detail and polygonal geometry, and the creation and application of sculpted detail. You also look at the practical aspects of handling large image and texture files.

**Animation Principles**
Animation Principles is concerned with fundamental animation concepts. Originally developed by Hollywood animators in the 1940s, these principles have been derived from classical drawn animation and model animation, transposed into the digital medium. Topics covered include: rules of thumb, bouncing ball, weight, line of action, secondary animation and effects.

**Digital Compositing**
This module specifically addresses the technical and artistic requirements for compositing video and 3D elements at a high resolution. Compositing is the artistic blending of several
disparate elements from a variety of sources into a single image, while making all the component elements appear to be in the same light space and shot with the same camera.

**Digital Visual Art Set-up**
This intensive four-week introductory module has been designed to get all students up to speed regarding the complicated technical processes that surround current animation practice. It covers the skills and procedures employed professionally such as modelling, rigging, skinning, muscle dynamics, texturing and lighting.

**Effects Animation**
The skills of the technical director in 3D animation rely on attention to detail, and setting up models so that they react accurately within a scene. In this module, you learn how to rig any model to automate secondary animation components such as doors opening and wheels turning, accurately and controllably. Teaching is therefore focused around the development of fully rigged 3D models.

**Film and Video Production**
This practical module focuses on photographic usage and terminology, to enable artists to create better effects composites.

**Pre-visualisation**
You are given intensive exposure to the current British and international film and television industry and discover how your specialism is practically carried on within it. You tour two or three digital post-production animation studios in London and interview current industry professionals. On the basis of their advice, you develop a plan, including a pre-visualisation, for your final project.

**Professional Group Work**
In this module, a series of group projects replicate the experience of working in a professional studio environment. In the spring term, you complete a series of one-day group projects which contribute to and lead into your major project, where all animation, digital effects and architectural visualisation students work together to produce an animation and effects shots.

Working in a simulated professional environment to a four-week deadline, you become familiar with the production process, chains of approval and departmental divisions.

**Technical Direction**
This module is concerned with the use of lighting and shading for storytelling and visual communication. You gain an understanding of the fundamental theoretical concepts in digital lighting as well as the necessary skills and experience to produce customised light and shading models, which provide aesthetic possibilities not available from off-the-shelf packages. Through this module, you become expert in the use of various renderers such as RenderMan and Mental Ray.

**Visual Effects Project**
You build a show reel where all the techniques that have been learnt over the course are applied. Your project contains sophisticated, original, articulate animation showing a large variety of motion and emotion to a professional standard. The subject is either your own concept developed with the help of your supervisor, or a brief from an industry professional. The work in this module accounts for one third of your programme.

**Visual Training**
The exact configuration which makes up a particular facial expression, the exact state of the muscles of a body under different circumstances, the exact nuance of meaning conveyed by different gesture positions, are all elements that go to distinguish superior from mediocre animation. The most effective way to develop such observational and outputting skills is through traditional drawing and sculpture, which is frequently reflected in studio hiring policies. This module uses traditional art techniques to develop your digital animation abilities.
TAUGHT INTERDISCIPLINARY MODULES

Below is a list of modules currently on offer on our taught interdisciplinary programmes.

Advanced Java for Programmers
This module provides for well-qualified computer science students entering the MSc programme from a range of backgrounds. You will have good programming skills but not necessarily have used Java or another object-oriented language extensively. This module seeks to ensure that you have the Java and object-oriented design skills necessary for the rest of your programme.

Advanced Sensors and Instrumentation Systems
In this module, you cover modern sensors and advanced measurement systems for a diverse range of industrial applications. General measurement principles and concepts are introduced. The module focuses on digital imaging and intelligent measurement and monitoring techniques. Real-life industrial case studies are included to enhance your learning experience in the design and applications of cutting-edge instrumentation technologies.

Biometric Technologies
This module includes a detailed treatment of the implementation of biometric systems, including examples of systems using the major modalities and an analysis of modality-specific features and feature extraction, selection and classification strategies.

Computer Security
You study cryptographic algorithms including symmetric and asymmetric techniques and the distinction between encryption and signatures. You also look at mechanisms to provide security such as firewalls and VPNs. The module also covers distributed mechanisms, including client authentication, public key infrastructures and certification, digital rights management systems and the security of Wi-Fi networks.

Image Analysis with Security Applications
This module focuses on image processing, image acquisition, quantisation and representation. It also covers the fundamentals of pattern classification and the role of classification in a variety of application scenarios, including security and biometrics.

System Security
The module looks at federated identity management, privacy protection, viruses and worms, hacking, secure architectures, formal verification methods, email security, secure software development methods and tools.

MSc Project (for Information Security and Biometrics)
Your project gives you practical experience of the design of a significant biometric or information security system. Projects may involve working closely with an industrial collaborator, which will provide experience of secure systems design in an industrial environment, allowing you to appreciate the practical difficulties in the development and utilisation of such systems. The project may be carried out in industry or at the University.

CONTINUED OVERLEAF
TAUGHT INTERDISCIPLINARY MODULES (CONT)

Object-Oriented Programming
This module provides an introduction to object-oriented programming using the popular Java language. It is designed for beginners who have not studied computer programming before. On completion, students will be able to develop simple programmes using Java.

System Security
You develop an increased understanding of the motivation, design and operation of modern systems for encryption, authentication, authorisation and identification, and gain an awareness of the importance of taking a systems-wide approach to maintaining information security.

Research Methods and Project Design
Working under the direction of your project supervisor, you write a full project proposal and acquire the skills necessary for your project. This may include: an appreciation of the methodologies of research, literature surveys, project management, the research process, computer-based data analysis, presentation skills, intellectual property rights (IPR) and research ethics.

Trust, Security and Privacy Management
A holistic view of security management is taken, starting with risk management and the formulation of security policies. Technical subjects include a description of the various security models, digital rights management, and an illustration of how authorisation policies can be automatically enforced.

Digital Integrated Circuit Design.
The School conducts high-quality national and international research and offers excellent opportunities for MSc and PhD research degrees.

We have consistently attracted substantial research funding from the UK Research Councils, European research programmes, industrial and commercial companies, government agencies and others, and our spread of expertise allows us to respond rapidly to new developments.

We offer research programmes on a full-time or part-time basis, for both MSc and PhD students.

Most of our research students are based at our Canterbury campus. However, for those who are not in a position to relocate, we also offer an external research degree; please contact us for more details.

Electronic Engineering

MSc by Research and PhD

We offer research-led degrees at PhD and MSc level in a wide range of research areas including:
- telecommunications
- mobile networks
- antennas and optical and radio systems
- instrumentation and control systems
- biometrics/cyber-security.

The one-year MSc by Research allows you to develop your practical research expertise within a structured programme. Unlike a taught MSc, there are no specific modules to take; instead the programme is based on project work with a series of clearly defined tasks that eventually lead to your final dissertation.

Developing your own research skills allows you to build a strong foundation for future work at PhD level. You also have the option to choose a practice-based approach which is more orientated toward industry.

Digital Arts

MSc by Research and PhD

Our Intelligent Interactions group has research interests in many areas of interactive multimedia and digital film and animation.

There is particular strength in web design and development, including e-commerce, e-learning and e-health.

The group also has substantial experience in interaction design (eg usability and accessibility), social computing (eg social networking, computer-mediated communication), mobile technology (eg smart wearable devices), immersive technologies (eg virtual and augmented reality) and video games.

In the area of time-based media, the group has substantial interest in digital film capture and editing, and manipulation on to fully animated 3D modelling techniques as used in games and feature films.

Research groups

As a postgraduate research student, you will join one of our three research groups.

Communication

The Communication research group’s activities cover system and component technologies from microwave to terahertz frequencies. These include photonics, antennas and wireless components for a broad range of communication systems. The group has extensive software research tools together with antenna anechoic chambers, network and spectrum analysers to millimetre-wave frequencies, and optical signal generation, processing and measurement facilities.

The group’s main research themes currently include:
- photonic components
- networks/wireless systems
- microwave and millimetre-wave systems
- antenna systems
- radio-over-fibre systems
- electromagnetic bandgaps and metamaterials
- frequency selective surfaces.

Instrumentation and Control

The Instrumentation and Control research group tackles challenging measurement, monitoring and control problems through applied research projects. The group has long-term partnerships with the power generation, manufacturing and healthcare industries. Its expertise lies in process sensors,
intelligent instrumentation, smart condition monitoring, digital image processing, data fusion, data modelling, and robust control and estimation. In addition to a well-equipped instrumentation laboratory, the group has regular access to industrial-scale test facilities, full-scale power plants, hospitals and clinics.

This group is currently working in the following areas:
• advanced control of industrial systems
• application-specific integrated circuits
• decentralised control of interconnected/networked systems
• detection of liquid and gas leakage from pipelines and vessels
• fault detection and isolation
• computer simulation for biological cell signalling
• controller and observer design of complex systems
• electrostatic sensors and instrumentation
• flow measurement of pneumatically conveyed solids
• high-speed architectures for real-time image processing
• low-power signal processing
• molecular simulation for soft matter
• monitoring and characterisation of burner flames
• signal processing architectures for high-speed OCT.

Intelligent Interactions
The Intelligent Interactions research group has interests in all aspects of information engineering and human–machine interactions. It has an international reputation for its work in key areas including:
• image processing and vision
• pattern recognition
• interaction design
• social, ubiquitous and mobile computing.

Research has led to a range of applications in security and biometrics, healthcare, e-learning, computer games, digital film and animation.

This group is currently working in the following areas:
• social and affective computing
• assistive robotics and human–robot interaction
• brain–computer interfaces
• mobile, ubiquitous and pervasive computing
• sensor networks and data analytics
• biometric and forensic technologies
• behaviour models for security
• distributed systems security (cloud computing, Internet of Things)
• advanced pattern recognition (medical imaging, document and handwriting recognition, animal biometrics)
• computer animation, game design and game technologies
• virtual and augmented reality
• digital arts and virtual narratives.
ACADEMIC STAFF

There are currently 32 academics in the School of Engineering and Digital Arts, who support teaching and research across a range of areas.

Full details of staff research interests can be found on our website: www.kent.ac.uk/eda/people

Dr (Jim) Chee Siang Ang
Senior Lecturer in Multimedia/Digital Systems
Human–computer interaction; usability and playability design; computer game studies and interactive narrative; social computing and sociability design; virtual worlds; online communities and computer-mediated communication.

Dr Philipppos Asimakopoulos
Research Associate
Ethernet fibre transport in cloud-radio access networks; functional virtualisation in fibre-distributed radio access networks; 5G harmonised research and trials for service evolution between EU and China.

Professor John Batchelor
Professor of Antenna Technology
Design and modelling of multi-band antennas for personal, on-body and mobile communication systems; passive RFID tagging/sensing and skin-mounted transfer tattoo tags; reduced-size frequency selective structures (FSS and EBG) for incorporation into smart buildings for control of radio spectrum.

Ania Bobrowicz
Senior Lecturer in Digital Arts
Human–computer interaction; computer-mediated communication; feminism and art history.

David Byers Brown
Senior Lecturer
Animation; digital visual effects; directing.

Dr Alexandra Covaci
Lecturer in Digital Arts and Technology
Research related to virtual reality including multisensory experiences for interactive technologies; perceptual media quality; collaborative virtual environments for data visualisation and manipulation.

CONTINUED OVERLEAF
Dr Farzin Deravi  
Professor of Information Engineering, Head of School  
Pattern recognition; information fusion; computer vision; image processing; image coding; fractals and self-similarity; biometrics; bio-signals; assistive technologies.

Dr Christos Efstratiou  
Senior Lecturer in Social/Ubiquitous Computing  
Context aware electronic guides; systems to monitor health and safety.

Mr Blaine Epsley  
Lecturer in Digital Arts and Technology  
Digital effects, professional 3D and compositing, 3D computer animation pipeline, digital visual effects and compositing.

Professor Steven Gao  
Professor of RF/Microwave Engineering  
Space antennas, smart antennas, microwave circuit and systems.

Professor Nathan Gomes  
Professor of Optical Fibre Communications  
Optical–microwave interactions, especially fibre-radio networks; optoelectronic devices and optical networks.

Dr Mike Green  
Lecturer in Digital Media  
Human–computer interaction including aspects of wearable computing, online disclosure and identity, and web technology; video-mediated communication among the LGBT community.

Dr Richard Guest  
Reader in Biometric Systems Engineering, Deputy Head of School  
Image processing; biometrics technologies including usability, cybermetric linkages and standardisation; automated analysis of handwritten data; document processing.

Dr Sanaul Hoque  
Lecturer in Secure Systems Engineering  
Computer vision; OCR; biometrics; security and encryption; multi-expert fusion and document modelling.

Dr Md Moinul Hossain  
Lecturer in Electronic Engineering  
Combustion diagnostics, sensors, instrumentation, measurement, condition monitoring, digital image processing, deep learning and solid oxide fuel cells.

Professor Gareth Howells  
Professor of Secure Electronic Systems  
Security, biometrics and pattern classification techniques; the development of secure device authentication systems with a focus on Internet of Things (IoT).

Dr Benito Sanz Izquierdo  
Senior Lecturer in Electronic Systems  
Antennas and microwaves.

Dr Rocio von Jungenfeld  
Lecturer in Digital Media  
Collaborative media production, contemporary and interdisciplinary art, hybrid environments, outdoor and mobile projections, and interaction design.

Dr Layla Larsen  
Clinical Engineer/Lecturer  
Tissue engineering, biomimetic sensors and control and interfaces of assistive technologies.

Dr Gang Lu  
Senior Lecturer in Electronic Instrumentation  
Advanced combustion instrumentation; vision-based instrumentation systems; digital image processing; condition monitoring.

Dr Gianluca Marcelli  
Lecturer in Engineering  
The understanding of complex systems, in particular, biological and financial systems; using mathematical modelling such as molecular simulation, Brownian dynamics and network theory.
Robert Owen
Senior Lecturer in Electronic Engineering, Director of Education
Modelling of ion implantation processes and ion diffusion into glass for integrated optic applications.

Dr Konstantinos Sirlantzis
Senior Lecturer in Intelligent Systems
Pattern recognition; multiple classifier systems; artificial intelligence techniques; neural networks, genetic algorithms and other biologically inspired computing paradigms; image processing; multimodal biometric models; handwriting recognition; numerical stochastic optimisation algorithms; nonlinear dynamics and chaos theory; Markov chain Monte Carlo (MCMC) methods for sensor data fusion.

Dr Chao Wang
Senior Lecturer in Electronic Systems
Optical communications, microwave photonics and biophotonics.

Dr Lijuan Wang
Lecturer in Electronic Engineering
Electrostatic sensing, multiphase flow measurement, condition monitoring of mechanical systems, sensors and instrumentation systems, data analysis and soft computing.

Professor Jiangzhou Wang
Professor of Telecommunications Engineering
Modulation; coding; MIMO; mobile communications; wireless sensor networks. Publications include: High-Speed Wireless Communications: Ultra-wideband, 3G Long Term Evolution, and 4G Mobile Systems.

Dr Xinggang Yan
Senior Lecturer in Control Engineering
Nonlinear control; sliding mode control; decentralised control; fault detection and isolation.

Professor Yong Yan
Professor of Electronic Instrumentation
Sensors; instrumentation; measurement; condition monitoring; digital signal processing; digital image processing; applications of artificial intelligence.

Dr Paul Young
Senior Lecturer in Electronic Engineering
Design and modelling of microwave and millimetre-wave devices and antennas, especially substrate integrated wave guides and smart antennas.

Dr Huiling Zhu
Reader in Communications
Wireless communications and networking, especially OFDMA, radio resource allocation, distributed antenna systems, wireless relay networks, user-centric networks, and co-operative communications.
Professor John Batchelor talks about his experience of teaching and research within the School.

Can you describe the research that you do?

My specialism is making an antenna into a more functional device. The area I explore uses radio frequency identification (RFID) – essentially small labels that carry an antenna and a tiny transponder chip. We’re developing these labels to make them as clever and as useful as possible, for example by putting sensing materials on them. It’s all about making them cheap, thin and flexible, so they can be stuck on to a wall, a device, a parcel, a cup, or even on to human skin.

There are many applications. The labels can be attached to skin, clothing, equipment, medicines or any everyday object. This creates a system that notices when things deviate from a particular pattern, such as if medicines are running low. The use of tiny devices called accelerometers can also pick up how a person is moving. This means that they allow people who are managing a disability, or recovering in rehabilitation, to be more independent.

How do PhD students fit into the research process?

It’s our PhD students who do most of the exciting stuff. The model in science is that the academic doesn’t do much of the hands-on work in the laboratory; we tend to become mentors, a bit like project managers. We meet our PhD students a lot but they’re the ones who are in the labs every day and they become world experts in their particular area of research.

How would you describe the benefits of being at Kent?

One of the benefits is our size. If we were a smaller school, it would be difficult to do serious research. But if we were much bigger, we’d lose that personal connection with our peers. So we’re at that happy size. If my students need to see me, they can find me quickly and when they’re working on a research paper, they probably see more of me than they’d like to!

And then there’s the staff. We have people in the School who are serious researchers in many different areas and Kent has an interdisciplinary culture so I work with people in the schools of Physical Sciences, Biosciences, Computer Science and the Durrell Institute for Conservation. It’s a good place for doing that.

Kent is also good at keeping things up to date, making sure that we’re well connected to industry and other researchers, not just in the UK but globally. We collaborate with hospitals such as Great Ormond Street. They’re interested in projects such as monitoring the brain waves of young children for epilepsy diagnosis. We invite industrial speakers in and we have a visiting professor from industry. Some of our projects are suggested by industry or hosted by industry. I also collaborate with many other universities including Warwick, UCL, York and Manchester. And the horizons expand further with our international collaborations.

Any highlights during your time at Kent?

One really exciting moment happened a few years ago after I asked one of my PhD students: ‘Can we make an RFID label work straight on the skin as a transfer tattoo?’ He went away and worked on it and a month later told me: ‘Yes, we’ve done it!’ That was very exciting and the breakthrough led to several grants and much of the research we’re now involved in.

It’s worth saying that this PhD student also did his MSc at Kent. Some of my most successful researchers have been recruited from our own MSc degrees. They get to know the environment here and how we work. And, of course, we get to know them, so we know we’re getting someone good.

To hear Professor John Batchelor’s Think Kent lecture, go to www.kent.ac.uk/global/GEA/think-kent.html/sciences
APPLYING TO KENT

General entry requirements
If you wish to apply for a higher degree, you must normally have a first or second class honours degree in a relevant or appropriate subject, or the equivalent from an internationally recognised institution (for more information on requirements for international qualifications, visit www.kent.ac.uk/internationalstudent/country)

For specific entry requirements, please refer to individual programme entries.

English language qualifications
All students from non-English speaking countries must show evidence of competence in an English language test at an appropriate level. Minimum standard: IELTS – 6.5, incl 6.0 in reading and writing, and 5.5 in listening and speaking; Pearson Test of English Academic (PTE Academic) – 62, incl 60 in each subtest; Cambridge English: Advanced and Proficiency 176, incl minimum of 169 in reading and writing and 162 in speaking and listening; Internet-based TOEFL – 90 incl minimum of 22 in reading, 21 in writing, 17 in listening, 20 in speaking.

Only English language tests taken up to a maximum of two years prior to the date of registration are accepted for admission to the University. Please note that if your university studies have been completed entirely in English, you may be exempt from providing an English test certificate.

Please contact the International Recruitment team for clarification www.kent.ac.uk/internationalstudent

If you do not reach the required standard, you can apply for one of our pre-sessional courses. For further information, please see www.kent.ac.uk/cewl

For full details of English language requirements, please see www.kent.ac.uk/ems/eng-lang-reqs

Making an application
Applications are made electronically via our website at www.kent.ac.uk/courses/postgrad/apply

If you do not have access to the web, please contact the Recruitment and Admissions Office for advice (see right).

If you are applying for a research degree, it is strongly recommended that you contact the School of Engineering and Digital Arts in the first instance so that you have an opportunity to discuss your study plans with the programme director.

Application deadline
There is no fixed deadline for applications. We strongly recommend that you apply as soon as possible and no later than three months before the start of term.

If you wish to apply for on-campus accommodation, an application must be made online by the end of July. Applicants requiring a Tier 4 visa to study in the UK must apply before 31 July for programmes commencing in September.

Tuition fees
For the most up-to-date information on tuition fees, please visit www.kent.ac.uk/finance-student/fees/

School enquiries
Postgraduate Admissions Officer, School of Engineering and Digital Arts, Jennison Building, University of Kent, Canterbury, Kent, CT2 7NT, UK
E: eda-admissions-pg@kent.ac.uk
T: +44 (0)1227 827323

Admissions enquiries
T: +44 (0)1227 768896
E: information@kent.ac.uk

This brochure was produced in May 2019. The University of Kent makes every effort to ensure that the information contained in its publicity materials is fair and accurate and to provide educational services as described. However, the courses, services and other matters may be subject to change. For the most up-to-date information, see www.kent.ac.uk/pg Full details of our terms and conditions can be found at: www.kent.ac.uk/termsandconditions

For the University to operate efficiently, it needs to process information about you for administrative, academic and health and safety reasons. Any offer we make to you is subject to your consent to process such information and is a requirement in order for you to be registered as a student. All students must agree to abide by the University rules and regulations at: www.kent.ac.uk/regulations
European connections
Kent is known as the UK’s European university. Our two main UK campuses, Canterbury and Medway, are located in the south-east of England, close to London, and we also have study locations in Paris, Rome, Athens and Brussels.

We have a diverse, cosmopolitan population with 159 nationalities represented. We have strong links with universities in Europe and, from Kent, you are around two hours away from Paris and Brussels by train.

World-leading research
As a student at Kent, you are taught by leading academics, who produce research of international standing. Following the most recent Research Excellence Framework, Kent was ranked in the top 20 for research intensity in the Times Higher Education, outperforming 11 of the 24 Russell Group universities, confirming our position as one of the UK’s leading research-intensive universities.

Strong academic community
Kent’s postgraduate students are part of a thriving intellectual community. In addition to lectures, seminars and supervision, you benefit from a rich and stimulating research culture. We have also invested in Woolf College, a modern facility on the Canterbury campus dedicated to postgraduates, which combines accommodation with academic and social space.

A global outlook
Kent has a great international reputation, attracting academic staff and students from around the world. Forty per cent of our academic staff are from overseas and our schools are engaged in collaborative research with universities worldwide. We also offer a range of opportunities to study abroad and an approach that is truly global.

The Graduate School
As a postgraduate student, you also have the support of the Graduate School, which promotes your academic interests, co-ordinates the Researcher Development Programme and the Global Skills Award, and facilitates cross-disciplinary interaction and social networking.

Funding
Kent provides a variety of financial support opportunities for postgraduate students. These include research studentships, location-specific funding, sport and music scholarships, and funding specifically for overseas fee-paying students. For further information, see www.kent.ac.uk/pgfunding

Career prospects
At Kent, we want you to be in a good position to face the demands of a tough economic environment. During your studies, you acquire a high level of academic knowledge and specialist practical skills. We also help you to develop key transferable skills that are essential within the competitive world of work.

Further information
For information about applying to Kent, or to order a copy of the Graduate Prospectus, contact: Recruitment and Admissions Office, The Registry, University of Kent, Canterbury, Kent CT2 7NZ, UK T: +44 (0)1227 768896 www.kent.ac.uk/pg

The University also holds Open Days and postgraduate recruitment events throughout the year. Please see www.kent.ac.uk/opendays
COME AND VISIT US

We hold Open Days and postgraduate events throughout the year.

For more information, see:
www.kent.ac.uk/visit