

OPINION

ROBOTICS AND AI – DRIVING THE UK'S INDUSTRIAL STRATEGY

Robotics and artificial intelligence have the potential to transform the UK's industry, economy and workplaces. Professor Guang-Zhong Yang CBE FREng, Director and Co-founder of The Hamlyn Centre for Robotic Surgery at Imperial College London and Chair of the UK-RAS Network, sets out how investment in these areas could improve innovation in the UK and secure our place as a world leader in the technologies.



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As the UK strives to overcome challenges when competing, not just with low-wage economies but also highly automated ones, we need to be open and fully prepared for changes in the workforce and a shift in the skills base. Repetitive and hazardous jobs will inevitably be at most risk, and highly skilled jobs will be in greater demand along with those that cannot be easily automated. The impact of robotics and artificial intelligence (AI) will affect manufacturing, transport and healthcare, as well as low-skilled jobs in the areas of agrifood, logistics, security, retail, and construction. It is important therefore to assess the economic impact and understand the social, legal and ethical issues surrounding robotics and AI in order to maximise the benefits of these technologies while mitigating potential adverse effects.

For the second year, UK Robotics Week, coordinated by the Engineering and Physical Sciences Research Council's UK-RAS (Robotics and Autonomous Systems) Network and supported by the Science Museum, RACE, Royal Academy of Engineering, the Institution of Engineering and Technology, and the Institution of Mechanical Engineers,

provides a spotlight on the UK's technology leadership in robotics and AI by engaging the nation's schools, colleges and universities to develop the digital skills needed to drive the UK's future economy. Communities behind the network are also working closely with government to drive world-leading research in the area and create a vibrant ecosystem that will support British industry and its international competitiveness in this critical time for the country, both politically and economically.

The recent announcement of an industrial strategy for the UK, against the backdrop of Brexit and global political turmoil fuelled by regional conflict and humanitarian crises, is a much-needed boost to our research, innovation and industrial base. It brings some certainty in this uncertain time, demonstrating the UK's drive to kick-start disruptive technologies that could transform our economy, with a clear vision for positioning the UK in the international landscape.

The timing could not have come at a better time. Across the EU and from the USA to China, major industrial

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nations have identified robotics and AI as strategic economic and policy priorities. Unfortunately, the UK trails behind Japan, Germany, the USA and many other nations in the uptake of industrial robots. This is in stark contrast to the strength of the UK's automotive and aerospace industries.

The Spring Budget confirmed an initial investment of £270 million from 2017 to 2018. Recognising the excellence in research and innovation that exists across the UK, there will be a further investment of £4.7 billion by 2020 to 2021. For the first time, government has singled out robotics and AI in its blueprint for a 'modern' industrial strategy. Robotics and AI are driving innovation in many sectors, including healthcare, manufacturing, transport, space, oil and gas, finance and other service industries. The UK has significant strengths in many of these areas. Accelerating development in these key sectors will ensure that the UK leads in commercialisation, as well as scientific advances.

The first wave of challenges that the UK funding bodies announced include the development of robotic and AI systems that will operate in extreme and hazardous environments, including off-shore energy, nuclear energy, space and deep mining.

Looking at the current robotics and AI landscape, what are the further opportunities and challenges? The first is in manufacturing and services. Manufacturing contributes over £7 trillion to the global economy. Contrary to common belief, the UK is one of the largest manufacturing nations, ninth in the world, with manufacturing accounting for 11% of the national output. We face strong competition from Europe, the USA and Japan, as well as new ambitious foreign

competitors particularly in Asia, where there is unprecedented investment in fundamental research and national infrastructure.

Adoption of robotics and AI to enable high-value manufacturing for not only big, but small- and medium-sized companies as well, is of strategic importance. There is also a significant demand for robotics and AI that focus on recycling components and subsystems used throughout the manufacturing process to reduce waste.

Transport is another area that presents challenges and opportunities for robotics and AI. As schemes to pilot driverless cars mature, automated transportation systems and solutions are set to expand from constrained environments such as airports to public transport, urban centres and other general-purpose environments. With the demographic shift associated with the ageing population, robotics will also transform transport solutions for the elderly and those with limited mobility, allowing them and wheelchair users to independently access their own vehicles and public transport systems. As a nation, we may not be able to compete with others in terms of hardware platforms, but we do have a strong competitive edge in the underlying technologies, particularly in machine vision, embedded intelligence, control and verification, which are at the heart of future autonomous transport systems.

Another area is in the use of robotics for space, environment, maritime and deep-sea exploration. In homeland security, law enforcement and defence, improved functionality and sophistication of search and rescue by unmanned systems, augmented by intelligent surveillance and different threat

countermeasures, will ensure a rapid uptake of the robotics and AI technologies.

One of the most exciting areas of robotics and AI is in healthcare. Medical robots represent one of the fastest-growing sectors in medical devices. For rehabilitation, robots play an increasing role to provide early support for faster and more complete recovery. With improved safety, efficacy and reduced costs, robotic platforms will soon approach a tipping point, moving beyond early adopters to become standard practices. Other drivers for healthcare robots are the ageing population and the increasing importance of quality of life, independence and autonomy for those with chronic illnesses and disabilities. However, the biggest hurdle for robotics to overcome in healthcare is how to make the technology more cost effective and accessible.

The pursuit of these areas requires synergistic efforts from academia and industry. Establishing our lead in robotics and AI is an opportunity that the UK cannot afford to miss. The future lies in our coordinated effort to establish our niche and leverage the significant strengths we already have, and expand upon those areas that are strategic to the UK.

BIOGRAPHY

Professor Guang-Zhong Yang CBE FREng is Director and Co-founder of The Hamlyn Centre for Robotic Surgery at Imperial College London and Chair of the UK-RAS Network (www.uk-ras.org), which organises UK Robotics Weeks each June. His main research interests are in medical imaging, sensing and robotics.